PROJECT MANUAL CITY OF PORTERVILLE

ANIMAL SHELTER PROJECT



CITY PROJECT NO.: 89-9015-88

BID No.: 21/22–CP1918

JULY 2022

DIVISION 00 CONTRACT REQUIREMENTS

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CONSTRUCTION PLANS (BOUND SEPARATELY)

NOTICE INVITING SEALED BIDS

ANIMAL SHELTER PROJECT PROJECT NO: 89-9015-88 BID NO.: 21/22 - CP1918

SEALED PROPOSALS will be received by the Purchasing Agent in the City Hall, 29l N. Main Street, Porterville, California, 93257, until 2:30 pm on Tuesday, August 9, 2022, and promptly thereafter all proposals that have been duly received will be publicly opened and read aloud for furnishing to said City all labor, materials, equipment, transportation, and services for the remodel of an existing commercial structure for the City's Animal Shelter.

Instructions to Bidders, plans, project manual, and proposal forms may be inspected at City Hall, 29l N. Main Street, Porterville, California. Proposal forms may be inspected and electronically downloaded with no cost, at the Public Purchase website, https://www.publicpurchase.com. No copies of said documents will be provided by the City. All addenda and correspondence during the bid process will be handled electronically through the Public Purchase website. No bid shall be received from a non-official Bidder who has not registered and accessed the proposal documents from the Public Purchase website.

A Certified Check, Cashier's Check, or Bidder's Bond in the amount of ten percent (10%) of the bid made payable to the City of Porterville will be required to accompany each proposal.

Any contract entered into pursuant to this notice will incorporate the provisions of the State Labor Code. Compliance with the prevailing rates of wages and apprenticeship employment standards established by the State Director of Industrial Relations will be required.

Pursuant to Section 1773 of the Labor Code, the general prevailing wage rates in the county, or counties, in which the work is to be done have been determined by the Director of the California Department of Industrial Relations. These wages are set forth in the General Prevailing Wage Rates for this project, available at City of Porterville address and available from the California Department of Industrial Relations' Internet web site at http://www.dir.ca.gov/DLSR/PWD. Future effective general prevailing wage rates, which have been predetermined and are on file with the California Department of Industrial Relations, are referenced but not printed in the general prevailing wage rates. As per SB854, passed by California State Senate on June 20, 2014, contractors and subcontractors will now be required to register with the California Department of Industrial Relations (DIR) per Section 1725.5 of the Labor Code.

Affirmative action to ensure against discrimination in employment practices on the basis of race, color, national origin, ancestry, disability, gender, age, sexual orientation, or

religion will also be required. No qualified disabled person shall, on the basis of disability, be excluded from participating in, be denied the benefits of, or otherwise be subject to discrimination.

The City hereby affirmatively ensures that minority business enterprises will be afforded full opportunity to submit bids in response to this notice and will not be discriminated against on the basis of race, color, national origin, ancestry, disability, gender, sexual orientation, or religion in any consideration leading to the award of contract.

No bid will be accepted from a Contractor who is not duly licensed in accordance with the provisions of Chapter 9, Division III, of the Business and Professions Code, and has a current "B" General Building Contractor license.

The right is reserved by the City of Porterville to reject any or all bids, to evaluate the bids submitted and to award the contract according to the proposal which best serves the interests of said City.

This bid includes "deductive alternates". The bids submitted shall be for the work in its entirety. Contract award will be based on the lowest responsive and responsible overall bid. The contractor shall assign values that would be deducted for each deductive alternate as well as the number of days that would be deducted from the overall work schedule should any of the listed deductive alternates be selected. Failure to complete the "Schedule of Deductive Alternates" section of the bid in its entirety will result in the bid being rejected as non-responsive. The final contract will reflect the final work being authorized.

The successful bidder will be required to furnish the City of Porterville with a "Performance Bond" in the amount of one hundred percent (100%) of the contract and a "Labor and Materials Bond" in the amount of one hundred percent (100%) of the contract amount.

Upon receiving the "NOTICE OF AWARD," the successful bidder has TEN (10) DAYS to submit the signed contract together with all required bonds, insurance and licenses to the Project Manager, and meet with the City in a PRE-CONSTRUCTION MEETING to discuss any problems or questions pertaining to this project. It is the Contractor's responsibility to contact the City's Project Manager immediately, to arrange for the PRE-CONSTRUCTION MEETING during the TEN (10) DAY PERIOD.

The Contractor shall have three hundred thirty (330) working days from the effective date of the NOTICE TO PROCEED to complete the required work.

The Contractor shall pay the City LIQUIDATED DAMAGES in the amount of twelve hundred dollars (\$1,200) a day for each calendar day the project is delayed beyond the "TIME OF COMPLETION DATE."

The City will withhold five percent (5%) retention from payments due the Contractor until thirty-five (35) days after date of recordation of the Notice of Completion. The Contractor may elect to receive one hundred percent (100%) of payments due under the contract by depositing securities of equivalent value with the City in accordance with the provisions of the California Public Contract Code Section 22300. Such securities, if deposited by the Contractor, shall be valued by the City, whose decision on valuation of the securities shall be final. Securities eligible for investment under this provision shall be limited to those listed in Section 22300 and Section 16430 of the California Government Code.

Dated at Porterville, California, this 2nd day of July, 2022.

Second Publication: July 9, 2022

Maria Bemis, Purchasing Agent City of Porterville, California

First Publication: July 2, 2022

INSTRUCTIONS TO BIDDERS

ANIMAL SHELTER PROJECT PROJECT NO: 89-9015-88 BID NO.: 21/22 - CP1918

PROPOSAL REQUIREMENTS AND CONDITIONS

<u>APPROXIMATE ESTIMATE</u> - The quantities given on the bid proposal form, the plans and contract documents are approximate only, being given as a basis for the comparison of bids, and the City of Porterville does not, expressly or by implication, agree that the actual amount of work will correspond therewith, but reserves the right to increase or decrease the amount of any class or portion of the work, or to omit portions of the work, as may be deemed necessary or advisable by the engineer at prices bid.

EXAMINATION OF PLANS, PROJECT MANUAL, CONTRACTS, AND WORK SITE - The bidder shall examine carefully the site of the work contemplated, the plans and project manual, and the proposal and contract forms. The submission of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantities of work to be performed and materials to be furnished, and as to the requirements of the proposal, plans, project manual, and the contract.

<u>PROPOSAL FORMS</u> - The City has furnished to each bidder a duplicate standard proposal form, which, when filled out and executed, may be submitted as its bid. Bids not presented on the furnished forms will be disregarded.

All proposals shall give the prices proposed in figures in the space provided and shall be signed by the bidder who shall fill out all blanks in the proposal form as required.

All proposals shall be submitted as directed in the "Notice Inviting Sealed Bids" under sealed cover plainly marked as a proposal and identifying the project to which the proposal relates and the date of the bid opening. Proposals which are not properly marked may be disregarded.

<u>REJECTION OF PROPOSALS</u> - Proposals may be rejected if they show any alteration of form, additions not called for, conditional bids, incomplete bids, erasures, or irregularities of any kind.

When proposals are signed by an agent, other than the officer or officers of a corporation authorized to sign contracts on its behalf or a member of a partnership, a "Power of Attorney" must be on file with the City of Porterville prior to opening bids or shall be submitted with the proposal; otherwise, the proposal will be rejected as irregular and unauthorized.

<u>PROPOSAL GUARANTY</u> - All bids shall be presented under sealed cover and accompanied by one of the following forms of bidder's security:

Cash, a cashier's check, a certified check, a bank money order of any national or state bank, or a bidder's bond executed by an admitted surety insurer, made payable to the City of Porterville.

The security shall be in an amount equal to at least ten percent (10%) of the amount bid, as payment by the Contractor to the City of Porterville. A bid will not be considered unless one of the forms of bidder's security is enclosed with it. A bidder's bond will not be accepted unless it contains all information and signatures as required by the City and is properly filled out and executed.

<u>WITHDRAWAL OF PROPOSALS</u> - Any bid may be withdrawn at any time prior to the time fixed in the public notice for the opening of bids only by written request for the withdrawal of the bid filed with the City Manager. The request shall be executed by the bidder or his duly authorized representative. The withdrawal of a bid does not prejudice the right of the bidder to file a new bid. No bid may be withdrawn after the time fixed in the public notice for the opening of bids.

<u>PUBLIC OPENING OF PROPOSALS</u> - Proposals will be opened and read publicly at the time and place indicated in the "Notice Inviting Sealed Bids." Bidders or their authorized agents are invited to be present.

<u>DISQUALIFICATION OF BIDDERS</u> - More than one proposal from an individual, firm, partnership, corporation, or combination thereof under the same or different names will not be considered. Reasonable grounds for believing that any individual, firm, partnership, corporation or combination thereof is interested in more than one proposal for the work contemplated may cause the rejection of all proposals in which that individual, firm, partnership, corporation or combination thereof is interested. If there is reason for believing that collusion exists among the bidders, any or all proposals may be rejected. Proposals in which the prices obviously are unbalanced may be rejected.

<u>LICENSING OF BIDDERS</u> - All bidders/and Contractors shall be licensed in accordance with the laws of this state, and any bidder or Contractor not so licensed is subject to the penalties imposed by such laws. The Contractor must be properly licensed as a contractor from contract award through Contract acceptance (Public Contract Code § 10164).

MATERIAL GUARANTY - Before any contract is awarded, the bidder may be required to furnish a complete statement of the origin, composition, and manufacture of any or all materials to be used in the construction of the work, together with samples, which samples may be subjected to the tests provided for in this project manual or in the special provisions to determine their quality and fitness for the work.

The successful bidder, who will execute the work, will warrant to the City of Porterville all materials and workmanship against any failures for a period of one year (I) from the date of acceptance of the work.

The two contract bonds required will continue in full force and effect for the duration of the warranty period unless a maintenance bond has been substituted for them.

<u>INSURANCE REQUIREMENTS</u> - Attention is directed to Part I of Special Provisions.

<u>PERMITS AND LICENSES</u> - Attention is directed to "Responsibilities of the Contractor," in the Special Provisions. The Contractor and all Subcontractors shall posses a valid City of Porterville business license at the time of beginning of construction and for the duration of the contract. A fee schedule is available from the Department of Finance.

<u>TAXES</u> - No mention shall be made in the proposal of Sales Tax, Use Tax, or any other tax, as all amounts bid will be deemed and held to include any such taxes which may be applicable.

<u>DISCREPANCIES AND MISUNDERSTANDINGS</u> - Bidders must satisfy themselves by personal examination of the work site, plans, project manual, and other contract documents and by any other means as they may believe necessary, as to the actual physical conditions, requirements, and difficulties under which the work must be performed. No bidder shall at any time after submission of a proposal make any claim or assertion that there was any misunderstanding or lack of information regarding the nature or amount of work necessary for the satisfactory completion of the job. Any errors, omissions, or discrepancies found in the plans, project manual, or other contract documents shall be called to the attention of the City and clarified prior to the submission of proposals.

The proposal form, contract, project manual, and addenda shall constitute the full contract for this project. Should the Contractor feel there has been a supplemental or oral modification, it shall be his responsibility to verify said modification in writing prior to submission of the proposal.

<u>EQUIVALENT MATERIALS</u> - Approval of equipment and materials offered as equivalents to those specified must be obtained not less than one week prior to the opening of bids. Requests for consideration of equivalents must be submitted in writing allowing sufficient time for complete consideration of all the project manual requirements for samples, references, tests, and other details to the full satisfaction of the City.

<u>LEGAL RESPONSIBILITIES</u> - All proposals must be submitted, filed, made, and executed in accordance with State and Federal laws relating to bids for contracts of this nature whether the same or expressly referred to herein or not.

AWARD OF CONTRACT - The right is reserved to reject any and all proposals.

The award of the contract, if awarded, will be to the lowest responsible bidder whose proposal complies with all the requirements prescribed. Such award, if made, will be made within 60 days after the opening of the proposals. If the lowest responsible bidder refuses or fails to execute the contract, the City Council may award the contract to the second lowest responsible bidder. If the second lowest responsible bidder refuses or fails to execute the contract, the City Council may award the contract to the third lowest responsible bidder.

This bid proposal contains "deductive alternates". The award of the contract will be based on the lowest total responsive bid amount. Should the lowest responsive bid be over the City's project budget, the City <u>may</u> deduct one or more alternates listed to cut costs and deliver the project within the approved budget amounts; the changes will be reflected in the final contract. A bid will be determined as non-responsive if it is received and the "Schedule of Deductive Alternatives" section of the bid is not completed; including the amount to be deducted for the changes detailed and the number of days deducted from the overall job schedule for said changes. The "deductive alternates" process does not prevent or limit the City from approving additional budget funding to fund the project in its entirety should they deem fit.

The City may make such investigation as it deems necessary to determine the ability of a proposer to furnish the required services, and the proposer will furnish to the City all such information and data for this purpose as the City may request. The City reserves the right to reject any quote if the evidence submitted by or investigation of such proposer fails to satisfy the City that such proposer is qualified to carry out the obligations of a contract and to deliver the services contemplated herein.

<u>BASIS OF BID AWARD</u> - Award of bid shall be made to the responsive, responsible bidder meeting the specification and requirements of the bid, having the lowest bid and satisfactory qualifications and performance record.

- A. Total bid price for project, in accordance with the requirements of the request for proposals and the ability to satisfy those requirements.
- B. Company's reputation and financial status.
- C. Past experience.

<u>SELF PERFORMANCE</u> – The Contractor shall perform, with his own organization, Contract work amounting to at least 50 percent of the contract price except that any designated "Specialty Items" may be performed by subcontract and the amount of any "Specialty Items" so performed will be deducted from the Contract Price before computing the amount required to be performed by the Contractor with its own organization. "Specialty Items" will be identified by the Agency in the bid or in the Special Provisions. When the entire item is subcontracted, the value of work subcontracted will be based on the Contract Unit Price. When a portion of an item is subcontracted, the value of the work subcontracted will be

based on the estimated percentage of the Contract Unit Price. This will be determined from information submitted by the Contract, and subject to approval of the Engineer.

<u>CONTRACT BONDS</u> - The successful bidder shall furnish the City of Porterville with a satisfactory "Performance Bond" in the amount of one hundred percent (100%) of the contract amount and a "Labor and Material Bond" in the amount of one hundred percent (100%) of the contract amount.

The successful bidder shall have as a surety for all bonds, a corporate surety authorized to act as a surety in California. The Performance Bond and the Labor and Materials Bond are solely for the benefit of the City of Porterville and create no cause of action by Subcontractors or suppliers against the Contractor or surety. The City does not guarantee the validity of such bonds or the solvency of the Contractor.

All alterations, extensions of time, extra and additional work, and other changes authorized by this project manual or any part of the contract may be made without securing the consent of the surety or sureties on the contract bonds.

Bonds are subject to action per the Contract Agreement section of this project manual.

<u>FAILURE TO EXECUTE CONTRACT</u> - Failure of the lowest responsible bidder, the second lowest responsible, or the third lowest responsible bidder to execute the contract and file acceptable bonds as provided herein within ten (I0) days, not including Sundays and legal holidays, after such bidder has received notice that the contract has been awarded to him will be just cause for the annulment of the award and the forfeiture of the proposal guaranty. If the successful bidder or his authorized representative files a notice specifying that the bidder will refuse to execute the contract if presented to him, the filing of such notice shall have the same force and effect as the failure of the bidder to execute the contract and furnish acceptable bonds within the time hereinbefore prescribed.

The remedies provided for under this provision shall not be construed to limit, waive or otherwise abrogate any other remedy that the City shall be entitled to under other terms and conditions of this contract

<u>EXECUTION OF CONTRACT</u> - The contract shall be signed by the successful bidder and returned to the Project Manager, together with the contract bonds, insurance certificates, insurance endorsements, etc. within ten (I0) days, not including Sundays and legal holidays, after the bidder has received notice that the contract has been awarded.

<u>RETURN OF PROPOSAL GUARANTIES</u> - Within ten (I0) days after the award of the contract to the lowest responsible bidder, the City of Porterville will return the proposal guaranties, other than bidder's bonds, accompanying the proposals that are not to be further considered in making the award. Retained proposal guaranties will be held until the contract has been finally executed, after which all proposal guaranties, except

bidder's bonds and any guaranties which have been forfeited, will be returned to the respective bidders whose proposals they accompany.

BID PROPOSAL

ANIMAL SHELTER PROJECT PROJECT NO: 89-9015-88 BID NO.: 21/22 - CP1918

TO: THE CITY OF PORTERVILLE

In accordance with City's Notice Inviting Sealed Bids, the undersigned BIDDER hereby proposes to furnish all materials, equipment, tools, labor, and incidentals required for the above stated project as set forth in the Plans, Project Manual, and Contract Documents therefore, and to perform all work in the manner and time prescribed therein.

BIDDER declares that this proposal is based upon careful examination of the work site, Plans, Project Manual, Instructions to Bidders, and all other Contract Documents. If this proposal is accepted for award, BIDDER agrees to enter into a contract with CITY at the unit and/or lump sum prices set forth in the following Bid Schedule. BIDDER understands that failure to enter into a contract in the manner and time prescribed will result in forfeiture to CITY of the guarantee accompanying this proposal.

BIDDER understands that a bid is required for the entire work that the estimated quantities set forth in the Bid Schedule are solely for the purpose of comparing bids, and that final compensation under the contract will be based upon the actual quantities of work satisfactorily completed. It is agreed that the unit and/or lump sum prices bid include all appurtenant expenses, taxes, royalties and fees. In the case of discrepancies in the amounts bid, unit prices shall govern over extended amounts and words shall govern over figures.

BID PROPOSAL FOR

ANIMAL SHELTER PROJECT PROJECT NO: 89-9015-88 BID NO.: 21/22 - CP1918

TO THE PURCHASING AGENT City of Porterville 29I N. Main Street Porterville, CA 93257

We, the undersigned bidder, having carefully examined the location of hereinafter described work and the plans and project manual thereof, thereby propose to furnish, all in strict accordance with said plans and project manual, all the materials, labor and equipment necessary for the completion of this project for the price set forth in the following bid, to wit:

BASE BID "A": Animal Shelter

ITEM	DESCRIPTION	QTY.	UNIT	AMOUNT
A1.	Animal Shelter Tenant Improvement Work	1	LS	
A2.	Dog Park	1	LS	
A3.	Site Improvements	1	LS	
	TOTAL BID PART A	(Figures)		\$

Total amount of BASE BID "A" _		Dollars
And	Cents (Words)	

BASE BID "B": D Street Improvements

ITEM	DESCRIPTION	QTY.	UNIT	AMOUNT
B1.	Mobilization & Clean-Up	1	LS	
B2.	Traffic Control	1	LS	
B3.	Demo Existing Flat Work	2000	SF	
B4.	Demo Existing Retain Curb	200	LF	
B5.	Demo Existing Pavement	600	SF	

ITEM	DESCRIPTION	QTY.	UNIT	AMOUNT
B6.	Furnish & Install Conduits, Wiring, Handholes, Pull Boxes and Appurtances for Street/Trail Lights per SCE and City Plans. (Price is set for bidding purposes and will be negotiated after award if SCE plan is not received in time for bid.)	1	LS	\$35,000
B7.	Furnish & Install Curb and Gutter	300	LF	
B8.	Furnish & Install Pavement Patch	600	SF	
B9.	Furnish & Install 10' Wide Sidewalk and Parkway	3000	SF	
B10.	Furnish & Install New 6"-12" Retain Curb	200	LF	
B11.	Furnish & Install Tree Wells	8	EA	
B12.	Furnish & Install Irrigation	250	LF	
B13.	Furnish & Install 18" SD Line	540	LF	
B14.	Furnish & Install Storm Drain Manhole	3	EA	
B15.	Furnish & Install 8" SS Line	500	LF	
B16.	Furnish & Install Sewer Manhole	2	EA	
B17.	Furnish & Install Curb Ramp @ Mill & D Street	1	EA	
B18.	Furnish & Install Modified C-20 Drive Approach	800	SF	
B19.	Furnish & Install Decorative Trash Receptacle	2	EA	
B20.	Furnish & Install Decorative Bench	2	EA	
B21.	Relocate Building Sign	1	EA	
	TOTAL BID PART B	(Figures)		\$

lotal amount of BASE BID "B"		Dollars
And	Cents (Words)	
Total amount of BASE BID "A" +	"B"	Dollars
and	Cents (Words)	

(Amount to be shown in both words and figures. In case of discrepancy between words and figures, the words shall prevail.)

SCHEDULE OF DEDUCTIVE ALTERNATIVES

Deductive Alternate 1: Rooms 141 & 142. (Additional Adoption Rooms)

- 1. Build hallway wall (Room 119).
- Rooms 141 & 142: Stub-out plumbing for hose reel and complete installation of floor drains. Do not install dividing walls between rooms or room finishes, including ceilings.
 Deduct \$_____ from Base Bid "A" + "B" total and ____ day/s from contract working days.

<u>Deductive Alternate 2: Rooms 151, 152, 153, 154, 155, 156, 157, & 158. (Lobby, Grooming, Meet & Greet, Cat Room, Crate Storage)</u>

- 1. Complete wall for Room 119 hallway, including parts along rooms 157, 151 & 152.
- 2. Room 157: Stub-out plumbing for water supply and complete floor drains.
- 3. Provide paint for reception counter and new paint on lobby walls.
- 4. Rooms 151, 152, & 153: Do no install dividing walls between rooms or room finishes, including ceilings.
- 5. Do not install walls for 154 & 155.
- 6. Do not install Crate Storage fence using fence type MTL-3 on exterior near through drive through aisle.

Deduct \$	from Base Bid "A" + "B"	total and	day/s from
contract working days.			

We, the undersigned, as bidder, declare that we have thoroughly examined all the Contract documents herein contained and that this proposal is made without collusion with any other person, firm or corporation.

And we agree, if this proposal is accepted, that we will contract with the City of Porterville in the form of the Articles of Agreement to provide all labor and materials and all other expenses of whatever nature necessary to comply with the drawings and Contract provisions contained herein or reasonably implied thereby or as necessary to complete the work in the manner and within the time specified and according to the requirements and to the reasonable satisfaction of the Engineer; to pay all charges of freight, taxes, transportation and hauling; to indemnify the City and the Engineer against any loss or damage arising from any act of the undersigned as Contractor; and that we will take in full payment therefore the sums as shown on the Bid Proposal and made a part hereof.

And we further agree, if this Proposal is accepted, to sign the Articles of Agreement and to furnish the required bonds of a surety satisfactory to the City within ten (I0) calendar days from the date notified by the City Clerk of award of contract; and if the undersigned shall fail to contract as aforesaid, it shall be understood that he/she has abandoned the Contract, and that, therefore, this Proposal shall be null and void and the certified check or bond accompanying this Proposal becomes the property of the City.

The General contractor shall submit for City review and approval, a "schedule of values" allocating portions of the contract sum to various portions of the work that will be used as the basis for reviewing contractor's applications for payment. The approved schedule of values must be received and approved by the City no later than 7 days before the date scheduled for submittal of initial Application for Payment.

The undersigned certifies that he/she has a va California, the classification and number of wh expiration date is The repres penalty of perjury.	ich are . The license
Witness our hands this day of	, 20
Signature of bidder, with business name, addr	ress and telephone number.
	(I) BIDDING FIRM
	(2) Corp, Individual, Partner, Other
	(3) Business Address
	City, State and Zip Code
	Area Code and Telephone Number
	(4) Signature of Authorized Person
	Type/Print Authorized Person Name

(PLEASE SEE THE FOLLOWING INSTRUCTIONS REGARDING SIGNATURE)

- (1) If bidder is an individual, enter name here in style used in business; if a joint venture, exact names of entities joining in the venture; if a partnership, the correct trade style of partnership if a corporation, the exact name of the corporation under which it is incorporated.
- (2) If bidder is other than an individual, identify here its character, i.e. joint venture, partnership, corporation (including state of incorporation) etc. If bidder is an individual operating under a trade name, state "an individual dba" (trade name in full).
- (3) State on this line the address to which all communications and notices regarding the Bid proposal and any contract awarded thereunder are to be addressed.
- (4) If bidder is a joint venture, signature must be by one of the joint ventures and if one or both of the joint venturers is a partnership or a corporation each participating partnership must sign by a general partner, and each corporation by an authorized officer or employee; if a partnership, by a general partner; if a corporation, by an authorized officer or employee. The title of the person signing must appear after his signature. Where bidder is a partnership or a corporation, the names of all other general partners, or the names of the president and secretary of the corporation and their business addresses must be shown below:

NOTE: All signatures must be typewritten under written signature.

NOTE: All addresses must be complete with Street number, City and State.

SUBCONTRACTORS: Pursuant to the provisions of Sections 4100 to 4113 inclusive, of the Public Contract Code of the State of California, the undersigned hereby designates below, for the project, opposite various portions of the work, the names and locations of the places of business of each subcontractor who will perform work or labor in the amount in excess of one-half of one percent (½ of I%) of the amount of the total bid. All work not listed below shall be performed by the undersigned bidder. It is understood that the bidder, if awarded the contract, shall not substitute any subcontractor in place of the subcontractors herein designated subcontractor, or sublet or subcontract any of the work as to which a subcontractor is not herein designated without the consent of the City and approval of the Engineer. The subletting or subcontracting of any work for which there was no subcontractor designated in the original bid may be permitted upon written consent of the City Engineer. (List one firm only for each portion of work.) Use additional pages if needed.

Name & Address	License #	Description of Work Assigned to Subcontractor
	Sig	nature of Bidder
	Title	e.

REFERENCES

The following are the names, addresses, and phone numbers for three public agencies for which BIDDER has performed similar work within the past two years:
DESIGNATION OF SURETIES
The following are the names, addresses, and phone numbers for all brokers and sureties from whom BIDDER intends to procure insurance and bonds:

NON-COLLUSION AFFIDAVIT

TO THE CITY OF PORTERVILLE:

The undersigned, in submitting a bid for performing the following work by contract, being duly sworn, deposes and says:

That he/she has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with such contract.

<u>Work to be Done:</u> Furnish to the City all labor, materials, equipment transportation and services for the construction of the Animal Shelter.

	Bidder's Name	
	0: (B:11	
	Signature of Bidder	
	Title	
	THO	
	Business Address	
	Place of Residence	
A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of		
State of California		
County of Tulare		
Subscribed and sworn to before me this day	of, 2022 by	
	_ proved to me on the basis of satisfactory	
evidence to be the person who appears before me.		
Signature of Notary Public		

WAIVER OF PROVISIONS FOR SUBSTITUTION OF SECURITIES UNDER SECTION 22300, PUBLIC CONTRACT CODE

Under Section 3513 of the California Civil Code, the undersigned Contractor hereby acknowledges having read the following provisions of Section 22300 of the Public Contract Code:

SECTION 22300. PERFORMANCE RETENTIONS: PROVISION FOR SUBSTITUTION OF SECURITIES: DURATION OF CHAPTER.

Provisions shall be included in any invitation for bid and in any contract documents to permit the substitution of securities for any money withheld by a public agency to ensure performance under a contract. At the request and expense of the Contractor, securities equivalent to the amount withheld shall be deposited with the public agency, or with the state or federally chartered bank as the escrow agent, who shall pay such moneys to the Contractor upon satisfactory completion of the contract.

Securities eligible for investment under this section shall include those listed in Section 16430 or bank or savings and loan certificates of deposit.

The Contractor shall be the beneficial owner of any securities substituted for money withheld and shall receive any interest thereon.

Failure to include these provisions in bid and contract documents shall void any provisions for performance retentions in a public agency contract.

Contractor further acknowledges that since financing for the project is provided in whole or in part by the United States of America, the Contractor is requested to execute a waiver under Section 3513 of the California Civil Code waiving the foregoing provisions of Section 22300 of the California Public Contract Code.

Therefore, based upon the foregoing, the undersigned hereby waives the foregoing provisions of Section 22300 of the California Public Contract Code for the purposes of this contract.

CONTRACTOR	Dated
Ву:	
Signature	

CONTRACT AGREEMENT

ANIMAL SHELTER PROJECT PROJECT NO: 89-9015-88 BID NO.: 21/22 - CP1918

day of

. 20 .

THIS AGREEMENT, made and entered into this

by and between the City of Porterville, a Municipal Corporation of the State of California, duly organized, existing and acting pursuant to the laws thereof with its principal place of business in the City of Porterville, California, hereinafter designated as the City, party of the first part, and
hereinafter designated as the Contractor, party of the second part,
WITNESSETH: That the parties hereto do mutually agree as follows:
ARTICLE I. The contract documents for the aforesaid project shall consist of the Notice Inviting Sealed Bids, Proposal, Standard Specifications, Special Provisions, Plans and all referenced specifications, details, standard drawings, and appendices; together with this Contract Agreement and all affidavits; and also including any and all addenda or supplemental agreements clarifying, amending, or extending the work contemplated as may be required to insure its completion in an acceptable manner. All of the provisions of said contract documents are made a part hereof as though fully set forth herein.
ARTICLE II. For and in consideration of the payments and agreements to be made and performed by the City, the Contractor agrees with the City to furnish all materials, equipment, tools and labor and construct facilities for the City; to perform and complete in a good and workmanlike manner all the work shown on the plans and described in the specifications; and to fulfill all other obligations as set forth in the contract documents.
Said awarded contract amount:

ARTICLE III. Contractor agrees to receive and accept the prices set forth in the Proposal as full compensation for furnishing all materials, performing all work, and fulfilling all obligations hereunder. Said compensation shall cover all expenses, losses, damages, and consequences arising out of the nature of the work during its progress or prior to its acceptance including those for well and faithfully completing the work and the whole thereof in the manner and time specified in the aforesaid contract documents; and also including those arising from actions of the elements, unforeseen difficulties or obstructions encountered in the prosecution of the work, suspension or discontinuance of the work, and all other unknowns or risks of any description connected with the work.

- ARTICLE IV. The City hereby promises and agrees to employ said Contractor to provide the materials to do the work according to the terms and conditions herein contained and referred to, for the prices aforesaid, and hereby contracts to pay the same at the time, in the manner and upon the conditions set forth in the specifications; and the said parties for themselves, their heirs, executors, administrators, successors, and assigns, do hereby agree to full performance of the covenants herein contained.
- ARTICLE V. The Contractor shall have **three hundred and thirty (330)** working days from the date of receipt of the <u>NOTICE TO PROCEED</u> to complete the required work. Should the Contractor fail to complete this contract, and the work provided therein within the time fixed for such completion, the Contractor shall become liable to the City for all loss and damage which the latter may suffer on account thereof; and it is hereby agreed and understood that it is and will be difficult and impossible to ascertain and determine the actual damage which the City will sustain in the event of, and by reason of, such delay. It is therefore agreed that said Contractor will pay to the City the sum of **one-thousand**, **two-hundred (\$1,200)** dollars per day for each and every day of delay beyond the time herein prescribed in finishing said work as liquidated damages, as herein provided, and in case the same is not paid, agrees that said City may deduct the amount thereof from any money due or that may become due said Contractor under this contract. All deductions from any money due the Contractor are considered to be liquidated damages and not a penalty. This paragraph does not exclude the recovery of damages under other provisions of the Contract Documents.

The Contractor shall not be charged with resulting damage if:

- (1) The delay in the completion of the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to, acts of God, acts of the public enemy, acts of the City, acts of another contractor in the performance of a contract with the City, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and such subcontractors or suppliers and;
- (2) The Contractor, within 10 days from the beginning of any such delay, (unless the Engineer grants a further period of time before the date of final payment under the contract) notifies the Engineer in writing of the cause of delay. The Engineer shall ascertain the facts and the extent of the delay and extend the time for completing the work when, in his judgment, the findings of fact justify such an extension, and his findings of facts shall be final and conclusive on the parties.
 - Should the contractor fail to begin work or halt work for a period of time equal to one-half ($\frac{1}{2}$) the original or amended contract completion time, the City shall call the contract bonds so the work can be completed by the City. Working days shall not include weather days, Saturdays, Sundays, or legal Federal holidays.
- ARTICLE VI. Contractor acknowledges the provisions of the State Labor Code requiring every employer to be insured against liability for worker's compensation, or to undertake self-insurance in accordance with the provisions of that code, and certifies compliance with such provisions.

- ARTICLE VII. Contractor agrees to indemnify and hold harmless City and all of its officers, agents, employees, and assigns from any and all claims, demands, or causes of action, including related expenses, attorney's fees, and costs based on, arising out of, or in any way related to the work undertaken by Contractor hereunder, regardless of the existence of passive concurrent negligence on the part of the City or anyone acting under its direction or control or on its behalf. It is further the intent of the parties that this indemnification requirement is not intended to relieve City from liability for the active negligence of City, its officers, agents and employees.
- ARTICLE VIII. Contractor affirms that the signatures, titles, and seals set forth hereinafter in execution of this Contract Agreement represent all individuals, firm members, partners, joint venturers, and/or corporate officers having a principal interest herein.
- ARTICLE IX. The Notice Inviting Sealed Bids, Instructions to Bidders, Bid Proposal, Non Collusion Affidavit, Bidder's Bond, Bond for Faithful Performance, Bond for Materialmen and Laborers, Contract Agreement, Project Manual, and the Plans mentioned therein together with all appendices, all of which are hereto attached, are hereby incorporated in and made part of this Agreement.
- ARTICLE X. Any controversy or claim arising out of or relating to this contract, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered in any court having jurisdiction thereof.

IN WITNESS WHEREOF: The parties hereto have caused this Contract to be executed the day and year first above written.

	CITY OF PORTERVILLE (City Seal)
	By
ATTEST:	Martha A. Flores, Mayor
John D. Lollis, City Clerk	Contractor
	Ву
	Title

UNDERWRITER/BROKER CERTIFICATION

Entity: CITY OF PORTERVILLE, 291 N. Main St., Porterville, CA 93257
Entity project identification:
Entity providing contractual services:
Insurer(s):
Best rating(s):
Name and title of underwriter, broker, or agent completing certification:

I, the undersigned insurance underwriter, insurance broker, or agent do hereby certify that I have examined the insurance specifications prepared by the CITY for the above referenced project and have attached herewith certificates or insurance and all endorsements specified in the insurance specifications provided by the CITY.

I further certify that the coverages provided to the CONTRACTOR/CONSULTANT and described in the certificates of insurance conform in all respects to the requirements set forth in the insurance specifications, including, but not limited to the following considerations:

- 1. The scope of insurance is at least as broad as the minimum requirements identified in the insurance specifications;
- 2. The minimum occurrence limits and aggregate limits of insurance are consistent with those set forth in the insurance specifications;
- 3. All deductibles and/or self-insured retentions have been declared;
- 4. All required endorsements identified in the insurance specifications have been provided and copies have been attached to the appropriate certificate of insurance;
- 5. All policies of insurance have been placed with insurers with a current rating from the A.M. Best Company of not less than A:VII;
- 6. All endorsements have been signed by a person authorized by the insurer to bind coverage on its behalf.

If the coverages provided to the CONTRACTOR/CONSULTANT do not conform in all respects to the requirements set forth in the insurance specifications, an explanation of each and every variance from the specifications and an evaluation of the relative risk exposures and protections to the CITY and the CONTRACTOR/CONSULTANT are attached.

I understand that the CITY will not authorize the CONTRACTOR/CONSULTANT to initiate work on behalf of the CITY until this certification has been fully executed and returned to the CITY.

Signature
Date
Name of Company
Business Address
Rusiness Phone Number

CITY OF PORTERVILLE

APPENDICES

TO THE

SPECIFICATIONS

APPENDIX I FAIR EMPLOYMENT PRACTICES PROVISIONS

Under the terms of the contract documents for the above stated project, the Contractor, and all subcontractors, suppliers, and vendors, shall comply with all City, State and Federal laws, ordinances, codes, executive orders, or regulations, including amendments and another requirements regarding equal employment opportunities and fair employment practices, including the following provisions:

- The Contractor shall not willfully discriminate against any employee or applicant for employment on the basis or race, color, national origin, ancestry, gender, or religion, and will take affirmative action to ensure that applicants are employed and employees are treated during employment without such discrimination. Such affirmative action shall include encouragement and assistance to qualified members of minority groups in all activities involving recruiting, advertising, or soliciting for employment; hiring, placing, training, upgrading, transferring, or demoting; selection for training or apprenticeship; rates of pay or other compensation; and layoff or termination.
- 2. In all advertisements, offers, requests, or solicitations for labor, personnel, or employment opportunities of any nature, the Contractor shall state that all qualified applicants will receive consideration for employment without regard to race, color, national origin, ancestry, gender, or religion.
- 3. No qualified disabled person shall, on the basis of disability, be excluded from participating in, be denied the benefits of, or otherwise be subject to discrimination under any program or activity that receives or benefits from federal financial assistance.
- 4. The Contractor shall fulfill the following requirements to the satisfaction of the City:
 - a. Provide notice to all sources of employee referrals including the State Department of Human Resources, employment agencies, and each union or other representative of labor with which the Contractor has a collective bargaining agreement, or other contract or understanding, and that copies of said notice have been posted in conspicuous places available to employees and applicants for employment.
 - b. Provide notice to all supervisors, foreman, personnel officers, subcontractors, suppliers, and vendors, and that they have been instructed as to their responsibilities hereunder.
 - c. Have a plan for affirmative action indicating the measures to be taken to encourage and assist qualified members of minority groups in the areas of recruitment, employment, training promotion, compensation, and selection for apprenticeship.
 - d. Provide a written agreement with each union, labor representative, or other source of employees or applicants for employment that sets forth

- the requirements and responsibilities for non-discrimination and affirmative action under these provisions.
- e. Notify the City in writing of any opposition to the requirements of these provisions by any individual, firm, union, labor representative, organization, corporation, or source of employees or applicants for employment.
- f. Upon request file with the City a basic compliance report detailing what actions have been taken under these provisions, indicating all sources from which the project work force has been assembled, and identifying all persons responsible for employment decisions in connection with this contract. False statements willfully made in said report will be punishable as provided by law.
- 5. Nothing in these provisions shall be construed as requiring or permitting the employment of persons restricted from such employment by provisions of state or federal laws.
- 6. Upon request, the Contractor shall compile records on forms provided by the City indicating ethnic distribution by man hours of work within various crafts and trades for the entire project work force, including subcontractors' forces and shall file said forms with the City by the tenth day of each month.
- 7. The Contractor shall maintain and disseminate all information as required by City, State, or Federal orders relative to these provisions and shall ensure unlimited access to records of such information for the purpose of ascertaining compliance hereunder.
- 8. If the Contractor or any subcontractor is in violation of these provisions, the City will serve written notice on the Contractor setting forth the nature of the violation. The Contractor shall meet promptly with the City to determine the manner and time for correcting the violation. If the Contractor fails or refuses to so correct the violation, the City will pursue all remedies which may be required under the law.
- 9. A finding by any governing body that the Contractor has willfully violated these provisions may be sufficient grounds for cancellation, termination, or suspension of the contract in whole or in part and may require the imposition of penalties, sanctions, and remedies as may be provided for under the law, including revocation of the Contractor's credentials as a responsible bidder and the deduction of monetary damages from any payments due the Contractor.
- 10. The Contractor shall include these provisions in every first tier subcontract or purchase order and shall require each subcontractor, supplier, or vendor to similarly bind each further subordinate agreement.
- 11. The Contractor shall take action with respect to any subcontractor, supplier, or vendor as may be directed by the City or any other governing body to ensure enforcement of these provisions.

APPENDIX II LIST OF UTILITIES

Southern California Gas Company	(599) 739-2238 or 811
Southern California Edison Company	(559) 684-3558 or 811
AT&T	(559) 739-6649 or 811
Charter Communications (Cable TV) - Porterville	(559) 560-5323 or 811
Sewer, Water & Storm Drain: City of Porterville, Field Services Division	(559) 782-7514
Underground Service Alert	811

The Contractor is fully responsible for notifying all of the correct parties regarding utility coordination.

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APPENDIX III FUGITIVE DUST CONTROL AT CONSTRUCTION SITES

COMPLIANCE ASSISTANCE BULLETIN April 2007

Fugitive Dust Control at Construction Sites: New Requirements

Regulation VIII, Fugitive PM10 Prohibitions, of the District's Rules and Regulations apply to many activities that generate fugitive dust, and particularly to construction sites.

Fugitive dust is emitted into the air by activities that disturb the soil, such as earthmoving and vehicular/equipment traffic on unpaved surfaces. Windblown dust is also of concern where soil has been disturbed at construction sites.

The District adopted Regulation VIII in 1993 and its most recent amendments became effective on October 1, 2004. This is a basic summary of the regulation's requirements as they apply to construction sites.

These regulations affect all workers at a regulated construction site, including everyone from the landowner to the subcontractors. Violations of Regulation VIII are subject to enforcement action including fines.

Visible Dust Emissions (VDE) may not exceed 20% opacity during periods when soil is being disturbed by equipment or by wind at any time. Visible Dust Emissions opacity of 20% means dust that would obstruct an observer's view of an object by 20%. District inspectors are state certified to evaluate visible emissions. Dust control may be achieved by applying water before/during earthwork and onto unpaved traffic areas, phasing work to limit dust, and setting up wind fences to limit wind blown dust.

Soil Stabilization is required at regulated construction sites after normal working hours and on weekends and holidays. This requirement also applies to inactive construction areas such as phased projects where disturbed land is left unattended. Applying water to form a visible crust on the soil and restricting vehicle access are often effective for short-term stabilization of disturbed surface areas. Long-term methods including applying dust suppressants and establishing vegetative cover.

Carryout and Trackout occur when materials from emptied or loaded vehicles falls onto a paved surface or shoulder of a public road or when materials adhere to vehicle tires and are deposited onto a paved surface or shoulder of a public road. Should either occur, the material must be cleaned up at least daily, and immediately if it extends more than 50 feet from the exit point onto a paved road. The appropriate clean-up methods require the complete removal and cleanup of mud and dirt from the paved surface and shoulder. Using a blower device or dry sweeping with any mechanical device other than a PM10-efficient street sweeper is a violation. Larger construction sites, or sites with a high amount of traffic on one or more days, must prevent carryout and trackout from occurring by installing gravel pads, grizzlies, wheel washers, paved interior roads, or a combination thereof at each exit point from the site. In many cases, cleaning up trackout with water is also prohibited as it may lead to plugged storm drains. Prevention is the best method.

Unpaved Access and Haul Roads, as well as unpaved vehicle and equipment traffic areas at construction sites must have dust control. Speed limit signs limiting vehicle speed to 15 mph or less at construction sites must be posted every 500 feet on uncontrolled and unpaved roads.

San Joaquin Valley Air Pollution Control District

Northern Region Office 4800 Enterprise Way Modesto, CA 95356 - 8718 (209)557-6400

FAX (209) 557-6475

Central Region Office 1990 East Gettysburg Avenue Fresno, CA 93726 - 0244 (559)230-6000 □ FAX (559)230-6062 Southern Region Office 34946 Flyover Court Bakersfield, CA 93308 (661)392-5500 □ FAX (661)392-5585 **Storage Piles and Bulk Materials** have handling, storage, and transportation requirements that include applying water when handling materials, wetting or covering stored materials, and installing wind barriers to limit VDE. Also, limiting vehicle speeds, loading haul trucks with a freeboard of six inches or greater along with applying water to the top of the load, and covering the cargo compartments are effective measures for reducing VDE and carryout from vehicles transporting bulk materials.

Demolition activities require the application of water to the exterior of the buildings and to unpaved surfaces where materials may fall. A Dust Control Plan will be required for large demolition projects. Consider all structures slated for demolition as possibly being regulated due to potential asbestos, per District Rule 4002 - *National Emission Standards for Hazardous Air Pollutants*. Contact the District well before starting because a 10 working-day notice will likely be required before a demolition can begin.

Dust Control Plans identify the dust sources and describe the dust control measures that will be implemented before, during, and after any dust generating activity for the duration of the project. Owners or operators are required to submit plans to the District at least 30 days prior to commencing the work for the following:

- Residential developments of ten or more acres of disturbed surface area.
- Non-residential developments of five or more acres of disturbed surface area.
- The relocation of more than 2,500 cubic yards per day of materials on at least three days.

Operations may not commence until the District has approved the Dust Control Plan. A copy of the plan must be on site and available to workers and District employees. All work on the site is subject to the requirements of the approved dust control plan. A failure to abide by the plan by anyone on site may be subject to enforcement action.

Owners or operators of construction projects that are at least one acre in size and where a Dust Control Plan is not required, must provide written notification to the District at least 48 hours in advance of any earthmoving activity.

Record Keeping is required to document compliance with the rules and must be kept for each day any dust control measure is used. The District has developed record forms for water application, street sweeping, and "permanent" controls such as applying long term dust palliatives, vegetation, ground cover materials, paving, or other durable materials. Records must be kept for one year after the end of dust generating activities (Title V sources must keep records for five years).

Exemptions exist for several activities. Those occurring above 3,000 feet in elevation are exempt from all Regulation VIII requirements. Further, Rule 8021 – *Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities* exempts the following construction and earthmoving activities:

- Blasting activities permitted by California Division of Industrial Safety.
- Maintenance or remodeling of existing buildings provided the addition is less than 50% of the size of the existing building or less than 10,000 square feet (due to asbestos concerns, contact the District at least two weeks ahead of time).
- Additions to single family dwellings.
- The disking of weeds and vegetation for fire prevention on sites smaller than ½ acre.
- Spreading of daily landfill cover to preserve public health and safety and to comply with California Integrated Waste Management Board requirements.

Nuisances are prohibited at all times because District Rule 4102 – *Nuisance* applies to all construction sources of fugitive dust, whether or not they are exempt from Regulation VIII. It is important to monitor dust-generating activities and implement appropriate dust control measures to limit the public's exposure to fugitive dust.

For more information please contact the Compliance Division of the District office nearest to you. Information on Regulation VIII, where you may obtain copies of record keeping forms, the Dust Control Plan template, and the Construction Notification form, is available on the District's website at:

www.valleyair.org, under Compliance Assistance/Dust Control.

SPECIAL PROVISIONS

PART 1 SUPPLEMENTARY GENERAL PROVISIONS

STANDARD SPECIFICATIONS

The standard specifications of the City for all public works projects are contained in the latest edition, adopted by the City of Porterville of the <u>Standard Specifications for Public Works Construction</u> ("The Greenbook"), including all supplements, as written and promulgated by the Joint Cooperative Committee of the Southern California Chapter of the American Public Works Association and the Southern California District of the Associated General Contractors of California. Copies of these standard specifications are available from the publisher, BNI Building News, Incorporated, 1612 South Clementine Street, Anaheim, CA 92802 phone 800/873-6397.

The standard specifications of the City for all building construction must meet the requirements of the California Code of Regulations, Title 24, 2019 California Codes, adopted by the City of Porterville. Copies of these standard specifications are available from the International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California, 9060l, phone 2l3/699-054l.

The Standard Specifications for Public Works Construction set forth above will control the general provisions, construction materials, and construction methods for this contract except as amended by the Plans, Special Provisions, or other Contract Documents.

The section numbers of the following Special Provisions coincide with those of the said Standard Specifications. Only those sections requiring amendment or elaboration, or specifying options, are called out.

DEFINITIONS

Whenever in the Standard Specifications the following terms are used, they shall be understood to mean the following:

AGENCY (State or Department) - The City of Porterville

ENGINEER - The City Engineer of the City of Porterville acting either directly or through properly authorized agents.

HIGHWAY RIGHT OF WAY - City Street Right of Way

PROJECT MANAGER - City employee assigned to manage the project.

ENGINEER-CITY-CONTRACTOR RELATIONS

- Α. Engineer's Responsibility and Authority. All work shall be done under the general supervision of the Engineer or the Engineer's designee(s). The Contractor shall bear all responsibility for, and have all control over, the construction means, methods, techniques, sequences, procedures and safety precautions or programs; and the Engineer shall not have control over, nor bear responsibility for same. Nor will the Engineer have control over nor bear responsibility for the acts or omissions of the Contractor, Subcontractors, their agents or employees, or for failure of any of these to carry out the work in accordance with the contract documents. The Engineer has the right to reject work which does not conform to the contract documents. The Engineer has the authority to make and/or approve minor changes in the work. For more substantial changes, the Engineer will prepare and issue Change Orders. The Engineer shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, rate of progress of work, interpretation of Plans and Project Manual and all questions as to the acceptable fulfillment of the Contract on the part of the Contractor.
- B. <u>Engineer's Decisions</u>. All claims of the City or the Contractor shall be presented to the Engineer for decision which shall be made in writing within a reasonable time. All decisions of the Engineer shall be final except in case which time and/or financial considerations are involved, which may be subject to ruling from the City Attorney.
- C. <u>Suspension of Work</u>. The Engineer shall have the authority to suspend the work, wholly or in part, for such period or periods as may be deemed necessary, due to unsuitable weather or other such conditions as are considered unfavorable for the prosecution of work, or failure on the part of the Contractor to carry out the provisions of the Contract or to supply materials conforming to the requirements of the Project Manual. The Contractor shall not suspend operation without the Engineer's permission.
- D. <u>Contractor's Superintendent.</u> A qualified superintendent, who is acceptable to the Engineer, shall be maintained on the work and give efficient supervision to the work to its completion. The Superintendent shall have full authority to act on behalf of the Contractor, and all direction given to the superintendent shall be considered given to the Contractor. In general, the Engineer's instructions shall be confirmed in writing and always upon written request from the Contractor.
- E. <u>Public/Private Property</u>. The Contractor shall not enter upon private property for any purpose without obtaining permission; shall be responsible for the preservation of all public property, trees, monuments, etc., along and adjacent to the street and/or right-of-way; shall use every precaution necessary to prevent damage to pipes, conduits and other underground structures; and shall protect carefully from disturbance or damage all monuments and property marks. Any damage to properties resulting from work under contract shall be repaired or replaced to the satisfaction of the owner(s) of

- such properties. The Contractor shall not be entitled to additional payment for such repair or replacement of damaged property.
- F. <u>Separate Contracts</u>. The City may let other contracts in connection with the work of the Contractor. The Contractor shall cooperate with other Contractors with regard to the storage of materials and execution of their work. It shall be the Contractor's responsibility to inspect all work by other Contractors affecting the work and report any irregularities which will not permit the work to be completed in a satisfactory manner. Failure to notify the Engineer of such irregularities shall indicate the work of the other Contractor has been satisfactorily completed to be compatible with this contract. The Contractor shall not be responsible for defects of which could not be known which develop in the work of others after the work is complete.
- G. <u>Subcontracts</u>. At the time specified by the contract documents, or when requested by the Engineer, the Contractor shall submit in writing to the City, for approval of the Engineer, the names of the Subcontractors proposed for the work. Subcontractors may not be changed except at the request, and with the approval, of the Engineer. The Contractor is responsible to the City for the acts and omissions of Subcontractors, and of their direct and indirect employees, to the same extent as the Contractor is responsible for the acts and omissions of employees. The contract documents shall not be construed as creating any contractual relationship between any Subcontractor and the City. The Contractor shall bind every Subcontractor by the terms of the contract documents.
- H. <u>City's Right to Correct Deficiencies</u>. Upon failure of the Contractor to perform the work in accordance with the contract documents, including any requirements with respect to the Schedule of Completion, and after five (5) days written notice to the Contractor and written receipt of approval from the Engineer, the City may, without prejudice to any other remedy it may have, correct such deficiencies from the Contractor. The expense so charged shall be deducted and paid by the City out of such monies as are, or may become, due under this contract, or if such monies are not sufficient to meet said expense, the additional monies shall be furnished by the Contractor, and if the Contractor refuses or neglects to provide the necessary monies, they shall be provided by the Contractor's surety.
- I. <u>City's Right to Terminate Contract and Complete the Work</u>. The City shall have the right to terminate the employment of the Contractor upon receiving written notice from the Engineer stating cause for such action. In the event of such termination, the City may take possession of the work and of the materials, tools and equipment thereon and may finish the work by whatever means they select. it shall be considered a default by the Contractor whenever he shall:
 - 1. Declare bankruptcy, become insolvent or assign his assets for the benefit of his creditors.

- 2. Disregard or violate important provisions of the contract documents or Engineer's instruction or fail to prosecute the work according to the agreed schedule of completion, including extensions thereof.
- 3. Fail to provide a qualified superintendent, competent workmen or Subcontractors, proper materials or fail to make prompt payment thereof. Upon termination of the contract under this section, the City shall have the right to recover any excess or additional costs of completion above the contract price from the Contractor or his Performance Bond.
- J. <u>Oral Agreements</u>. No oral order, objections, 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, other than by a definitely agreed waiver, or modification thereof, in writing; and no evidence shall be introduced in any proceeding of any other waiver or modification.

ORDER OF PRECEDENCE OF CONTRACT DOCUMENTS

The contract documents are complimentary; what is called for in one is as binding as if called for in all. If the Contractor finds a conflict, error, or discrepancy in the contract documents, it should be called to the attention of the engineer in writing before proceeding with the work affected thereby. In resolving such conflicts, errors, and discrepancies, the documents shall be given preference in the following order:

- 1. Contract Agreement
- Plans
- 3. Project Manual

Within the Project Manual, the order of precedence is as follows:

- 1. Addenda
- 2. Supplementary General Provisions
- 3. Instruction to Bidders
- General Provisions
- 5. City Standard Plans and Specifications for Public Works Construction
- 6. Standard Specifications

With reference to the Plans, the order of precedence is as follows:

- 1. Figures govern over scaled dimensions
- 2. Detail plans govern over general plans
- 3. Change order plans govern over contract plans
- 4. Contract plans govern over standard plans
- 5. Contract plans govern over shop drawings

The submission of shop drawings that deviate substantially from the requirements of the contract documents must be accompanied by a written request for a change order.

This "Order of Precedence of Contract Documents" supersedes Section 2-5.2, "Precedence of Contract Documents," in the Standard Specifications.

SCOPE OF WORK

The work to be done consists of furnishing all labor, tools, equipment, materials, and incidentals as required to complete the remodel of an existing commercial structure for the City's Animal Shelter.

LOCATION OF WORK

The area of work is located at 185 North G Street, Porterville, CA 93257.

<u>INSURANCE</u>

The Contractor shall procure, and maintain for the duration of the contract, insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, his agents, representatives, employees or Subcontractors.

MINIMUM SCOPE OF INSURANCE

Coverage shall be at least as broad as:

- 1. Insurance Services Office Commercial General Liability coverage (occurrence form CG 00 01 11 88).
- 2. Insurance Services Office form number CA 00 01 06 92 covering Automobile Liability, code 1 (any auto).
- 3. Workers' Compensation Insurance as required by the State of California and Employer's Liability Insurance.

MINIMUM LIMITS OF INSURANCE

The Consultant shall maintain limits no less than:

 General Liability: \$2,000,000 per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit.

- 2. Automobile Liability: \$1,000,000 per accident for bodily injury and property damage.
- 3. Employer's Liability: \$1,000,000 per accident for bodily injury or disease.

DEDUCTIBLES AND SELF-INSURED RETENTIONS

Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the CITY, either: the insured shall reduce or eliminate such deductibles or self-insured retentions as respects the City, its officers, officials, employees and volunteers; or the Contractor shall provide a financial guarantee satisfactory to the City guaranteeing payment of losses and related investigations, claim administration and defense expenses.

OTHER INSURANCE PROVISIONS

The commercial general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:

- 1. The City, its officers, officials, employees and volunteers are to be covered as insureds as respects: liability arising out of work or operations performed by or on behalf of the Contractor; or automobiles owned, leased, hired or borrowed by the Contractor.
- 2. For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects the City, its officers, officials, employees and volunteers. Any insurance or self-insurance maintained by the CITY, its officers, officials, employees or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
- 3. The Contractor shall provide an insurance certificate for each policy that states "CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING COMPANY WILL MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER".

ACCEPTABILITY OF INSURERS

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII, unless otherwise acceptable to the City.

VERIFICATION OF COVERAGE

Contractor shall furnish the City with a completed Underwriter/Broker Certification form along with original certificates and amendatory endorsements affecting coverage required by this clause. The endorsements shall conform to City requirements and, at the option of City, the endorsements shall be provided on forms provided by City. All certificates and

endorsements are to be received and approved by the City before work commences. The City reserves the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by this Project Manual at any time.

SUBCONTRACTORS

Contractor shall include all Subcontractors as insureds under its policies or shall furnish separate certificates and endorsements for each Subcontractor. All coverages for Subcontractors shall be subject to all the requirements stated herein.

This insuring provision and the one contained in the Standard Specifications, insofar as it may be adjudged to be against public policy or in violation of Insurance Code Section 11580.04, shall be void and unenforceable only to the minimum extent necessary so that the remaining terms of the insuring provisions, contained therein, may be within public policy and enforceable

PRE-CONSTRUCTION MEETING

The Contractor shall meet with the Project Manager prior to the start of work to discuss any problems or questions that may come up. At this time the Contractor shall furnish a schedule showing the tentative starting and completion dates and traffic control plan. The Contractor shall be responsible for contacting the City for arranging the pre-construction meeting in the I0 day period between notice of award and filing of contract document. Arrangements shall be made by contacting (559) 782-7462.

PROJECT PLANS AND SPECIFICATIONS

The City shall furnish up to five (5) sets of plans and specifications, at no charge, to the Contractor for the construction of improvements. Should the Contractor require additional plans and specifications beyond the five sets furnished by the City, all costs associated with the reproduction of the additional sets shall be paid by the Contractor at the City's cost plus ten percent (10%).

CONTRACT BONDS

The Faithful Performance Bond and the Material and Labor Bond shall each be for not less than one hundred percent (100%) of the total contract amount. The Material and Labor Bond shall remain in force until thirty-five (35) days after the date of recordation of the Notice of Completion. The Faithful Performance Bond will not be released until one year after said date. The Contractor is advised to read Article V of the contract relative to bonds. All surety shall be in compliance with the requirements of the Code of Civil Procedure (Section 995.120).

AS BUILT PLANS

The Contractor shall maintain a control set of Plans and Project Manual on the project site at all times. All final locations determined in the field, and any deviations from the Plans and

Project Manual shall be marked in red on this control set to show the as-built conditions. Upon completion of all work, the Contractor shall return the control set to the Project Manager. Final payment will not be made until this requirement is met.

GUARANTEE PERIOD

Besides guarantees required elsewhere, the Contractor shall and hereby does guarantee the work for a period of one (1) year after the date of acceptance of the work by the City. The Contractor shall repair or remove and replace any and all work, together with any other work which may be displaced in so doing, that is found to be defective in workmanship and/or materials within said one year periods, without expense whatsoever to the City, ordinary wear and tear and unusual abuse or neglect excepted. In the event of failure to comply with the above-mentioned conditions within one week after being notified in writing, the City is hereby authorized to proceed to have the defects remedied and made good at the expense of the Contractor, who hereby agrees to pay the cost and charges therefore immediately on demand. Such action by the City will not relieve the Contractor of the guarantees required by this article or elsewhere in the contract documents.

The performance bond, or a maintenance bond, shall continue in full force and effect for the guarantee period.

If, in the opinion of the City, defective work creates a dangerous condition or required immediate correction or attention to prevent further loss to the City or to prevent interruption of operation of the City, the City will attempt to give the notice required by this article. If the Contractor cannot be contacted or does not comply with the City's request for correction within a reasonable time as determined by the City, the City may, notwithstanding the provisions of this article, proceed to make such correction or provide such attention; and the costs of such correction or attentions shall be charged against the Contractor. Such action by the City will not relieve the Contractor of the guarantees required by this article or elsewhere in the contract documents.

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 or supplier gives a guarantee for a longer period. The Contractor agrees to act as a co-guarantor with such manufacturer or supplier and shall furnish the City all appropriate guarantee or warranty certificates upon completion of the project. No guarantee period, whether provided for in this article or elsewhere, shall in any way limit the liability of Contractor or his sureties or insurers under the indemnity or insurance provisions of these General Provisions.

UTILITIES

<u>Location</u>. The location and existence of substructures were determined from a search of records maintained by their owners. No guarantee is made or implied that the information is complete or accurate. It shall be the Contractor's responsibility alone to

determine the exact location of substructures of every nature and to protect them from damage. The Contractor shall notify the owners of all utilities and substructures not less that forty-eight (48) hours prior to working in the vicinity of any such facility. In addition, the Contractor shall request that the owners pothole or otherwise expose all non-City owned high risk underground facilities. Representatives of some and/or all affected utilities may be present at the pre-construction meeting; however, their presence at the pre-construction meeting shall not relieve the Contractor of the responsibility of notifying each utility prior to beginning any work.

Any list of names and telephone numbers for utility or substructure owners shown on the Plans or in any other contract document is intended for the convenience of the Contractor and is not guaranteed to be complete or correct.

<u>Connections</u>. The Contractor shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission of the public or private authorities having jurisdiction over the use of said fire hydrant or pipeline and from the public or private agency owning the affected water system. For each such connection made, the Contractor shall first attach to the fire hydrant, or pipeline, a valve and a meter, if required by said authority, of a size and type acceptable to said authorities and agency. The Contractor will be granted privilege to draw water from an authorized point of connection as needed for the proper execution of said contract. There will be no charge for the water.

PROSECUTION, PROGRESS, AND ACCEPTANCE OF THE WORK

Construction Schedule and Commencement of Work. The Contractor's proposed Construction Schedule shall be submitted to the Project Manager within ten (10) working days after the date of the Notice of Contract Approval. The schedule shall be supported by written statements from each supplier of materials or equipment indicating that all orders have been placed and acknowledged, and setting forth the dates that each item will be delivered.

Prior to issuing the Notice to Proceed, the Project Manager will schedule a preconstruction meeting with the Contractor to review the proposed Construction Schedule and delivery dates, arrange utility coordination, discuss construction methods, and clarify inspection procedures.

The Contractor shall submit periodic Progress Reports to the Project Manager by the tenth day of each month. The report shall include an updated Construction Schedule. Any deviations from the original schedule shall be explained. Progress payments will be withheld pending receipt of any outstanding reports.

TIME OF COMPLETION

The time for completion shall be as set forth in Article V of the Contract Agreement.

Working Day. The Contractor's activities shall be confined to the hours between 7:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays. Deviation from these hours will not be permitted without the prior consent of the Engineer, except in emergencies involving an immediate hazard to persons or property. In the event of either a requested or emergency deviation, inspection service fees will be charged against the Contractor. The service fees will be calculated at overtime rates including benefits, overhead, and travel time. The service fees will be deducted from any amounts due the Contractor.

PROJECT SITE MAINTENANCE

Comply with Section 7-8 of the Standard Specifications. To comply with Air District rules, limit or expeditiously remove accumulations of mud or dirt from adjacent public streets at the end of each workday. Do <u>not</u> use rotary brushes. Use a regenerative air sweeper with properly maintained dust filters. Remove "Trackout", within the urban areas, immediately when it extends more than 50 feet from work site and at the end of each workday. Failure to comply with any of these requirements will result in the Contractor being assessed \$400 per day in penalties.

NOISE PRODUCED BY CONTRACTOR'S EQUIPMENT AND FACILITIES

A noise level limit of 86 db at a distance of fifty feet (50') shall apply to all construction equipment on or related to the job whether owned by the Contractor or not. The use of excessively loud warning signals shall be avoided except in those cases required for the protection of personnel.

WORK REQUIRING CITY PERSONNEL

The Contractor shall pay for City personnel labor, equipment and materials wherever City forces are called upon to repair marked water mains, services, valves, sewer mains, laterals, etc. Fee schedules for all City personnel and equipment are available upon request.

LABOR LAWS

The Contractor, and all Subcontractors, suppliers, and vendors, shall comply with all City, state and federal orders regarding affirmative action to ensure equal employment opportunities and fair employment practices. Failure to file any report due under said orders will result in suspension of periodic progress payments.

The Contractor shall ensure unlimited access to the job site for all equal employment opportunity compliance officers.

PERMITS

Prior to the start of any work, the Contractor shall take out the applicable City permits and make arrangements for City inspections. The Contractor and all Subcontractors shall each obtain a City business license and shall be licensed in accordance with the State Business and Professions Code. The Contractor shall also obtain, at his own cost and expense, any and all other permits, licenses, inspections, certificates, or authorizations required by any governing body.

CONSTRUCTION SURVEYING

Construction surveying will be provided by the City of Porterville. All re-staking and requested special staking will be at the Contractor's expense. See Section 2-9, "Surveying," of the Standard Specifications for Public Works Construction.

PUBLIC CONVENIENCE AND SAFETY

Notice to the Public. Prepare a written notice to all property owners/occupants adjacent to and/or affected by the construction works and submit it for City approval not less than five days prior to start of construction. Include in the notice, the name of company, the name and phone number of the contact person(s) in your company and the date construction work will start. Deliver the notice to all owners/occupants of the property adjacent to and/or affected by the construction, not less than 48 hours prior to start of construction.

<u>Traffic and Access</u>. The Contractor shall comply with Section 7-10 of the Standard Specifications and Part 6 of the California Manual on Uniform Traffic Control Devices. The Contractor shall notify the occupants of all affected properties at least forty-eight (48) hours prior to any temporary obstruction of access. No overnight closure of any driveway will be allowed except as permitted by the Engineer.

At least one 10' wide (minimum) traffic lane shall be provided for each direction of travel on all streets at all times. The traffic lanes shall remain unobstructed. Lane transitions shall not be sharper than a taper of thirty to one (30:1).

Clearances from traffic lanes shall be 5' to the edge of any excavation and 2' to the face of any curb, pole, barricade, delineator, or other vertical obstruction.

One 4' foot wide paved pedestrian walkway shall be maintained parkway area on each side of all streets. The clearance from the pedestrian walkway to any traffic lane shall be 5', unless otherwise authorized.

<u>Street Closures, Detours, and Barricades</u>. Street closures will not be allowed except as specifically permitted by the Engineer. The Contractor shall prepare any traffic control or detour plans that may be required as directed by the Engineer.

Temporary traffic channelization shall be accomplished with flashing barricades and delineators. Temporary striping will not be allowed unless specifically permitted by the Engineer. The Contractor shall prepare any plans that may be required for temporary striping to the satisfaction of the Engineer. In no event will temporary striping be allowed on pavement surfaces to remain.

<u>Public Safety Orders</u>. The Contractor shall comply with the provisions of any ordinances or regulations regarding requirements for the protection of excavations and the nature of such protection.

LAWS TO BE OBSERVED

The Contractor shall give all notices and comply with all prevailing Federal, State and Local laws, ordinances and all such orders and decrees as exist, or may be enacted by bodies or tribunals having any jurisdiction or authority over the work, and shall indemnify and save harmless the City against any claim or liability arising from, or based on, the violation of any such law, ordinance, regulation, order or decree, whether by him/herself or his/her employees and Subcontractors.

PAYROLL RECORDS

Certified payroll records shall be kept in the office of the Contractor for five years after completion of the work. Required certified payroll records should be submitted weekly to the City and should include daily and/or weekly status reports. Required certified payroll records from each contractor and subcontractor shall be submitted to the City no later than the 15th day of each month for the previous month's work. Progress payments will be withheld pending receipt and approval of any outstanding reports or if the records are not properly certified.

DUST ABATEMENT

The Contractor shall furnish all labor, equipment and means required, and shall carry out effective measures wherever and as often as necessary to prevent his operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals or causing a nuisance to persons living or occupying buildings in the vicinity. The Contractor shall be responsible for any damage resulting from any dust originating from his operations. Dust abatement measures, in compliance with all applicable San Joaquin Valley Unified Air Pollution Control District Rules, shall be continued until the Contractor is relieved of further responsibility by the Engineer (see Compliance Assistance Bulletin dated April 2007 in the appendix). No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the various prices named in the bid sheet(s) for completion of the work. Failure to comply with any of these requirements will result in the Contractor being assessed \$400 per day in penalties.

MEASUREMENT AND PAYMENT

<u>Partial and Final Payment</u>. The closure date for periodic progress payments will be the twenty-fifth day of each month.

Authorization to pay is commonly received on the tenth day of the following month. However, payments will be withheld pending receipt of any outstanding reports required by the contract documents. In addition, the final progress payment will not be released until the Contractor returns the control set of Plans and Specifications showing the asbuilt conditions.

The full five percent (5%) retention will be deducted from all payments. The final retention will be authorized for payment thirty-five (35) days after the date of recordation of the Notice of Completion, provided no liens or stop notices are filed and required testing is completed (e.g., Mandril tests).

The Contractor may elect to receive one hundred percent (100%) of payments due under the contract from time to time without retention of any portion of the payments by the public agency by depositing securities of equivalent value with the public agency in accordance with the provisions of Section 22300 of the California Public Contract Code. Such securities, if deposited by the Contractor, shall be valued by the Public Agency's Finance Director, whose decisions on valuation of the securities shall be final.

<u>Delivered Materials</u>. Materials and equipment delivered but not incorporated into the work, will not be included in the estimate for progress payment.

<u>Final Payment</u>. After the Contractor has completed all the work to be performed to the approval of the Engineer, and in strict accordance with the Plans, Specifications and Contract, the Engineer shall measure the work and prepare a final estimate of the total amount payable to the Contractor. The estimate shall be itemized as to contract item quantities, extra work and any other basis for payment and shall show all deductions made or to be made for prior payments and amounts to be kept or retained under the provision of the Contract. All prior estimates and payments shall be subject to correction in the proposed final estimate. Within 30 days after said final estimate has been submitted to the Contractor, he shall submit to the Engineer his written approval thereof. No claim will be considered that was not included in the proposed final estimate.

On the Contractor's approval, or if he files no claim within said period of 30 days, the Engineer will submit the final estimate of the total amount payable to the City Manager. If the City Council is satisfied the work has been properly completed and the final estimate is correct, and properly stated, the City will pay the Contractor ninety percent (90%) of the sum found to be due.

The date on which the City Council accepts the improvement shall be the beginning of the maintenance or warranty period.

COOPERATION AND COLLATERAL WORK

The Contractor shall be required, under contract, to work in conjunction with other affected agencies or companies for relocation or adjustment of their facilities. Coordination efforts will be discussed at the preconstruction meeting prior to starting the project. Every effort will be made to provide for the timely completion of all aspects of this project.

EXTRA WORK

Extra Work shall be governed by Section 3-3 of the Standard Specifications except that the mark up shall be governed by Section 9-1.03A *Work Performed by Contractor* of the Caltrans Standard Specifications.

PART 2 CONSTRUCTION MATERIALS & METHODS

CONSTRUCTION MATERIALS

Construction materials shall comply with all applicable sections of the following:

- Standard Specifications for Public Works Construction (Greenbook), latest edition.
- 2. Standard Plans and Specifications of the City, latest edition.
- 3. Standard Specifications, State of California Department of Transportation (Cal-Trans), latest edition.
- 4. Standard Plans, State of California Department of Transportation (Cal-Trans), latest edition.
- 5. California Code of Regulations, Title 24, 2019 California Codes, previously adopted by City Council.

The Standard Plans and Specifications of the Agency and with the specific requirements of the Special Provisions.

CONSTRUCTION METHODS

Construction methods shall comply with all applicable sections of the Standard Specifications for Public Works Construction ("The Greenbook") latest edition adopted by the City of Porterville, the Standard Plans and Specifications of the City and with the specific requirements of the Special Provisions unless noted otherwise herein.

Rejected Work. The Engineer may reject work which is not done in accordance with the contract. All work which has been rejected shall be remedied or removed and replaced by the Contractor in an acceptable manner and no compensation will be allowed for such removal, replacement or remedial work.

Any work done beyond the boundaries established by the engineer or any work as hereinafter specified which is done without proper permits, inspection and testing, will be considered as unauthorized work and will be rejected. Upon order of the Engineer, unauthorized work shall be remedied, removed, or replaced at the Contractor's expense.

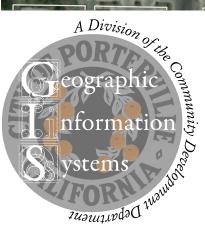
Upon failure of the Contractor to comply promptly with an order, the Engineer may cause rejected or unauthorized work to be remedied, removed or replaced, and deduct the cost from any money to become due to the Contractor.

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LOCATOR MAP

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Porterville Animal Shelter 185 North D Street Project Locator Map

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PART 3 TECHNICAL SPECIFICATIONS

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PORTERVILLE ANIMAL SHELTER FACILITY

CONSTRUCTION DOCUMENTS - 100% SET

SPECIFICATIONS PACKAGE

October 27, 2020

RA-DA

SECTION 00 01 01 PROJECT TITLE PAGE

PROJECT MANUAL

FOR

PORTERVILLE ANIMAL SHELTER FACILITY

100% CONSTRUCTION DOCUMENTS PACKAGE

CITY OF PORTERVILLE 185 N. D STREET PORTERVILLE, CA 93257

DATE: OCTOBER 27, 2020

PREPARED BY:

RA-DA

END OF SECTION

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SECTION 01 10 00 SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Portervile Animal Shelter Facility.
- B. Owner's Name: City of Porterville, 291 North Main Street, Porterville, California 93257.
- C. Architect's Name: Rania Alomar, RA-DA, 7523 Norton Avenue, West Hollywood, CA 90046, Telephone: (323) 851-4040.
- D. Associate Architect's Name: Dennis A Townsend, Townsend Architectural Group, Telephone: (559) 789-9999.
- E. The Project consists of the alteration of existing building at 185 North D Street, Porterville, CA into animal shelter facility per Contract Drawings.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Bid Proposal and Agreement forms furnished by the City of Porterville.

1.03 DESCRIPTION OF ALTERATIONS WORK

- Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.
- B. Scope of alterations work is indicated on drawings.
- C. Plumbing: Alter existing and add new construction.
- D. HVAC: Alter existing and add new construction.
- E. Electrical Power and Lighting: Alter existing and add new construction.
- F. Fire Suppression Sprinklers: Alter existing and add new construction.
- G. Fire Alarm: Alter existing and add new construction.
- H. Telephone: Alter existing and add new construction.

1.04 WORK BY OWNER

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion.
 - 1. Equipment listed in schedules on Drawings.
- B. Owner will supply the following for installation by Contractor:
 - 1. Equipment listed in schedules on Drawings.

1.05 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

- A. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

B. Time Restrictions:

- 1. Limit conduct of especially noisy exterior work to hours established by City of Porterville regulations and ordinances.
- 2. Limit conduct of construction work, including clean up; to the hours of between 7:00 AM and 5:00 PM Monday through Friday.

- 3. Working days shall not include weather days, Saturdays, Sundays, or legal Federal Holidays.
 - a. Exceptions may be granted only with explicit permission from Owner.
- C. Utility Outages and Shutdown:
 - Prevent accidental disruption of utility services to other facilities.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for style of language and intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in Specifications. Unless otherwise indicated, linked information is not part of Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to Work of all Sections in Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

END OF SECTION

01 10 00 - 2 SUMMARY

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.

1.02 RELATED REQUIREMENTS

- A. Section 01 25 00 Substitution Procedures.
- B. Section 01 60 00 Product Requirements.
- C. Section 01 78 00 Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

- Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement or most current version.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement or most current version.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.
 - 9. Balance to Finish.
 - 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
 - 1. Transmittal letter as specified for submittals in Section 01 30 00.
 - 2. Construction progress schedule, revised and current as specified in Section 01 32 16.
 - 3. Current construction photographs specified in Section 01 30 00.
 - 4. Partial release of liens from major subcontractors and vendors.
 - 5. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 25 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
 - 3. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.

- c. Time records and wage rates paid.
- Invoices and receipts for products, equipment, and subcontracts, similarly documented.
- 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:

 1. All closeout procedures specified in Section 01 70 00.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 23 00 ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

- A. Instructions to Bidders prepared by the City of Porterville.
- B. Bid Form prepared by the City of Porterville.
- C. Construction Contract Agreement prepared by the City of Porterville.
- D. Division 01 Sections prepared by the City of Porterville.

1.03 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.
- For alternates accepted at the times of bid award, detailed base bid work shall be considered as future work.

1.04 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 Rooms 141 and 142:
 - 1. Base Bid: Full build-out of area as indicated on Drawings.
 - 2. Deductive alternate:
 - a. Build hallway wall (Room 119).
 - Rooms 141 & 142: Stub-out plumbing for hose reel and complete installation of floor drains. Do not install dividing walls between rooms or room finishes, including ceilings.
- B. Alternate No. 2 Rooms 151, 152, 153, 154, 155, 156, 157, and 158:
 - 1. Base Bid: Full build-out of area as indicated on Drawings.
 - 2. Deductive alternate:
 - a. Complete wall for Room 119 hallway, including parts along rooms 157, 151 & 152.
 - b. Room 157: Stub-out plumbing for water supply & complete floor drains.
 - c. Provide paint for reception counter and new paint on lobby walls.
 - d. Rooms 151, 152, & 153: Do not install dividing walls between rooms or room finishes, including ceilings.
 - e. Do not install walls for 154 & 155.
 - f. Do not install Crate Storage fence using fence type MTL-3 on exterior near through drive through aisle.

PART 2 PRODUCTS - NOT USED PART 3 EXECUTION - NOT USED

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

- A. Section 01 23 00 Alternates, for product alternatives affecting this section.
- B. Section 01 30 00 Administrative Requirements: Submittal procedures, coordination.
- C. Section 01 60 00 Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.
- D. Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability.
 - b. Regulatory changes.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
 - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. No specific form is required. Contractor's Substitution Request documentation must include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - 2) Owner's, Architect's, and Contractor's names.

- b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Indication of whether the substitution is for cause or convenience.
 - 3) Issue date.
 - 4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 5) Description of Substitution.
 - 6) Reason why the specified item cannot be provided.
 - 7) Differences between proposed substitution and specified item.
 - 8) Description of how proposed substitution affects other parts of work.
- c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Sustainable design features.
 - 6) Warranties.
 - 7) Other salient features and requirements.
 - 8) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
 - 1) Savings to Owner for accepting substitution.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.
- B. Owner will consider requests for substitutions only if submitted at least 10 days prior to the date for receipt of bids.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- Architect will consider requests for substitutions only within 15 days after date established in Notice to Proceed.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions will not be considered under one or more of the following circumstances:
 - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 - 2. Without a separate written request.
 - 3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

 Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Construction progress schedule.
- G. Contractor's daily reports.
- H. Progress photographs.
- I. Submittals for review, information, and project closeout.
- J. Number of copies of submittals.
- K. Requests for Interpretation (RFI) procedures.
- L. Submittal procedures.

1.02 RELATED REQUIREMENTS

- Section 01 32 16 Construction Progress Schedule: Form, content, and administration of schedules.
- B. Section 01 60 00 Product Requirements: General product requirements.
- C. Section 01 70 00 Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 78 00 Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.
- E. Section 01 91 13 General Commissioning Requirements: Additional procedures for submittals relating to commissioning.
 - Where submittals are indicated for review by both Architect and the Commissioning Authority, submit one extra and route to Architect first, for forwarding to the Commissioning Authority.
 - Where submittals are not indicated to be reviewed by Architect, submit directly to the Commissioning Authority; otherwise, the procedures specified in this section apply to commissioning submittals.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - Requests for Interpretation (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
 - Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
 - Contractor and Architect are required to use this service.
 - 3. It is Contractor's responsibility to submit documents in allowable format.
 - 4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
 - 5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
 - 6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
 - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Cost: The cost of the service is to be paid by Contractor; include the cost of the service in the Contract Sum.
- C. Submittal Service: The selected service is:
 - Procor or other equivalent service, as approved by Architect and Owner.
- D. Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.
 - 1. Representatives of Owner are scheduled and included in this training.
- E. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
 - 1. Owner.
 - 2. Architect.
 - 3. Associate Architect.
 - 4. Contractor.
 - 5. Major subcontractors.
- C. Agenda:
 - 1. Execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 5. Submission of initial Submittal schedule.
 - 6. Designation of personnel representing the parties to Contract and Architect.

- 7. Procedures and processing of field decisions, RFIs, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
- 8. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

- A. Schedule meeting at the Project site prior to Contractor occupancy.
 - 1. Site mobilization meeting may be combined with Preconstruction meeting if all parties agree.

B. Attendance Required:

- 1. Contractor.
- 2. Owner.
- Architect.
- 4. Associate Architect.
- 5. Contractor's superintendent.
- 6. Major subcontractors.

C. Agenda:

- 1. Use of premises by Owner and Contractor.
- 2. Owner's requirements.
- 3. Construction facilities and controls provided by Owner.
- 4. Temporary utilities provided by Owner.
- 5. Survey and building layout.
- 6. Security and housekeeping procedures.
- 7. Schedules.
- 8. Application for payment procedures.
- 9. Procedures for testing.
- 10. Procedures for maintaining record documents.
- 11. Requirements for start-up of equipment.
- 12. Inspection and acceptance of equipment put into service during construction period.
- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at maximum weekly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

- 1. Contractor.
- 2. Owner.
- 3. Architect.
- 4. Associate Architect.
- 5. Contractor's superintendent.
- 6. Major subcontractors.

D. Agenda:

- 1. Review minutes of previous meetings.
- 2. Review of work progress.
- 3. Field observations, problems, and decisions.
- 4. Identification of problems that impede, or will impede, planned progress.
- 5. Review of submittals schedule and status of submittals.
- 6. Review of RFIs log and status of responses.
- 7. Review of off-site fabrication and delivery schedules.

- 8. Maintenance of progress schedule.
- 9. Corrective measures to regain projected schedules.
- 10. Planned progress during succeeding work period.
- 11. Coordination of projected progress.
- 12. Maintenance of quality and work standards.
- 13. Effect of proposed changes on progress schedule and coordination.
- 14. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. See section 01 32 16 - Construction Progress Schedule for requirements.

3.06 DAILY CONSTRUCTION REPORTS

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Submit copies weekly through electronic document submittal service.
- C. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
 - 1. Date.
 - 2. High and low temperatures, and general weather conditions.
 - 3. List of subcontractors at Project site.
 - 4. Approximate count of personnel at Project site.
 - 5. Major equipment at Project site.
 - 6. Material deliveries.
 - 7. Safety, environmental, or industrial relations incidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (submit a separate special report).
 - 10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
 - 11. Emergency procedures.
 - 12. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
 - 13. Testing and/or inspections performed.
 - 14. Signature of Contractor's authorized representative.

3.07 PROGRESS PHOTOGRAPHS

- A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.
- B. Maintain one set of all photographs at project site for reference; same copies as submitted, identified as such.
- C. Photography Type: Digital; electronic files.
- D. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect. Show all areas where work is occuring with each application for payment.
- E. In addition to periodic, recurring views, take photographs of each of the following events:
 - 1. Completion of site clearing and building preparation.
 - 2. Structural framing in progress and upon completion.
 - 3. Final completion, minimum of ten (10) photos.
- F. Take photographs as evidence of existing project conditions as follows:
 - 1. Interior views: 20.
 - 2. Exterior views: 20.

G. Views:

- 1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
- 2. Consult with Architect for instructions on views required.
- 3. Provide factual presentation.
- 4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
- H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
 - 1. Delivery Medium: Via email.
 - 2. File Naming: Include project identification, date and time of view, and view identification.
 - 3. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.
 - 4. Hard Copy: Printed hardcopy (grayscale) of PDF file and point of view sketch.

3.08 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Prepare in a format and with content acceptable to Owner.
 - 3. Prepare using software provided by the Electronic Document Submittal Service.
 - 4. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
 - a. Approval of submittals (use procedures specified elsewhere in this section).
 - b. Approval of substitutions (see Section 01 60 00 Product Requirements)
 - c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
 - d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
 - 3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response.
 - 4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.

- a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 - Official Project name and number, and any additional required identifiers established in Contract Documents.
 - 2. Owner's, Architect's, and Contractor's names.
 - 3. Discrete and consecutive RFI number, and descriptive subject/title.
 - 4. Issue date, and requested reply date.
 - 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 - 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 - 7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 - 2. Note dates of when each request is made, and when a response is received.
 - 3. Highlight items requiring priority or expedited response.
 - 4. Highlight items for which a timely response has not been received to date.
 - 5. Identify and include improper or frivolous RFIs.
- H. Review Time: Architect will respond and return RFIs to Contractor within 5 working days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 1:00 PM will be considered as having been received on the following regular working day.
 - 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
 - 1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
 - Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
 - 3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
 - 4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.09 SUBMITTAL SCHEDULE

- A. Submit to Architect for review a schedule for submittals in tabular format.
 - Submit at the same time as the preliminary schedule specified in Section 01 32 16 -Construction Progress Schedule.
 - 2. Coordinate with Contractor's construction schedule and schedule of values.

- Format schedule to allow tracking of status of submittals throughout duration of construction.
- Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
- 5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.10 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 - 1. Product data.
 - 2. Shop drawings.
 - 3. Samples for selection.
 - 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 - Design data.
 - 2. Certificates.
 - 3. Test reports.
 - 4. Inspection reports.
 - 5. Manufacturer's instructions.
 - 6. Manufacturer's field reports.
 - 7. Field engineering daily reports.
 - 8. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 Closeout Submittals:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Extra Copies at Project Closeout: See Section 01 78 00.
- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 - 1. After review, produce duplicates.
 - 2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

- A. General Requirements:
 - 1. Use a single transmittal for related items.
 - 2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
 - 3. Transmit using approved form.
 - a. Use form generated by Electronic Document Submittal Service software.
 - 4. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
 - 5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
 - 6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
 - 7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
 - Upload submittals in electronic form to Electronic Document Submittal Service website.
 - 1) Samples shall be delivered to Architect at business address.
 - 8. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 10 working days excluding delivery time to and from the Contractor.
 - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 5 working days.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
 - d. For the purpose of establishing the start of the mandated response period, submittals received after 1:00 PM will be considered as having been received on the following regular working day.
 - 9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
 - 10. Provide space for Contractor and Architect review stamps.
 - 11. When revised for resubmission, identify all changes made since previous submission.
 - 12. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
 - 13. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
 - 14. Submittals not requested will not be recognized or processed.

B. Product Data Procedures:

- 1. Submit only information required by individual specification sections.
- 2. Collect required information into a single submittal.
- 3. Submit concurrently with related shop drawing submittal.
- 4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

- 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
- 2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- 3. Floor plan sheets only are available as a single-time request for electronic documents in AutoCAD 2020 format.

D. Samples Procedures:

- 1. Transmit related items together as single package.
- Identify each item to allow review for applicability in relation to shop drawings showing installation locations.
- 3. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.
- Transmit actual samples for review. Photographs will be used to document review and comments.

3.15 SUBMITTAL REVIEW

- Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 - 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. Reviewed: Where submittal is marked "Reviewed," that part of Work covered by submittal may proceed provided it complies with requirement of Contract Documents; final acceptance will depend upon that compliance.
 - b. Reviewed: Additional Information Required: Where submittal is marked "Reviewed -- Additional Information Required," information submitted has been reviewed and approved as noted. However, additional information as noted and/or required by Contract Documents needs to be submitted.
 - c. Furnish as Corrected: When submittal is marked "Furnish as Corrected," that part of Work covered by submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 - 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Revise and Resubmit".
 - When submittal is marked "Revise and resubmit," do not proceed with that part of Work covered by submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare new submittal in accordance with notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - (a) Do not permit submittals marked "Revise and Resubmit" to be used at Project Site, or elsewhere Work is in progress.
 - b. "Rejected".
 - When submittal is marked "Rejected," information submitted is not in compliance with Contract Documents. Resubmit submittal as required by Contract Documents.
 - 2) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
 - Architect will review each submittal and not return it if acceptable. If item does not comply with requirements, item will be returned to Contractor.
- F. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.
- G. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- H. Submittals not required by the Contract Documents may be returned by the Architect without action.

SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary: owner-furnished items.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit in PDF format.
- G. Submit under transmittal letter form specified in Section 01 30 00 Administrative Requirements.

1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with three years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.
- B. Contractor's Administrative Personnel: Three years minimum experience in using and monitoring CPM schedules on comparable projects.

1.06 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: 22 x 17 inches (560 x 432 mm).
- C. Sheet Size: Multiples of 8-1/2 x 11 inches (216 x 280 mm).
- D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Provide sub-schedules to define critical portions of the entire schedule.
- D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

- E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- F. Indicate delivery dates for owner-furnished products.
- G. Coordinate content with schedule of values specified in Section 01 20 00 Price and Payment Procedures.
- H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's construction-related professional design services.
- F. Contractor's design-related professional design services.
- G. Control of installation.
- H. Mock-ups.
- I. Tolerances.
- Manufacturers' field services.
- K. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 Administrative Requirements: Submittal procedures.
- Section 01 60 00 Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- B. ASTM C1093 Standard Practice for Accreditation of Testing Agencies for Masonry.
- C. ASTM D3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- D. ASTM E329 Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- E. ASTM E543 Standard Specification for Agencies Performing Nondestructive Testing.
- F. ASTM E699 Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components.
- G. IAS AC89 Accreditation Criteria for Testing Laboratories.

1.04 DEFINITIONS

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
 - Design Services Types Required:
 - a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.
 - b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.05 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
 - 1. Temporary sheeting, shoring, or supports.
 - 2. Temporary scaffolding.
 - 3. Temporary stairs or steps required for construction access only.

1.06 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
 - 1. Submit a Request for Interpretation to Architect if the criteria indicated are not sufficient to perform required design services.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
 - Items as indicated on Drawings.

1.07 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
 - 1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
 - a. Full name.
 - b. Professional licensure information.
 - c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.
- C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
 - 1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
 - 2. Include required product data and shop drawings.
 - 3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
 - 4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.
- Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
 - Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.

- j. Compliance with Contract Documents.
- k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.08 QUALITY ASSURANCE

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Contractor's Quality Control (CQC) Plan:
 - 1. Prior to start of work, submit a comprehensive plan describing how contract deliverables will be produced. Tailor CQC plan to specific requirements of the project. Include the following information:
 - a. Management Structure: Identify personnel responsible for quality. Include a chart showing lines of authority.
 - 1) Include qualifications (in resume form), duties, responsibilities of each person assigned to CQC function.
 - b. Management Approach: Define, describe, and include in the plan specific methodologies used in executing the work.
 - 1) Management and control of documents and records relating to quality.
 - 2) Communications.
 - 3) Coordination procedures.
 - 4) Resource management.
 - 5) Process control.
 - 6) Inspection and testing procedures and scheduling.
 - 7) Control of noncomplying work.
 - Tracking deficiencies from identification, through acceptable corrective action, and verification.
 - 9) Control of testing and measuring equipment.
 - 10) Project materials certification.
 - 11) Managerial continuity and flexibility.
 - c. Owner will not make a separate payment for providing and maintaining a Quality Control Plan. Include associated costs in Bid price.
 - d. Acceptance of the plan is required prior to start of construction activities not including mobilization work. Owner's acceptance of the plan will be conditional and predicated on continuing satisfactory adherence to the plan. Owner reserves the right to require

Contractor to make changes to the plan and operations, including removal of personnel, as necessary, to obtain specified quality of work results.

C. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.09 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.10 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 - 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1077, ASTM C1093, and ASTM D3740, as appropriate.
 - 2. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
 - 3. Laboratory: Authorized to operate in the State in which the Project is located.
 - 4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- D. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- E. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- F. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
- G. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.

- b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
- c. To facilitate tests/inspections.
- d. To provide storage and curing of test samples.
- 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- Field offices.

1.02 REFERENCE STANDARDS

1.03 TEMPORARY UTILITIES

- A. Provide and pay for all electrical power, lighting, and water required for construction purposes.
- B. Existing restroom facilities and HVAC/ventilation system may not be used.
- C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

- Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
 - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
 - 2. Internet Connections: Minimum of one; DSL modem or faster.
 - 3. Email: Account/address reserved for project use.
 - 4. Project web site.

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.
- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- G. Existing parking areas may be used for construction parking.
- H. Designate one parking space for Owner and Architect use.

1.10 WASTE REMOVAL

- A. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

- A. Provide project identification sign of design, construction, and location approved by Owner.
- B. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Office: In existing building. location where construction will not be disturbed. Office area shall be restored to required conditions for Substantial Completion.
- C. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- D. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Performance bond.
- E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

A. Section 32 93 00 - Planting.

1.03 REFERENCE STANDARDS

- A. ASTM D4355/D4355M Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
- B. ASTM D4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- C. ASTM D4533/D4533M Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- D. ASTM D4632/D4632M Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- E. ASTM D4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- F. ASTM D4873/D4873M Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
- G. EPA (NPDES) National Pollutant Discharge Elimination System (NPDES), Construction General Permit.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of State of California Erosion and Sedimentation Control Manual.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.
- E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
- F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
- G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

- 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
 - 1. Prevent windblown soil from leaving the project site.
 - 2. Prevent tracking of mud onto public roads outside site.
 - 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 - 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
 - If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- L. Open Water: Prevent standing water that could become stagnant.
- M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Erosion and Sedimentation Control Plan:
 - 1. Submit within 2 weeks after Notice to Proceed.
 - 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - Format required by law is acceptable, provided any additional information specified is also included.
 - 3. Obtain the approval of the Plan by authorities having jurisdiction.
 - 4. Obtain the approval of the Plan by Owner.
- C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

- D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- E. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 - 1. Straw or hav.
 - Wood waste, chips, or bark.
 - 3. Erosion control matting or netting.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Bales: Air dry, rectangular straw bales.
 - 1. Cross Section: 14 by 18 inches (350 by 450 mm), minimum.
 - 2. Bindings: Wire or string, around long dimension.
- D. Bale Stakes: One of the following, minimum 3 feet (1 m) long:
 - Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
 - 2. Wood, 2 by 2 inches (50 by 50 mm) in cross section.
- E. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve (0.600 mm), maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 100 pounds-force (450 N), minimum, in cross-machine direction; 124 pounds-force (550 N), minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force (245 N), minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- F. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Linear Sediment Barriers: Made of silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Across the entrances to culverts that receive runoff from disturbed areas.

- 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet (30 m)..
 - b. Slope Between 2 and 5 Percent: 75 feet (23 m).
 - c. Slope Between 5 and 10 Percent: 50 feet (15 m).
 - d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
 - e. Slope Over 20 Percent: 15 feet (4.5 m).
- C. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
 - 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- D. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- E. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- F. Soil Stockpiles: Protect using one of the following measures:
 - 1. Cover with polyethylene film, secured by placing soil on outer edges.
 - 2. Cover with mulch at least 4 inches (100 mm) thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches (150 mm) of straw or hay.
- G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
 - 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
- H. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Silt Fences:
 - Store and handle fabric in accordance with ASTM D4873/D4873M.
 - 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
 - 7. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch (19 mm) diameter flat or button head, 1 inch (25 mm) long, and 14 gage, 0.083 inch (2.11 mm) shank diameter.
 - b. Five staples per post with at least 17 gage, 0.0453 inch (1.150 mm) wire, 3/4 inch (19 mm) crown width and 1/2 inch (12 mm) long legs.
 - 8. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).
- B. Straw Bale Rows:
 - 1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
 - 2. Install bales so that bindings are not in contact with the ground.

- 3. Embed bales at least 4 inches (100 mm) in the ground.
- 4. Anchor bales with at least two stakes per bale, driven at least 18 inches (450 mm) into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
- 5. Fill gaps between ends of bales with loose straw wedged tightly.
- 6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

C. Mulching Over Small and Medium Areas:

- 1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
- 2. Wood Waste: Apply 2 to 3inches (50 to 75 mm) depth.
- 3. Erosion Control Matting: Comply with manufacturer's instructions.

D. Temporary Seeding:

- 1. When hydraulic seeder is used, seedbed preparation is not required.
- 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
- 3. If temporary mulching was used on planting area but not removed, apply nitrogen fertilizer at 1 pound per 1000 sq ft (0.5 kg per 100 sq m).
- 4. On soils of very low fertility, apply 10-10-10 fertilizer at rate of 12 to 16 pounds per 1000 sq ft (6 to 8 kg per 100 sq m).
- 5. Incorporate fertilizer into soil before seeding.
- 6. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
- 7. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
- 8. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.

C. Silt Fences:

- 1. Promptly replace fabric that deteriorates unless need for fence has passed.
- 2. Remove silt deposits that exceed one-third of the height of the fence.
- 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Straw Bale Rows:

- 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
- 2. Remove silt deposits that exceed one-half of the height of the bales.
- 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 Summary: Identification of Owner-supplied products.
- B. Section 01 25 00 Substitution Procedures: Substitutions made during procurement and/or construction phases.
- Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 01 74 19 Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

A. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.

1.04 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

1.05 QUALITY ASSURANCE

A. CAL (CDPH SM) v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
 - 1. Made using or containing CFC's or HCFC's.
 - 2. Made of wood from newly cut old growth timber.
 - 3. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 25 00 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

- A. See Section 01 10 00 Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
 - Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:

- 1. Review Owner reviewed shop drawings, product data, and samples.
- Receive and unload products at site; inspect for completeness or damage jointly with Owner.
- 3. Handle, store, install and finish products.
- 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.
 - 1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- I. Comply with manufacturer's warranty conditions, if any.
- J. Do not store products directly on the ground.
- K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- M. Prevent contact with material that may cause corrosion, discoloration, or staining.
- N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

SECTION 01 61 16

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings applied on site.
 - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- C. CAL (CDPH SM) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers.
- D. CARB (ATCM) Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board.
- E. CARB (SCM) Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- F. CHPS (HPPD) High Performance Products Database.
- G. CRI (GLP) Green Label Plus Testing Program Certified Products.
- H. SCAQMD 1113 Architectural Coatings.
- I. SCAQMD 1168 Adhesive and Sealant Applications.
- J. SCS (CPD) SCS Certified Products.
- K. UL (GGG) GREENGUARD Gold Certified Products.

1.05 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
 - 2. Joint Sealants: SCAQMD 1168 Rule.
 - 3. Paints and Coatings: Each color; most stringent of the following:

- a. 40 CFR 59, Subpart D.
- b. SCAQMD 1113 Rule.
- c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Surveying for laying out the work.
- F. Cleaning and protection.
- G. Starting of systems and equipment.
- H. Demonstration and instruction of Owner personnel.
- I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- J. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 30 00 Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 40 00 Quality Requirements: Testing and inspection procedures.
- D. Section 01 51 00 Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- E. Section 01 57 13 Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
- F. Section 01 74 19 Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- G. Section 01 78 00 Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- H. Section 01 79 00 Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- I. Section 01 91 13 General Commissioning Requirements: Contractor's responsibilities in regard to commissioning.
- J. Section 07 84 00 Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

- 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
- 2. Identify demolition firm and submit qualifications.
- 3. Include a summary of safety procedures.
- D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate Contractor.
 - g. Written permission of affected separate Contractor.
 - h. Date and time work will be executed.
- E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of five years of documented experience.
- B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 2. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. At All Times: Excessively noisy tools and operations will not be tolerated inside the building at any time of day; excessively noisy includes jackhammers.

- 2. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm, on other limits set by the City of Porterville.
- H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
 - 1. Pest Control Service: Weekly treatments.
- I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.
- D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- G. Utilize recognized engineering survey practices.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
 - 4. Controlling lines and levels required for mechanical and electrical trades.
- I. Periodically verify layouts by same means.
- J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. See Section 01 10 00 for other limitations on outages and required notifications.
 - c. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - Remove abandoned pipe, ducts, conduits, and equipment, including those above
 accessible ceilings; remove back to source of supply where possible, otherwise cap stub
 and tag with identification; patch holes left by removal using materials specified for new
 construction.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

- 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
- 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- 3. Where a change of plane of 1/4 inch (6 mm) or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- 4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
 - 1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 - 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- J. Patching:

- 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
- 2. Match color, texture, and appearance.
- 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- H. Prohibit traffic from landscaped areas.
- I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven 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, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification 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 that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

3.12 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 Testing, Adjusting, and Balancing for HVAC.

3.13 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- F. Clean filters of operating equipment.
- G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- H. Clean site; sweep paved areas, rake clean landscaped surfaces.
- I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Architect and Owner.
- B. Accompany Architect on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- E. Owner will occupy all of the building as specified in Section 01 10 00.
- F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- H. Accompany Architect on Contractor's preliminary final inspection.
- I. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- J. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Meet waste management goals as started on Drawings.
- E. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood.
 - Land clearing debris, including brush, branches, logs, and stumps; see Section 31 10 00 -Site Clearing for use options.
 - 6. Concrete.
 - 7. Asphalt paving.
 - 8. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 9. Glass.
 - 10. Gypsum drywall and plaster.
 - 11. Plastic buckets.
 - 12. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.
 - 13. Plastic sheeting.
 - 14. Acoustical ceiling tile and panels.
- F. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- G. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- H. The following sources may be useful in developing the Waste Management Plan:
 - 1. CalGreen resources.
- I. Methods of trash/waste disposal that are not acceptable are:
 - Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
 - 5. Incineration, either on- or off-site.
- J. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

- B. Section 01 50 00 Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 60 00 Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 70 00 Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 10 00 Site Clearing: Handling and disposal of land clearing debris.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.

- 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
- 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
- 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
- 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
- 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- 7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.
- D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
 - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Owner.
 - 3. Landfill Disposal: Include the following information:
 - Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and
 - 4. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 - 5. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
 - 6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.
- E. Recycling Incentive Programs:
 - Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.
 - 2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

- A. See Section 01 60 00 Product Requirements for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00:
 - 1. Relative amount of waste produced, compared to specified product.
 - Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

- A. See Section 01 30 00 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 50 00 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 60 00 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 70 00 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. Instruction: 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.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Prebid meeting.
 - 2. Preconstruction meeting.
 - 3. Regular job-site meetings.
 - 4. Job safety meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. As a minimum, provide:
 - a. Separate area for storage of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. Separate dumpsters for each category of recyclable.
 - c. Recycling bins at worker lunch area.
 - 2. Provide containers as required.
 - 3. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 - 4. Locate enclosures out of the way of construction traffic.
 - 5. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 6. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

SECTION 01 78 00 CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:

- 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
- 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
- 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Addenda.
 - 3. Change Orders and other modifications to the Contract.
 - 4. Reviewed shop drawings, product data, and samples.
 - 5. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

- 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
- 3. Field changes of dimension and detail.
- 4. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- 3. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
 - 1. Include HVAC outdoor and exhaust air damper calibration strategy.
 - a. Include provisions which ensure that full closure of dampers can be achieved.
 - 2. Include Carbon Dioxide Monitoring Protocol.

- 3. Include Carbon Monoxide Monitoring Protocol.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports.
- O. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.
 - b. Product data, shop drawings, and other submittals.
 - c. Operation and maintenance data.
 - d. Field quality control data.
 - e. Photocopies of warranties and bonds.
 - 4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

SECTION 01 79 00 DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - HVAC systems and equipment.
 - 2. Plumbing equipment.
 - 3. Electrical systems and equipment.
 - 4. Landscape irrigation.
 - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Finishes, including flooring, wall finishes, ceiling finishes.
 - 2. Fixtures and fittings.
 - 3. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Section 01 78 00 Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect for transmittal to Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such a slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: DVD Disc.
 - 2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

- 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
- 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 - The location of the O&M manuals and procedures for use and preservation; backup copies.
 - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
 - Review the applicable O&M manuals.
 - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 - Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 - 6. Discuss common troubleshooting problems and solutions.
 - 7. Discuss any peculiarities of equipment installation or operation.
 - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 - 10. Review spare parts and tools required to be furnished by Contractor.
 - 11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

SECTION 02 41 00 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 Summary: Limitations on Contractor's use of site and premises.
- Section 01 50 00 Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 01 70 00 Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- D. Section 01 74 19 Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- E. Section 32 93 00 Planting Landscape: Protection and pruning of existing vegetation to remain.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: No hazardous materials are anticipated on site. If suspect materials are discovered during demolition, notify Owner before proceeding with affected work.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Site Plan: Showing:
 - 1. Areas for temporary construction and field offices.
- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
 - 2. Identify demolition firm and submit qualifications.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.06 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
 - 1. Minimum of five years of documented experience.

PART 2 PRODUCTS

2.01 BASIS OF PERFORMANCE

- A. Design and Performance Requirements:
 - 1. Perform demolition so that elements and assemblies to remain are not disturbed, and in such a way as to facilitate reconstruction efforts.
 - 2. Do not compromise structural capacity of elements indicated to remain in place.
- B. Coordination Requirements:
 - Do not disturb or interrupt utilities or connections for any of the adjacent facilities or properties.

PART 3 EXECUTION

3.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits, and meet all demolition waste division requirements.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 7. Do not close or obstruct roadways or sidewalks without permit.
 - 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

3.02 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.03 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and Security): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

3.04 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- Concrete formwork.
- B. Concrete reinforcement.
- C. Joint devices associated with concrete work.
- D. Miscellaneous concrete elements, including equipment pads, equipment pits, thrust blocks, and trash enclosure footings and foundations.
- E. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 04 20 00 Unit Masonry: Trash enclosure walls.
- B. Section 07 92 00 Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ACI 117 Standard Specifications for Tolerances for Concrete Construction and Materials.
- C. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- D. ACI 301 Specifications for Structural Concrete.
- E. ACI 302.1R Guide to Concrete Floor and Slab Construction.
- F. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- G. ACI 305R Guide to Hot Weather Concreting.
- H. ACI 306R Guide to Cold Weather Concreting.
- I. ACI 308R Guide to External Curing of Concrete.
- J. ACI 318 Building Code Requirements for Structural Concrete and Commentary.
- K. ACI 347R Guide to Formwork for Concrete.
- L. ACI SP-66 ACI Detailing Manual.
- M. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- N. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- O. ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- P. ASTM C33/C33M Standard Specification for Concrete Aggregates.
- Q. ASTM C39/C39M Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- R. ASTM C94/C94M Standard Specification for Ready-Mixed Concrete.
- S. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).
- T. ASTM C150/C150M Standard Specification for Portland Cement.
- U. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

- V. ASTM C685/C685M Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- W. ASTM C881/C881M Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- X. ASTM C1107/C1107M Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- Y. ASTM C1315 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
- Z. ASTM D2103 Standard Specification for Polyethylene Film and Sheeting.
- AA. ASTM E1643 Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- AB. ASTM E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- AC. ICRI 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Patch cuts in existing concrete floors where new, removed or revised utility connections are placed.
 - 1. Patch underslab vapor barrier where cutting existing concrete slab on grade to control moisture penetration at repaired slab areas.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- C. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
 - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.
- D. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 Concrete Mixtures.
- E. Samples: Submit samples of underslab vapor retarder to be used.
- F. Samples: Submit two, 12 inch (305 mm) long samples of waterstops and construction joint devices.
- G. Test Reports: Submit report for each test or series of tests specified.
- H. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Follow recommendations of ACI 305R when concreting during hot weather.
- C. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch (1.29 mm).
 - Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type I Normal Portland type.
 - 1. Acquire cement for entire project from same source.
- B. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- C. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ACCESSORY MATERIALS

- A. Underslab Vapor Retarder for use at climate controlled spaces: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
 - 1. Installation: Comply with ASTM E1643.
 - 2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
 - 3. Manufacturers:
 - a. Inteplast Group; Barrier-Bac VB-350: www.barrierbac.com/#sle.
 - b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.
 - c. Poly-America; Husky Yellow Guard 15 mil Vapor Barrier: www.yellowguard.com/#sle.
 - d. Stego Industries, LLC; Stegowrap 15 mils: www.stegoindustries.com/#sle.
 - e. W. R. Meadows, Inc; PERMINATOR Class A 15 mils (0.38 mm): www.wrmeadows.com/#sle.
 - f. Substitutions: See Division 01 section for requirements and procedures.
- B. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Grout: Comply with ASTM C1107/C1107M.
 - 2. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch (13.7 MPa).

2.05 BONDING AND JOINTING PRODUCTS

- A. Epoxy Bonding System:
 - 1. Complying with ASTM C881/C881M and of Type required for specific application.
- B. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.
- C. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

2.06 CURING MATERIALS

- A. Curing and Sealing Compound, Moisture Emission Reducing, Membrane-Forming: Liquid, membrane-forming, clear sealer, for application to newly-placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.
 - 1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.
 - 2. Comply with ASTM C309 and ASTM C1315 Type I Class A.
 - 3. VOC Content: Less than 100 g/L.
 - 4. Solids Content: 25 percent, minimum.
- B. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch (0.102 mm) thick, clear.
- C. Water: Potable, not detrimental to concrete.

2.07 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch (20.7 MPa), unless otherwise indicated on Drawings.
 - 2. Water-Cement Ratio: Maximum 40 percent by weight.
 - 3. Maximum Slump: 3 inches (75 mm).
 - 4. Maximum Aggregate Size: 5/8 inch (16 mm).

2.08 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- C. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R, and requirements of final coating manufacturer.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
 - 1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches (150 mm). Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
 - 1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

- A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.
- B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.
- C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- F. Finish floors level and flat, unless otherwise indicated, to match the tolerances of the existing floor slabs.

3.05 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness:
 - 1. Exposed Concrete Floors: 1/4 inch (6 mm) in 10 feet (3 m).
 - 2. Under Seamless Resilient Flooring: 1/4 inch (6 mm) in 10 feet (3 m).
 - 3. Under Carpeting: 1/4 inch (6 mm) in 10 feet (3 m).
- B. Correct the slab surface if tolerances are less than specified.
- C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
 - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include seamless flooring and fluid applied flooring.
 - 2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
- C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.

C. Surfaces Not in Contact with Forms:

- Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
- 2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
- 3. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.10 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

SECTION 03 54 00 CEMENTITIOUS UNDERLAYMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pourable cementitious self-leveling floor underlayment.

1.02 RELATED REQUIREMENTS

- A. Section 09 05 61 Common Work Results for Flooring Preparation.
- B. Section 09 67 00 Fluid-Applied Flooring.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).
- C. ASTM C1602/C1602M Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
- D. ASTM C348 Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
- E. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ICRI 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Underlayment must be compatible with finish flooring applied on top of it. Certifiy compatibility with flooring manufacturer .

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Instructions.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.08 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cementitious Underlayment:

- Basis of Design:ARDEX Engineered Cements; ARDEX AM 100: www.ardexamericas.com/#sle.
- 2. Substitutions: See Division 01 section for requirements and procedures.

2.02 MATERIALS

- A. Cast Underlayments, General:
 - 1. Comply with applicable code for combustibility or flame spread requirements.
 - 2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.
- B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
 - 1. Compressive Strength: Minimum 3000 pounds per square inch (20.68 MPa) after 28 days, tested per ASTM C109/C109M.
 - 2. Flexural Strength: Minimum 700 psi (4.86 MPa) after 28 days, tested per ASTM C348.
 - 3. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
 - 4. Final Set Time: 1-1/2 to 2 hours, maximum.
 - 5. Thickness: Capable of thicknesses from feather edge to maximum 1-1/4 inch (32 mm) in single coat.
 - 6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
- D. Primer: Manufacturer's recommended type.
- E. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.03 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

- A. Concrete: Prepare surfaces according to ICRI 310.2R, and Section 09 05 61. Level existing floors or add slope to acheive required drainage.
- B. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- C. Vacuum clean surfaces.
- D. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- E. Close floor openings.

3.03 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.
- B. Pump or pour material onto substrate. Do not retemper or add water.
 - 1. Pump, move, and screed while the material is still highly flowable.
 - 2. Be careful not to create cold joints.
 - 3. Wear spiked shoes while working in the wet material to avoid leaving marks.
- C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).
- D. For final thickness over 1-1/2 inches (38 mm), place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

- E. Place before partition installation.
- F. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
- B. Do not permit traffic over unprotected floor underlayment surfaces.

SECTION 04 20 00 UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete block.
- B. Mortar and grout.
- C. Reinforcement and anchorage.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 Cast-in-Place Concrete: Concrete for slab floor and footing of trash enclosure.
- B. Section 32 31 19 Decorative Metal Fences and Gates: Gates for trash enclosure.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A615/A615M Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- C. ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
- D. ASTM A951/A951M Standard Specification for Steel Wire for Masonry Joint Reinforcement.
- E. ASTM A1064/A1064M Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- F. ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units.
- G. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
- H. ASTM C150/C150M Standard Specification for Portland Cement.
- I. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
- J. ASTM C270 Standard Specification for Mortar for Unit Masonry.
- K. ASTM C404 Standard Specification for Aggregates for Masonry Grout.
- L. ASTM C476 Standard Specification for Grout for Masonry.
- M. ASTM C1714/C1714M Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.
- N. TMS 402/602 Building Code Requirements and Specification for Masonry Structures.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
 - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

 Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete Block: Comply with referenced standards and as follows:
 - 1. Size: Standard center scored units with nominal face dimensions of 16 by 8 inches (400 by 200 mm) and nominal depth of 6 inches (150 mm).
 - 2. Special Shapes: Provide non-standard blocks configured for corners.
 - 3. Load-Bearing Units: ASTM C90, normal weight.
 - a. Hollow block, as indicated.
 - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
 - c. Pattern: Vertical single score.

2.02 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I.
 - 1. Not more than 0.60 percent alkali.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.
- F. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type N.
 - 2. Color: Standard gray.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa), deformed billet bars; galvanized.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss or ladder.
 - Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class
 3.
 - 3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

2.04 ACCESSORIES

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - Exterior, non-loadbearing masonry: Type N.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
- C. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.

3.02 COLD AND HOT WEATHER REQUIREMENTS

 Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.03 COURSING

- Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
 - 1. Bond: Running.
 - 2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
 - 3. Mortar Joints: Raked.

3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

3.05 REINFORCEMENT AND ANCHORAGE - GENERAL AND SINGLE WYTHE MASONRY

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches (150 mm).
- F. Reinforce joint corners and intersections with strap anchors 16 inches (400 mm) on center.

3.06 GROUTED COMPONENTS

- A. Reinforce bond beams with 2, No. 4 (M12.7 mm) bars, 1 inch (25 mm) from bottom web.
- B. Lap splices minimum 24 bar diameters.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.

3.07 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.
- D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).
- F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

3.08 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.
- C. Use non-metallic tools in cleaning operations.

SECTION 05 50 00 METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated miscellaneous steel items.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 09 91 23 Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ANSI A14.3 American National Standard for Ladders -- Fixed -- Safety Requirements.
- C. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- D. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- E. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- F. ASTM A283/A283M Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- G. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- H. ASTM A501/A501M Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- J. ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- K. ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- L. AWS A2.4 Standard Symbols for Welding, Brazing, and Nondestructive Examination.
- M. AWS D1.1/D1.1M Structural Welding Code Steel.
- N. IAS AC172 Accreditation Criteria for Fabricator Inspection Programs for Structural Steel.
- O. SSPC-Paint 15 Steel Joist Shop Primer/Metal Building Primer.
- P. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic").
- Q. SSPC-SP 2 Hand Tool Cleaning.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.

- a. Include the following, as applicable:
 - Design criteria.
 - Engineering analysis depicting stresses and deflections.
 - 3) Member sizes and gages.
 - 4) Details of connections.
 - 5) Support reactions.
 - 6) Bracing requirements.
- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- D. Designer's Qualification Statement.
- E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.05 QUALITY ASSURANCE

A. Design supporting structure under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
- B. Bumper Posts and Guard Rails: As detailed; prime paint finish.

- C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of joists and masonry; prime paint finish.
- E. Lintels: As detailed; prime paint finish.
- F. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.
- G. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.
- H. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Obtain approval prior to site cutting or making adjustments not scheduled.
- E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

SECTION 05 70 00 DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Railing assemblies used for 'playpen' in lobby area.
- B. Aluminum panels for exterior signage.

1.02 RELATED REQUIREMENTS

- A. Section 01 74 19 Construction Waste Management and Disposal: Additional requirements for cleaning.
- B. Section 05 50 00 Metal Fabrications: Supports.
- C. Section 09 21 16 Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- D. Section 09 91 13 Exterior Painting and 09 91 23 Interior Painting: Painting for signs.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
- C. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
- D. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design.
- E. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- F. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- G. ASTM A276/A276M Standard Specification for Stainless Steel Bars and Shapes.
- H. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- I. ASTM A554 Standard Specification for Welded Stainless Steel Mechanical Tubing.
- J. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- K. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- L. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- M. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- N. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- O. ASTM E488/E488M Standard Test Methods for Strength of Anchors in Concrete Elements.
- P. ASTM E935 Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
- Q. ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

- C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
 - 1. For signage applications, provide detailed shop drawing of panel, including edge condidtions and fastener openings.
- D. Samples: Submit one (1) of each item below for each type and condition shown.
 - Glass: 12 inch by 12 inch (305 mm by 305 mm), illustrating color, thickness and edge condition.
 - 2. Railing: 12 inch (305 mm) long section of handrail illustrating color, finish and connection detail.
- E. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.
- F. Manufacturer's Installation Instructions.
- G. Maintenance Data: Manufacturer's instructions for care and cleaning.
- H. Manufacturer's Qualification Statement.
- Installer's Qualification Statement.
- J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Safety Glazing Certification Council (SGCC).
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Templates: Supply installation templates, reinforcing, and required anchorage devices.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.
- C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
- D. Prior to installation, store materials and components under cover, in a dry location.

1.07 FIELD CONDITIONS

- A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C).
- B. Maintain ambient temperature of space at minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C) for 24 hours before, during, and after railing installation.

1.08 WARRANTY

A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Decorative Metal Railings:
 - 1. C. R. Laurence Company, Inc; CRL GPS TAPER-LOC Dry Glaze Glass Railing System: www.crl-arch.com/#sle.

- 2. Global Glass Railings; Hercules system (base mounted): www.architecturalglassrailings.com/#sle.
- 3. Stainless Fabricators, Inc; Boca Grande: www.stainlessfabinc.com/#sle.
- 4. Viva Railings, LLC; SHOE: www.vivarailings.com/#sle.
- 5. Substitutions: See Division 01 section for requirements and procedures.

2.02 RAILING SYSTEMS

- A. Railing Systems General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
 - Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
 - Lateral Force: 75 lb (333 N) minimum, at any point, when tested in accordance with ASTM E935.
 - b. Distributed Load: 50 lb/ft (0.73 kN per m) minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
 - c. Concentrated Load: 200 lbs (888 N) minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
 - 2. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
 - 3. Joints: Tightly fitted and secured, machined smooth with hairline seams.
 - 4. Field Connections: Provide sleeves to accommodate site assembly and installation.
- B. Structural Glass Railing System, Base-Mounted: Engineered, base-shoe supported railing system with structural glass.
 - 1. Configuration: Guardrail only.
 - 2. Top Rail: 1 by 1-1/2 inch (25 by 38 mm) stainless steel; No. 4 satin finish.
 - 3. Base Cladding
 - a. Material: 18 gage, 0.0500 inch (1.27 mm) stainless steel; No. 4 satin finish.
 - 4. Glass: As specified in this section.
 - 5. Handrail Brackets: Same metal as railing.
 - 6. Stainless Steel Finish, Exposed Surfaces: No. 4 satin finish.
 - 7. Fasteners:
 - a. Attachment to Concrete:
 - Provide anchors capable of sustaining, without failure, a load equal to four times the load imposed when installed in concrete, tested in accordance with ASTM E488/E488M
 - 8. Basis of Design: C.R. Laurence Company, Inc; CRL GRS TAPER-LOC Dry Glaze Glass Railing System: www.crl-arch.com/#sle and gate CRL Wall Mount Swing Gate with TOp and Bottom Pivot.

2.03 MATERIALS

- A. Aluminum Components: ASTM B221 or ASTM B221M.
 - 1. Tubes: Schedule 40 pipe.
 - 2. Sheet Aluminum: ASTM B209ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
 - 3. Clear Anodized Finish: Class I, AAMA 611 AA-M12C22A41 Clear anodic coating with electrolytically deposited organic seal; not less than 0.7 mils (0.018 mm) thick.
 - 4. Mill Finish.
- B. Steel Components:
 - Sections, Shapes, Plate and Bar: ASTM A36/A36M.
 - 2. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- C. Stainless Steel Components:
 - 1. ASTM A666, Type 304.

- 2. Stainless Steel Tubing: ASTM A554, Type 304, 16 gage, 0.0625 inch (1.59 mm) minimum metal thickness. 1-1/2 inch (38 mm) diameter.
- 3. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- 4. Stainless Steel Finish: No. 4 Bright Polished finish unless otherwise noted.
- D. Glass: Fully tempered, ASTM C1048, Condition A, Type 1, transparent, Class 1, Quality Q3, unless otherwise indicated.
 - 1. Impact Strength: Category II, tested in accordance with 16 CFR 1201.
 - 2. Thickness: 1/2 inch (13 mm).
 - 3. Configuration: As indicated on drawings.
 - 4. Edges: Ground smooth and polished.
 - 5. Color: Clear, no tint.

2.04 ACCESSORIES

- A. Non-Weld Mechanical Fittings for Stainless Steel Railings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
 - For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
 - 3. For anchorage to stud walls, provide backing plates for bolting anchors.
 - 4. Exposed Fasteners: No exposed bolts or screws.
- C. Carbon Steel Bolts and Nuts: ASTM A307.
- D. Sealant: Silicone: black.
- E. Finish Touch-Up Materials: As recommended by manufacturer for field application.

PART 3 EXECUTION

3.01 EXECUTION REQUIREMENTS

- A. General:
 - 1. Configure railing into play pen as indicated on Drawings.

3.02 EXAMINATION

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Architect immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.
- E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.03 PREPARATION

- A. Protect existing work.
- B. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions and directions for installation of anchorages and fasteners.
- C. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.04 INSTALLATION

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.

- C. Anchor securely to structure.
- D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.

3.05 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.06 CLEANING

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents or other substances that may damage the material or finish.
- C. Glass and Glazing: Clean glazing surfaces; remove excess glazing sealant compounds, dirt, and other substances.
- D. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.

3.07 PROTECTION

- A. Protect installed components and finishes from damage after installation.
- B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
 - If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

- Structural dimension lumber framing.
- B. Non-structural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Roofing nailers.
- F. Preservative treated wood materials.
- G. Fire retardant treated wood materials.
- H. Miscellaneous framing and sheathing.
- Communications and electrical room mounting boards.
- J. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

- Section 05 50 00 Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
- B. Section 07 62 00 Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- C. ASTM C557 Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- D. ASTM D2898 Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
- E. ASTM D3498 Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing.
- F. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- G. AWPA U1 Use Category System: User Specification for Treated Wood.
- H. PS 1 Structural Plywood.
- I. PS 2 Performance Standard for Wood-Based Structural-Use Panels.
- J. PS 20 American Softwood Lumber Standard.
- K. WCLIB (GR) Standard Grading Rules for West Coast Lumber No. 17.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 BASIS OF PERFORMANCE

- A. Design and Performance Requirements:
 - 1. Fire resistance treat all wood products in contact with electrical or low voltage equipment, and in all locations as indicated on Drawings.

2.02 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Western Woods, unless otherwise indicated.
 - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
 - Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.03 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6 (50 by 50 mm through 50 by 150 mm)):
 - 1. Species: Any allowed under referenced grading rules.
 - 2. Grade: No. 2.
- E. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 (50 by 150 mm through 100 by 400 mm)):
 - 1. Machine stress-rated (MSR) as follows:
 - a. Fb-single (minimum extreme fiber stress in bending): 1350 psi (9,300 kPa).
 - b. E (minimum modulus of elasticity): 1.300.000 psi (8960 MPa).
 - 2. Species: Any allowed under grading rules.
- F. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No. 2 or Standard Grade.
 - 2. Boards: Standard or No. 3.
 - 3. Fir retardant treat all miscellaneous lumber.

2.04 CONSTRUCTION PANELS

- A. Subflooring: Any PS 2 type, rated Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 48.
 - Performance Category: 3/4 PERF CAT.
- B. Roof Sheathing: Any PS 2 type, rated Structural I Sheathing.
 - 1. Bond Classification: Exterior.
 - 2. Span Rating: 60.
 - Performance Category: 3/4 PERF CAT.

- C. Wall Sheathing: Any PS 2 type.
 - 1. Bond Classification: Exterior.
 - 2. Grade: Structural I Sheathing.
 - 3. Span Rating: 24.
 - 4. Performance Category: 5/16 PERF CAT.
 - 5. Edge Profile: Square edge.
- D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

E. Other Applications:

- Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
- 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
- 3. Other Locations: PS 1, C-D Plugged or better.

2.05 ACCESSORIES

- A. Fasteners and Anchors:
 - Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
- B. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.
- C. Sill Flashing: As specified in Section 07 62 00.
- D. Subfloor Adhesives: Waterproof, air cure type, cartridge dispensed; adhesives designed for subfloor applications and complying with either ASTM C557 or ASTM D3498.

2.06 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:

- Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat all exterior rough carpentry items.
 - c. Do not use treated wood in direct contact with the ground.
- Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. All interior rough carpentry items are to be fire retardant treated.
 - Do not use treated wood in applications exposed to weather or where the wood may become wet.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.
- B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.
- E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.
- F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.05 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.06 INSTALLATION OF CONSTRUCTION PANELS

- A. Subflooring: Glue and nail to framing; staples are not permitted.
- B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
 - At long edges provide solid edge blocking where joints occur between roof framing members.
 - 2. Nail panels to framing; staples are not permitted.
- C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
 - 1. Use plywood or other acceptable structural panels at building corners, for not less than 96 inches (2440 mm), measured horizontally.
 - Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.
- D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
 - 4. Size: 48 by 96 inches (2440 by 4880 mm), installed horizontally at ceiling height, unless otherwise indicated on Drawings.

3.07 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

3.08 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

3.09 CLEANING

- A. Waste Disposal: Comply with the requirements of Section 01 74 19 Construction Waste Management and Disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

SECTION 06 41 00 ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

A. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
- C. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1.
- D. BHMA A156.9 American National Standard for Cabinet Hardware.
- E. NEMA LD 3 High-Pressure Decorative Laminates.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Location of electrical outlets and connections adjacent to and within casework.
- B. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
 - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
 - 3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
 - 2. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LAMINATE MATERIALS

- Patterns and Colors: As indicated on Finish Schedule and Finish Legend on Drawings.
- B. Manufacturers:
 - 1. Arborite: www.arborite.com/#sle.
 - 2. Formica Corporation: www.formica.com/#sle.
 - 3. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 4. Wilsonart LLC: www.wilsonart.com/#sle.
 - 5. Substitutions: See Division 01 section for requirements and procedures.
- C. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
- D. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- E. Provide specific types as indicated.
 - 1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 - 2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch (0.71 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 - 5. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, through color, colors as indicated, finish as indicated.
 - 6. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.
- F. Laminate substrate: Exterior grade plywood.
 - 1. No particleboard, MDF, or fiberboard is allowed.

2.04 COUNTERTOPS

A. Countertops are specified in Section 12 36 00.

2.05 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- E. Catches: Magnetic.
- F. Drawer Slides:
 - 1. Type: Extension types as indicated.
 - 2. Static Load Capacity: Heavy Duty grade.
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - Features: Provide self closing/stay closed type.
- G. Hinges: European style concealed self-closing type, steel with polished finish.
- H. Soft Close Adapter: Concealed, frame-mounted, screw-adjustable damper; steel with polished finish.
- I. Sliding Door Track Assemblies: Upper and lower track of satin anodized aluminum, with matching shoe equipped with nylon rollers.

2.07 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet (600 mm) from sink cut-outs.
 - 1. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

PART 3 EXECUTION

3.01 EXECUTION REQUIREMENTS

- A. General:
 - 1. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

3.02 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.03 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.

- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.

3.04 ADJUSTING

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

SECTION 07 21 00 THERMAL AND ACOUSTICAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation and integral vapor retarder at cavity wall construction and exterior wall behind custom sign facing wall finish.
- B. Batt insulation in wall and ceiling construction.

1.02 RELATED REQUIREMENTS

- A. Section 05 70 00 Decorative Metal: Decorative custom sign facing.
- B. Section 06 10 00 Rough Carpentry: Supporting construction for batt insulation.
- C. Section 07 84 00 Firestopping: Insulation as part of fire-rated through-penetration assemblies.
- D. Section 09 22 16 Non-Structural Metal Framing: Supporting construction for batt insulation.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
- C. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C.
- F. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

 Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. Insulation Inside Custom Signage Assemblies: Extruded polystyrene (XPS) board.
- B. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.
- C. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

- Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with natural skin surfaces.
 - 1. Type and Compressive Resistance: Type XII, 15 psi (104 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

- 4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88) per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
- 5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
- 6. Board Edges: Square.
- 7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
- 8. Manufacturers:
 - a. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
 - b. Kingspan Insulation LLC: www.kingspan.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - d. Substitutions: See Division 01 section for requirements and procedures.

2.03 BATT INSULATION MATERIALS

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 - 4. Formaldehyde Content: Zero.
 - 5. Thermal Resistance: R-value (RSI-value) of 11 (1.94).
 - 6. Thickness: 3.5 inch (89 mm).
 - 7. Manufacturers:
 - a. CertainTeed Corporation: www.certainteed.com/#sle.
 - b. Johns Manville: www.jm.com/#sle.
 - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
 - d. Substitutions: See Division 01 section for requirements and procedures.
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
 - 3. Thermal Resistance: R-value (RSI-value) of 15 (2.64).
 - 4. Thickness: 3.5 inch (89 mm).
 - 5. Manufacturers:
 - a. Johns Manville: www.jm.com/#sle.
 - b. Knauf Insulation: www.knaufinsulation.com/#sle.
 - c. ROCKWOOL (ROXUL, Inc): www.rockwool.com/#sle.
 - d. Thermafiber, Inc: www.thermafiber.com/#sle.
 - e. Substitutions: See Division 01 section for requirements and procedures.

2.04 ACCESSORIES

- A. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- B. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, or irregularities.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards vertically on vertical substrates.
 - 1. Place boards to maximize adhesive contact.
 - 2. Butt edges and ends tightly to adjacent boards and protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Staple or nail facing flanges in place at maximum 6 inches (150 mm) on center.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

SECTION 07 25 00 WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls and joints around frames of openings in exterior walls.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 Joint Sealants: Sealing building expansion joints.
- B. Section 09 21 16 Gypsum Board Assemblies: Exterior sheathing.

1.03 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

1.04 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.
- C. ASTM D1970/D1970M Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM E2178 Standard Test Method for Air Permeance of Building Materials.
- G. ICC-ES AC38 Acceptance Criteria for Water-Resistive Barriers.
- H. ICC-ES AC212 Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls use air barrier coating.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

- A. Self adhered sheet or fluid applied products are both acceptable for application.
- B. Air Barrier Sheet, Self-Adhered:
 - Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

- 2. Water Vapor Permeance: 10 perms (572 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F (23 degrees C).
- Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
- 4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
- 5. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
- 6. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
- 7. Seam and Perimeter Tape: As recommended by sheet manufacturer.
- Manufacturers:
 - a. Dorken Systems Inc; DELTA-VENT SA: www.dorken.com/#sle.
 - b. GCP Applied Technologies; Perm-A-Barrier VPS: www.gcpat.com/#sle.
 - c. Henry Company; Blueskin VP160: www.henry.com/#sle.
 - d. SIGA Cover Inc; SIGA-Majvest 500 SA: www.siga.swiss/#sle.
- C. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
 - 1. Air Barrier Coating:
 - a. Air Permeance: 0.004 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.
 - Water Vapor Permeance: 10 perms (574 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M Procedure B (Water Method) at 73.4 degrees F (23 degrees C).
 - c. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to four months of weather exposure after application.
 - d. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
 - e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - f. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - g. VOC Content: 100 g per L or less.
 - h. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.
 - i. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - j. Manufacturers:
 - Master Builders Solutions by BASF; MasterSeal AWB 660: www.master-builders-solutions.basf.us/en-us/#sle.
 - 2) Master Wall, Inc; Rollershield LAB System: www.masterwall.com/#sle.
 - 3) PROSOCO, Inc; R-GUARD Cat 5: www.prosoco.com/r-guard/#sle.
 - 4) PROSOCO, Inc; R-GUARD Spray Wrap MVP: www.prosoco.com/r-guard/#sle.
 - 5) Sto Corp; Sto Gold Coat: www.stocorp.com/#sle.
 - 6) Sto Corp; Sto EmeraldCoat: www.stocorp.com/#sle.
 - 7) Substitutions: See Division 01 section for requirements and procedures.

2.03 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Self-Adhered Sheets:

- Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
- 2. Lap sheets shingle-fashion to shed water and seal laps air tight.
- 3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
- 4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
- 5. At wide joints, provide extra flexible membrane allowing joint movement.

D. Coatings:

- 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
- 2. Use flashing to seal to adjacent construction and to bridge joints.

E. Openings and Penetrations in Exterior Weather Barriers:

- 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
- 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
- 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
- 4. At head of openings, install flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
- 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
- 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, exterior penetrations, and other items indicated in Schedule.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 Rough Carpentry: Wood nailers for sheet metal work.
- B. Division 23 for rooftop mounted HVAC units and curb supports for units.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- E. ASTM D226/D226M Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- F. ASTM D4586/D4586M Standard Specification for Asphalt Roof Cement, Asbestos-Free.
- G. CDA A4050 Copper in Architecture Handbook.
- H. SMACNA (ASMM) Architectural Sheet Metal Manual.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate flashing locations and configurations for the minimum following locations:
 - 1. Penetrations in roofing systems.
 - 2. Penetrations in exterior building envelope.
- B. Coordinate flashings on or adjacent to roof surface with existing thermoplastic roofing. Refer to exsiting roofing manufacturer for recommendations for installatyion and sealing to existing roofing.
- C. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239 inch) (0.61 mm) thick base metal.
- B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) (0.40 mm) thick: smooth No. 4 Brushed finish.
- C. Flexible Flashing materials at roofing: Same material as existing roofing membrane.

2.02 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing surface. Return and brake edges. Seal edges to existing roofing to prevent water from creeping underneath.

2.03 EXTERIOR PENETRATION FLASHING PANELS

A. 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.

2.04 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Underlayment: ASTM D226/D226M, organic roofing felt, Type I (No. 15).
- C. Primer: Zinc chromate type.
- D. Concealed Sealants: Non-curing butyl sealant.
- E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- F. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.03 INSTALLATION

- A. Secure flashings in place using concealed fasteners.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

E. Flashings at existing roof membrane shall be attached to membrane in manner recommended by roofing manufacturer that will not harm or degrade existing roofing.

3.04 SCHEDULE

- A. Through-Wall Flashing in Masonry: Stainless steel.
- B. Counterflashings at Curb-Mounted Roof Items: Galvanized steel.
- C. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports: Galvanized steel or flexible flashing compatible with existing roofing membrane.

SECTION 07 84 00 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 21 16 Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems.
- C. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- D. ITS (DIR) Directory of Listed Products.
- E. FM 4991 Approval Standard for Firestop Contractors.
- F. FM (AG) FM Approval Guide.
- G. SCAQMD 1168 Adhesive and Sealant Applications.
- H. UL (DIR) Online Certifications Directory.
- I. UL (FRD) Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for all non-preformed materials.
- E. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.
 - 2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
 - 3. Verification of minimum three years documented experience installing work of this type.

- 4. Verification of at least five satisfactorily completed projects of comparable size and type.
- 5. Licensed by local authorities having jurisdiction (AHJ).

1.06 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Firestopping Manufacturers:
 - 1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
 - 3. Everkem Diversified Products, Inc: www.everkemproducts.com/#sle.
 - 4. Grabber Construction Products, Inc: www.grabberman.com/#sle.
 - 5. Hilti, Inc: www.us.hilti.com/#sle.
 - 6. Specified Technologies Inc: www.stifirestop.com/#sle.
 - 7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 8. Substitutions: See Division 01 section for requirements and procedures.

2.02 MATERIALS

- A. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

- A. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Any material meeting requirements.
- B. Firestopping at Combustible Pipe and Conduit Penetrations, of diameter 4 inches (100 mm) or less: Any material meeting requirements.
- C. Firestopping at Cable Tray Penetrations: Any material meeting requirements.
- D. Firestopping at Cable Penetrations, not in Conduit or Cable Tray: Any material meeting requirements.
- E. Firestopping Between Edge of Floor Slab and wall framing (without Penetrations): Fiber firestopping with smoke seal coating; UL Design as required, T Rating 1 hour.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

SECTION 07 92 00 JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 84 00 Firestopping: Firestopping sealants.
- C. Section 08 71 00 Door Hardware: Setting exterior door thresholds in sealant.
- D. Section 08 80 00 Glazing: Glazing sealants and accessories.
- E. Section 09 21 16 Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- F. Section 09 22 16 Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- ASTM C661 Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
- C. ASTM C794 Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.
- D. ASTM C834 Standard Specification for Latex Sealants.
- E. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications.
- F. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- G. ASTM C1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
- H. ASTM C1193 Standard Guide for Use of Joint Sealants.
- I. ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants.
- J. ASTM C1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
- K. SCAQMD 1168 Adhesive and Sealant Applications.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
 - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

- 8. Certification by manufacturer indicating that product complies with specification requirements.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
 - 1. Adhesion Testing: In accordance with ASTM C794.
 - 2. Compatibility Testing: In accordance with ASTM C1087.
 - 3. Allow sufficient time for testing to avoid delaying the work.
 - 4. Deliver to manufacturer sufficient samples for testing.
 - 5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
 - 6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:

- Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
- 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - Other joints indicated below.
- Do not seal the following types of joints.
 - a. Intentional weepholes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.

- Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 - 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
- D. Interior Wet Areas: Grooming, laundry, restrooms, kitchens, and medical areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, other similar items, and laundry/medical equipment.

2.02 JOINT SEALANTS - GENERAL

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: As indicated on drawings.

2.03 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 50 percent, minimum.
 - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
 - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 - 4. Color: Match adjacent finished surfaces.
 - 5. Service Temperature Range: Minus 20 to 180 degrees F (Minus 29 to 82 degrees C).
 - 6. Manufacturers:
 - a. Dow Chemical Company; DOWSIL 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - c. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - d. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): www.pecora.com/#sle.
 - e. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
 - f. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
 - g. Sika Corporation; Sikasil 728NS: www.usa-sika.com/#sle.
 - h. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - i. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.
 - j. Tremco Commercial Sealants & Waterproofing; Spectrem 3: www.tremcosealants.com/#sle.
 - k. Substitutions: See Division 01 section for requirements and procedures.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
 - Manufacturers:
 - a. ADFAST Corporation; ADSEAL KB 4800 Series: www.adfastcorp.com/#sle.
 - b. Everkem Diversified Products, Inc; TruSil 100: www.everkemproducts.com/#sle.

- Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com/#sle.
- d. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
- e. Substitutions: See Division 01 section for requirements and procedures.
- C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
 - Manufacturers:
 - a. Pecora Corporation; DynaTrol II: www.pecora.com/#sle.
 - b. The QUIKRETE Companies; QUIKRETE® Polyurethane Non-Sag Sealant: www.quikrete.com/#sle.
 - c. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - d. Sherwin-Williams Company; Stampede 2NS Polyurethane Sealant: www.sherwin-williams.com/#sle.
 - e. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
 - f. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com/#sle.
 - g. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
 - h. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
 - i. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
 - j. Substitutions: See Division 01 section for requirements and procedures.
- D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.
 - 1. Movement Capability: Plus and minus 35 percent, minimum.
 - 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: Match adjacent finished surfaces.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
 - Manufacturers:
 - a. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
 - b. Sika Corporation; Sikaflex-2c NS: www.usa-sika.com/#sle.
 - c. Substitutions: See Division 01 section for requirements and procedures.
- E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
 - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
 - 2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).

2.04 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Service Temperature Range: Minus 40 to 180 degrees F (Minus 40 to 82 degrees C).
 - 5. Manufacturers:
 - a. Pecora Corporation: www.pecora.com/#sle.
 - b. The QUIKRETE Companies; QUIKRETE® Polyurethane Self-Leveling Sealant: www.quikrete.com/#sle.

- Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
- d. Sherwin-Williams Company; Stampede 2SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
- e. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.
- f. Sika Corporation; Sikaflex-2c SL: www.usa-sika.com/#sle.
- g. Substitutions: See Division 01 section for requirements and procedures.

2.05 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 - Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C -Closed Cell Polyethylene.
 - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type C Closed Cell Polyethylene.
 - 3. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

- Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 Door Hardware.
- B. Section 08 80 00 Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 Exterior Painting: Field painting.
- D. Section 09 91 23 Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design.
- C. ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.
- D. ANSI/SDI A250.6 Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
- E. ANSI/SDI A250.8 Specifications for Standard Steel Doors and Frames (SDI-100).
- F. ANSI/SDI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- G. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- H. ASTM A1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- ASTM A1011/A1011M Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- J. BHMA A156.115 American National Standard for Hardware Preparation in Steel Doors and Steel Frames.
- K. ICC A117.1 Accessible and Usable Buildings and Facilities.
- L. ITS (DIR) Directory of Listed Products.

- M. NAAMM HMMA 830 Hardware Selection for Hollow Metal Doors and Frames.
- N. NAAMM HMMA 831 Hardware Locations for Hollow Metal Doors and Frames.
- NAAMM HMMA 840 Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames.
- P. NAAMM HMMA 861 Guide Specifications for Commercial Hollow Metal Doors and Frames.
- Q. NFPA 80 Standard for Fire Doors and Other Opening Protectives.
- R. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.
- S. SDI 117 Manufacturing Tolerances for Standard Steel Doors and Frames.
- T. UL (DIR) Online Certifications Directory.
- U. UL 10C Standard for Positive Pressure Fire Tests of Door Assemblies.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: When sidelight is installed next to existing lights in series, match style, appearance, and finisih of existing lites as closely as possible.

1.06 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/quidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Samples: Submit two samples of metal, 2 inch by 2 inch in size (50 mm by 50 mm in size) showing factory finishes, colors, and surface texture.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 4. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 5. Steelcraft, an Allegion brand: www.allegion.com/#sle.
 - 6. Substitutions: See Division 01 section for requirements and procedures.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturers standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
 - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
 - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Interior Doors, Non-Fire-Rated:
 - Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 Full Flush.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - . Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 - 3. Door Finish: Factory primed and field finished.
- B. Fire-Rated Doors:
 - Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 Full Flush.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - 3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
 - 4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - a. Attach fire rating label to each fire rated unit.
 - 5. Door Thickness: 1-3/4 inch (44.5 mm), nominal.
 - 6. Door Finish: Factory primed and field finished.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
 - 2. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - 3. Frame Finish: Factory primed and field finished.
- C. Door Frames, Fire-Rated: Full profile/continuously welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch (150 mm), maximum, above floor at 45 degree angle.
 - 3. Frame Metal Thickness: 18 gage, 0.042 inch (1.0 mm), minimum.
 - 4. Frame Finish: Factory primed and field finished.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Field painted per Section 09 91 23 Interior Painting.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - Size: As indicated on drawings.
 - 2. Frame Material: 18 gage, 0.0478 inch (1.21 mm), galvanized steel.
 - 3. Metal Finish: To match door finish.
 - 4. Glazing: 1/4 inch (6.4 mm) thick, tempered glass, in compliance with requirements of authorities having jurisdiction.
- B. Glazing: As specified in Section 08 80 00, factory installed.
- C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Install door hardware as specified in Section 08 71 00.
 - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- E. Comply with glazing installation requirements of Section 08 80 00.
- F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.03 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 08 11 13 Hollow Metal Doors and Frames.
- B. Section 08 71 00 Door Hardware.
- C. Section 08 80 00 Glazing.
- D. Section 09 91 23 Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
- C. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics; and accessories.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Specimen warranty.
- H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 DOORS AND PANELS

- A. Doors: Refer to drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
 - Provide solid core doors at each location.

2.02 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type framed non-bonded particleboard core (FPC), plies and faces as indicated.

2.03 DOOR FACINGS

A. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.04 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- F. Provide edge clearances in accordance with the quality standard specified.

2.05 ACCESSORIES

- A. Hollow Metal Door Frames: As specified in Section 08 11 13.
- B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - Shape: Circular Porthole
 - 2. Size: 300 mm (11.8 inches) diameter clear vision size; 350 mm (13.78 inches) rough openeing size .
 - 3. Frame Material: 18 gage, 0.0478 inch (1.21 mm), stainless steel, stain finish.
 - 4. Glazing: 1/4 inch (6.4 mm) thick, tempered glass, in compliance with requirements of authorities having jurisdiction.
 - 5. Basis of Design:
 - Hafele America Co; Circular Porthole Frame for Max. 44 mm Door Thickness, Stainless Steel
 - b. Substitutions: See Section 01 60 00 Product Requirements.
- C. Glazing: As specified in Section 08 80 00.
- D. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- E. Door Hardware: As specified in Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Field-Finished Doors: Trimming to fit is acceptable.
 - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
 - 2. Trim maximum of 3/4 inch (19 mm) off bottom edges.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION

SECTION 08 31 00 ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ITS (DIR) Directory of Listed Products.
- C. UL (FRD) Fire Resistance Directory.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.
- E. Manufacturer's Qualification Statement.
- F. Project Record Documents: Record actual locations of each access unit.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units in Wet Areas:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
 - 3. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.
- B. Fire-Rated Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Wall Fire-Rating: As indicated on drawings.
 - 3. Panel Material: Steel.
 - 4. Size: 12 inch by 12 inch (305 mm by 305 mm).
 - Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

2.02 WALL MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. ACUDOR Products Inc: www.acudor.com/#sle.
 - 2. Babcock-Davis: www.babcockdavis.com/#sle.
 - 3. Bauco Access Panel Solutions Inc: www.accesspanelsolutions.com/#sle.
 - 4. Cendrex, Inc: www.cendrex.com/#sle.

- 5. Elmdor Stonemen: www.elmdorstoneman.com/#sle.
- 6. Karp Associates, Inc: www.karpinc.com/#sle.
- 7. MIFAB, Inc: www.mifab.com/#sle.
- Milcor, Inc: www.milcorinc.com/#sle.
- 9. Nystrom, Inc: www.nystrom.com/#sle.
- 10. Substitutions: See Division 01 section for requirements and procedures.
- B. Wall Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Style: Exposed frame with door surface flush with frame surface.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16 gage, 0.0598 inch (1.52 mm), minimum thickness.
 - 4. Single Steel Sheet Door Panels: 1/16 inch (1.6 mm), minimum thickness.
 - 5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
 - a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
 - b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
 - 6. Steel Finish: Primed.
 - 7. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
 - 8. Hardware:
 - a. Hardware for Fire-Rated Units: As required for listing.
 - b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - c. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 33 23 OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 **SECTION INCLUDES**

- A. Overhead coiling doors, operating hardware, non-fire-rated and exterior; electrically operated.
- B. Wiring from electric circuit disconnect to operator to control station.

1.02 RELATED REQUIREMENTS

- A. Section 08 71 00 Door Hardware: Cylinder cores and keys.
- B. Division 26 sections for electrical.
- C. Section 26 05 83 Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ITS (DIR) Directory of Listed Products.
- F. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. NEMA ICS 2 Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.
- H. NEMA MG 1 Motors and Generators.
- I. NFPA 70 National Electrical Code.
- J. NFPA 105 Standard for Smoke Door Assemblies and Other Opening Protectives.
- K. UL (DIR) Online Certifications Directory.
- L. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- M. UL 1784 Standard for Air Leakage Tests of Door Assemblies.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Motor connection and controls with electrical.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples: Submit two slats, 12 x 12 inch (300 x 300 mm) in size illustrating shape, color and finish texture.
- E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- F. Manufacturer's Qualification Statement.
- G. Installer's Qualification Statement.
- H. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.07 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Provide lifetime manufacturer limited warranty for counterweights and tension springs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Overhead Coiling Doors:
 - 1. Basis of Design: Cornell Iron Works, Inc; Roll-up Service Door ESD10: www.cornelliron.com/#sle.
 - 2. Alpine Overhead Doors, Inc: www.alpinedoors.com/#sle.
 - 3. C.H.I. Overhead Doors: www.chiohd.com/#sle.
 - 4. Raynor Garage Doors: www.raynor.com/#sle.
 - 5. The Cookson Company: www.cooksondoor.com/#sle.
 - 6. Wayne-Dalton, a Division of Overhead Door Corporation: www.wayne-dalton.com/#sle.
 - 7. Substitutions: See Division 01 section for requirements and procedures.

2.02 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa), without undue deflection or damage to components.
 - 2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
 - 3. Nominal Slat Size: 2 inches (50 mm) wide x required length.
 - 4. Finish: Factory painted, color as selected.
 - 5. Guide, Angles: Galvanized steel.
 - 6. Hood Enclosure: Manufacturer's standard; primed steel.
 - 7. Electric operation.
 - 8. Mounting: Surface mounted.
 - 9. Locking Devices: Slide bolt on inside.

2.03 MATERIALS AND COMPONENTS

- A. Curtain Construction: Interlocking slats.
 - 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 - 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 - 3. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
 - 4. Smoke Seals: Provide brush or gasket type weatherstripping seals to prevent passage of smoke and hot gases in compliance with UL 1784 testing requirements.
 - Steel Slats: Minimum thickness, 22 gage, 0.03 inch (0.76 mm); ASTM A653/A653M galvanized steel sheet.
 - a. Manufacturer's factory applied powder coat in color as selected by Architect.

- B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- C. Guides Angle: ASTM A36/A36M metal angles, size as indicated.
 - 1. Hot-dip galvanized in compliance with ASTM A123/A123M.
- D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
 - 1. Minimum thickness; 20 gage, 0.0359 inch (0.91 mm).
 - 2. Prime paint.
- E. Lock Hardware:
 - 1. For motor operated units, additional lock or latching mechanisms are not required.
 - Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.
- F. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb (10 kg) nominal force to operate.

2.04 ELECTRIC OPERATION

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
 - 1. Provide interlock switches on motor operated units.
- B. Electric Operators:
 - 1. Mounting: Side mounted.
 - 2. Motor Enclosure:
 - a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
 - 3. Motor Rating: 1/3 hp (250 W); continuous duty.
 - 4. Motor Voltage: 120 volts, single phase, 60 Hz.
 - 5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
 - 6. Controller Enclosure: NEMA 250, Type 1.
 - 7. Opening Speed: 12 inches per second (300 mm/sec).
 - 8. Brake: Adjustable friction clutch type, activated by motor controller.
 - 9. Manual override in case of power failure.
 - 10. Refer to Section 26 05 83 for electrical connections.
- C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. 24 volt circuit.
 - 2. Surface mounted, at interior door jamb.
 - 3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
 - b. Secondary Device: Provide electric sensing edge with wireless edge kit or non-monitored safety edge as an option along with continuous-constant control device.
- E. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install smoke door assemblies in accordance with NFPA 105.
- C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- F. Coordinate installation of electrical service with Section 26 05 83.
- G. Complete wiring from disconnect to unit components.
- H. Install enclosure and perimeter trim.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).
- C. Maximum Variation From Level: 1/16 inch (1.6 mm).
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3.2 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 51 13 ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Extruded aluminum windows with fixed sash.
- B. Factory glazing.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 Rough Carpentry: Rough opening framing.
- B. Section 07 92 00 Joint Sealants: Sealing joints between window frames and adjacent construction.
- C. Section 08 80 00 Glazing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. AAMA/WDMA/CSA 101/I.S.2/A440 North American Fenestration Standard/Specification for windows, doors, and skylights.
- C. AAMA CW-10 Care and Handling of Architectural Aluminum From Shop to Site.
- D. AAMA 609 & 610 Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document).
- E. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
- F. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- G. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- I. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- J. ASTM B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
- K. ASTM E2112 Standard Practice for Installation of Exterior Windows, Doors and Skylights.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
 - 1. Evidence of AAMA Certification.
 - 2. Evidence of WDMA Certification.
 - 3. Evidence of CSA Certification.

- 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.
- E. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.09 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Boyd Aluminum; Series 1200 Narrow Sight Line Fixed Window System..
- B. Other Acceptable Aluminum Windows Manufacturers:
 - Arcadia, Inc: www.arcadiainc.com/#sle.
 - 2. Peerless Products, Inc: www.peerlessproducts.com/#sle.
 - 3. TRACO: www.traco.com/#sle.
 - 4. Wausau Window and Wall Systems: www.wausauwindow.com/#sle.
 - 5. Winco Window Company, Inc: www.wincowindow.com/#sle.
 - 6. Substitutions: See Division 01 section for requirements and procedures.

2.02 BASIS OF DESIGN - CW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of CW, and Performance Grade at least as high as specified design pressure.

2.03 ALUMINUM WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 - 1. Provide units factory glazed.
 - 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.

- 3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- 4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
- System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Performance Requirements: Provide products that comply with the following:
 - 1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
 - a. Performance Class (PC): CW.
- C. Fixed, Non-Operable Type:
 - 1. Construction: Non-thermally broken.
 - 2. Glazing: Single; clear; transparent.
 - 3. Exterior Finish: High performance organic coatings.
 - 4. Interior Finish: High performance organic coatings.
 - 5. Sizes: As indicated on Drawings.

2.04 COMPONENTS

- A. Frames: Narrow profile frames witrh visible frame of 1-1/2 inch (38 mm) wide by 2.375 inch (60 mm) deep system profile, with flush glass stops of snap-on type.
- B. Glazing: As specified in Section 08 80 00.
- C. Glazing Materials: As specified in Section 08 80 00.
- D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.05 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5005 alloy, H12 or H14 temper.
- Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.06 FINISHES

- A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
- B. Finish Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions.
- B. Install windows in accordance with ASTM E2112.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill and sill end angles.
- F. Set sill members and sill flashing in continuous bead of sealant.
- G. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Install glass and infill panels in accordance with requirements specified in Section 08 80 00.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.04 CLEANING

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.
- D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

- 1. Door hardware, including electric hardware.
- 2. Storefront and entrance door hardware.
- 3. Power supplies for electric hardware.
- 4. Cylinders for doors fabricated with locking hardware.

B. Related Divisions:

- 1. Division 06 door hardware installation
- 2. Division 07 sealant at exterior thresholds
- 3. Division 08 metal doors and frames, interior aluminum frames, wood doors, integrated security systems, specialty doors, storefront and glazed curtainwall systems.
- 4. Division 10 operable partitions
- 5. Division 21 fire and life safety systems
- 6. Division 28 security access systems
- C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
 - 1. Windows.
 - 2. Cabinets, including open wall shelving and locks.
 - 3. Signs, except where scheduled.
 - 4. Toilet accessories, including grab bars.
 - Installation.
 - 6. Rough hardware.
 - 7. Conduit, junction boxes & wiring.
 - 8. Folding partitions, except cylinders where detailed.
 - 9. Sliding aluminum doors, except cylinders where detailed.
 - 10. Access doors and panels, except cylinders where detailed.
 - 11. Corner Guards.
 - 12. Welded steel gates and supports.

1.2 REFERENCES:

- A. Use date of standard in effect as of Bid date.
 - 1. American National Standards Institute
 - a) ANSI 156.18 Materials and Finishes.
 - 2. BHMA Builders Hardware Manufacturers Association
 - 3. 2016 California Building Code
 - a) Chapter 11B Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
 - 4. DHI Door and Hardware Institute

- 5. NFPA National Fire Protection Association
 - NFPA 80 2016 Edition Standard for Fire Doors and Other Opening Protectives.
 - b) NFPA 105 Smoke and Draft Control Door Assemblies
 - c) NFPA 252 Fire Tests of Door Assemblies
- 6. UL Underwriters Laboratories
 - a) UL10C Positive Pressure Fire Tests of Door Assemblies.
 - b) UL 305 Panic Hardware
- 7. WHI Warnock Hersey Incorporated State of California Building Code
- 8. Local applicable codes
- 9. SDI Steel Door Institute
- 10. WI Woodwork Institute
- 11. AWI Architectural Woodwork Institute
- 12. NAAMM National Association of Architectural Metal Manufacturers
- B. Abbreviations
 - 1. Manufacturers: see table at 2.1.A of this section
 - 2. Finishes: see 2.7 of this section.

1.3 SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Submit six copies of schedule per Section 01330. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
 - 1. Type, style, function, size, quantity and finish of hardware items.
 - 2. Use BHMA Finish codes per ANSI A156.18.
 - 3. Name, part number and manufacturer of each item.
 - 4. Fastenings and other pertinent information.
 - 5. Location of hardware set coordinated with floor plans and door schedule.
 - 6. Explanation of abbreviations, symbols, and codes contained in schedule.
 - 7. Mounting locations for hardware.
 - 8. Door and frame sizes, materials and degrees of swing.
 - 9. List of manufacturers used and their nearest representative with address and phone number.
 - 10. Catalog cuts.
 - 11. Manufacturer's technical data and installation instructions for electronic hardware.
- B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.
- C. Deviations: Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.
- D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.

- E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
- F. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.4 QUALITY ASSURANCE:

A. Qualifications:

- Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
 - Responsible for detailing, scheduling and ordering of finish hardware.
 Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
 - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.6 PROJECT CONDITIONS AND COORDINATION:

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.

- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
 - 1. Location of embedded and attached items to concrete.
 - 2. Location of wall-mounted hardware, including wall stops.
 - 3. Location of finish floor materials and floor-mounted hardware.
 - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
 - 5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
 - 6. Coordinate: low-voltage power supply locations.
 - 7. Coordinate: back-up power for doors with automatic operators.
 - 8. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
 - 9. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.
- E. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
 - 1. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.

1.7 WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.
- B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:
- C. Minimum warranties:

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Locksets: Three years
 Extra Heavy Duty Cylindrical Lock: Seven Years

3. Exit Devices: Three years mechanical

One year electrical

4. Closers: Thirty years mechanical

Two years electrical

5. Hinges: One year6. Other Hardware Two years

1.8 COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

- 1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
- 2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
- 3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Manufacturers and their abbreviations used in this schedule:

ADA Adams Rite
IVE H. B. Ives
LCN LCN Closers

SCE Schlage Electronics SCH Schlage Lock Company

VON Von Duprin
ZER Zero International

2.2 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.

- C. Conventional Hinges: Steel or stainless steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
 - 1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins and security studs.
 - Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

D. Continuous Hinges:

- Geared-type aluminum.
 - a) Use wide-throw units where needed for maximum degree of swing, advise architect if commonly available hinges are insufficient.
 - b) If units are used at storefront openings, color-coordinate hinge finish with storefront color. Custom anodizing and custom powdercoat finishes subject to Architect approval.
- 2. Pinned steel/stainless steel type: continuous stainless steel, 0.25-inch diameter stainless-steel hinge pin.
 - Use engineered application-specific wide-throw units as needed to provide maximum swing degree of swing, advise architect if required width exceeds 8 inches.

2.3 LOCKSETS, LATCHSETS, DEADBOLTS:

- A. Mortise Locksets and Latchsets: as scheduled.
 - 1. Chassis: cold-rolled steel, handing field-changeable without disassembly.
 - 2. Universal lock case 10 functions in one case.
 - 3. Floating mounting tabs automatically adjusts to fit a beveled door edge.
 - 4. Latchbolts: 0.75 inch throw stainless steel anti-friction type.
 - 5. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
 - Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
 - b) Inside lever applied by screwless shank mounting no exposed trim mount screws.
 - c) Levers rotate up or down for ease of use.
 - d) Vandalgard locks: locked lever freely rotates down while remaining securely locked. This feature prevents damage to internal lock components when subjected to excessive force.
 - 6. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
 - 7. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
 - 8. Deadbolts: stainless steel 1-inch throw.
 - 9. Electric operation: Manufacturer-installed continuous duty solenoid.
 - 10. Strikes: 16 gage curved steel, bronze or brass with 1 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 - 11. Scheduled Lock Series and Design: Schlage L series, 17A design.
 - 12. Certifications:

- a) ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
- b) ANSI/ASTM F476-84 Grade 31 UL Listed.
- 13. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2016 11B-404.2.7 and 11B-309.4.
- B. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.
 - Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, throughbolted
 - 2. Locking Spindle: stainless steel, integrated spring and spindle design.
 - 3. Latch Retractors: forged steel. Balance of inner parts: corrosion-resistant plated steel, or stainless steel.
 - 4. Latchbolt: solid steel.
 - 5. Backset: 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
 - 6. Lever Trim: accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to door face.
 - 7. Electric operation: Manufacturer-installed continuous duty solenoid.
 - 8. Strikes: 16 gage curved steel, bronze or brass with 1.00 inch deep box construction, lips of sufficient length to clear trim and protect clothing.
 - 9. Lock Series and Design: Schlage ND series, "Sparta" design.
 - 10. Certifications:
 - a) ANSI A156.2, 1994, Series 4000, Grade 1.
 - b) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.
 - 11. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2016 11B-404.2.7 and 11B-309.4

2.4 EXIT DEVICES / PANIC HARDWARE

A. General features:

- 1. Independent lab-tested 1,000,000 cycles.
- 2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
- 3. Deadlocking latchbolts, 0.75 inch projection.
- 4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
- 5. No exposed screws to show through glass doors.
- 6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
- 7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
- 8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.
- 9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2016 11B-404.2.7 and 11B-309.4.

- a) Mechanical method: Von Duprin "AX-" feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
- b) Electrical method: Von Duprin's "RX-QEL-", where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.

B. Specific features:

- 1. Non-Fire Rated Devices: cylinder dogging.
- 2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
- 3. Rod and latch guards with sloped full-width kickplates for doors fitted with surface vertical rod devices with bottom latches.
- 4. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

2.5 CLOSERS

A. Surface Closers: (4040XP)

- 1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
- 2. ISO 2000 certified. Units stamped with date-of-manufacture code.
- 3. Independent lab-tested 10,000,000 cycles.
- 4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
- 5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
- 6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2013 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
 - a) Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
- 7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
- 8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
- 9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
- 10. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
- 11. Non-flaming fluid, will not fuel door or floor covering fires.
- 12. Pressure Relief Valves (PRV) not permitted.

2.6 OTHER HARDWARE

A. Automatic Flush Bolts: Low operating force design.

- B. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- C. Door Stops: Provide stops to protect walls, casework or other hardware.
 - 1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
 - 2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- D. Thresholds: As scheduled and per details. Comply with CBC 2016 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
 - 1. Saddle thresholds: 0.125 inches minimum thickness.
 - 2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
 - 3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
 - a) City of Los Angeles: regardless of critical radiant flux values of organicmaterial floor coverings, furnish metal, concrete, or stone thresholds at firerated openings.
 - 4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
 - 5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
 - 6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
 - 7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- E. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.
 - 1. Exception: surface-mounted overhead stops, holders, and friction stays.
- F. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression only enough to effect a seal.
- G. Key Control Software: Same manufacturer as key cylinders, supply to Owner.

2.7 FINISH:

- A. Generally: BHMA 626 Satin Chromium
 - 1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.
 - 1. Provide satin-chrome plated arms, tracks and covers where scheduled bright metallic powder coat (MTLPC) not available.

2.8 KEYING REQUIREMENTS:

A. Key System: Schlage Everest utility-patented keyway, interchangeable core. Utility patent protection to extend at least until 2029. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and Allegion representatives to determine system keyway(s), keybow styles, structure and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Owner will install permanent cylinders/cores.

B. Keys

- 1. New factory registered master key system.
- 2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
- 3. Furnish 10 construction keys.
- 4. Furnish 2 construction control keys.
- 5. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.
- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
 - 1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
 - 2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
 - 3. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS:

A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.2 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
 - 1. Notify Architect of code conflicts before ordering material.
 - 1. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1008.1.9.2 and 11B-404.2.7.
 - 2. Locate panic hardware between 36 inches to 44 inches above the finished floor.
 - 3. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.
- D. Existing frames and doors to be retrofitted with new hardware:
 - 1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
 - 2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
 - 3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.
 - 4. Provide wrap-around repair plates at doors where required to cover the original preparation and allow installation of new hardware.

3.3 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.
 - Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
 - 2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
 - 3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
 - 4. Replace fasteners damaged by power-driven tools.

- B. Locate floor stops no more that 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.
- G. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- H. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.
- I. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.
- J. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

3.4. ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
 - 1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
 - 2. Adjust doors to fully latch with no more than 1 pound of pressure.
 - Door closer valves: turn valves clockwise until at bottom do not force.
 Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
 - 3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
 - 4. Adjust door closers per 1.9 this section.
- B. Inspection of fire door assemblies and means-of-egress panic-hardware doors: Per 2016 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware. Certification, Testing and Quality Control shall be in accordance with Division 01 45 23 Testing and Inspection services. All doors hardware and installation will be inspected by a third party selected by the architect/owner

Div 01 45 23:

Per 2016 NFPA-80 5.2.1: Use a third party inspector not associated with the
construction, supply or installation of this project to develop a field survey of the
doors and hardware. Survey is to be done by a member certified as a FDAI (Fire
Door Assembly Inspector), Certified AHC (Architectural Hardware Consultant) or
a certified testing laboratory: UL or Intertek. Certified Inspectors may be found at
DHI.org, Intertek, or CAFDI.org.

C. Fire-rated doors:

- Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.
- 2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
- 3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- D. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
 - 1. Has re-adjusted hardware.
 - 2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
 - 3. Has identified items that have deteriorated or failed.
 - 4. Has submitted written report identifying problems.

3.5 DEMONSTRATION:

A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.6 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.7 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

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HW S	et #: 01 ·	- EXST EXT PR ALD PANIC - :	SCUSH/NO KP						
Provide each PR door(s) with the following:									
2	EA	CONT. HINGE	112XY	628	IVE				
1	EA	PANIC HARDWARE	3549A-EO	626	VON				
1		PANIC HARDWARE	3549A-NL-OP-388	626	VON				
1	EA	RIM CYLINDER	20-057 ICX	626	SCH				
1	EA	FSIC CORE	23-030	626	SCH				
2	EA	90 DEG OFFSET PULL	8190HD 10" O	630	IVE				
2	EΑ	SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN				
2	EΑ	MOUNTING PLATE	4040XP-18 (AS REQ'D)	689	LCN				
2	EA		FS444/FS448 (AS REQ'D)	626	IVE				
2	EA		39A	A	ZER				
1	EA	THRESHOLD	PER SILL DETAIL	AA	SCH				
=			OOOR/FRAME MANUFACTURER	701	0011				
		TING CONDITIONS PRIOR TO							
		EXST EXT SGL HM STORE	- REG/KP/WS						
		SGL door(s) with the following:							
3	EA	HINGE	3CB1 4.5 X 4.5 NRP	630	IVE				
1	EA	STOREROOM LOCK	L9080T 17A	626	SCH				
1		FSIC CORE	23-030	626	SCH				
1		SURFACE CLOSER	4040XP REG OR PA AS REQ	689	LCN				
1		KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1		WALL STOP	WS406/407CCV	626	IVE				
1		RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER				
1	EA	GASKETING	429AA	AA	ZER				
1	EA	DOOR SWEEP	39A	Α	ZER				
1	EA	THRESHOLD	PER SILL DETAIL	AA	SCH				
		D SEAL BEFORE CLOSER							
VERIF	Y EXIS	TING CONDITIONS PRIOR TO	ORDERING HARDWARE						
11147.0	-+ 4. OO	- STANDALONE KEYPAD MO	DTISE I OOK						
		SGL door(s) with the following:	K 113E LOCK						
2	EA	HINGE	3CB1 4.5 X 4.5 NRP	630	IVE				
1	EA	ELECTRIC CLASSROOM	CO-100-MS-70-KP-RHO-R 4B	626	SCE				
1	EA	LOCK	BATTERY OPERATED	020	SCE				
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS	689	LCN				
'	LA	SON ACE CEOSEN	REQ	009	LOIN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	EΑ	WALL STOP	WS406/407CCV	626	IVE				
1	EΑ	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER				
1	EA	GASKETING	429AA	AA	ZER				
1	EA	DOOR SWEEP	39A	A	ZER				
1	EA	THRESHOLD	PER SILL DETAIL	AA	SCH				
		D SEAL BEFORE CLOSER	I LIX OILL DETAIL	~~	3011				
10 17	, , ,	D CLINE DEI CINE OLOGEIN							

PORTERVILLE ANIMAL SHELTER FACILITY 100% CD SET – OCTOBER 27, 2020

		INT PR HM FB/CLASS - H/KFPR door(s) with the following:	P/FS						
6	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	SET	CONST LATCHING BOLT	FB51P/FB61P (AS REQ'D)	630	IVE				
1	EA	DUST PROOF STRIKE	DP1/DP2 (AS REQ'D)	626	IVE				
1	EA	CLASSROOM LOCK	ND70TD SPA	626	SCH				
1	EA	FSIC CORE	23-030	626	SCH				
1	EA	COORDINATOR	COR X FL	628	IVE				
2	EA	MOUNTING BRACKET	MB	689	IVE				
2	EA	SURFACE CLOSER	4040XP STD H	689	LCN				
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
2	EA EA	FLOOR STOP		626	IVE				
1	EA	GASKETING	FS436/FS438 (AS REQ'D) 488SBK PSA	BK	ZER				
1	EA	ASTRAGAL	47A	A	ZER				
I	EA	ASTRAGAL	4/A	А	ZER				
HW Set #: 05 - INT SGL HM PANIC - PA/NO KP/FS									
		SGL door(s) with the following:							
3	EA	HINGE	3CB1HW 4.5 X 4.5	652	IVE				
1	EA	PANIC HARDWARE	AX-35A-L-17	626	VON				
1	EA	RIM CYLINDER	20-057 ICX	626	SCH				
1	EA EA		23-030	626	SCH				
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS REQ	689	LCN				
1	EA	MOUNTING PLATE	4040XP-18 (AS REQ'D)	689	LCN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	EA	FLOOR STOP	FS436/FS438 (AS REQ'D)	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
HARDWARE SPECIFIED FOR WIDE STILE ALUMINUM STOREFRONT - PLEASE VERIFY STILES									
		INT SGL A/G NO LOCK - NO SGL door(s) with the following:	CLOSER/NO KP/FS						
1	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA			626	SCH				
1		FSIC CORE	23-030	626	SCH				
1	EA		FS436/FS438 (AS REQ'D)	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
HARDWARE SPECIFIED FOR WIDE STILE ALUMINUM STOREFRONT - PLEASE VERIFY STILES									

PORTERVILLE ANIMAL SHELTER FACILITY 100% CD SET – OCTOBER 27, 2020

		- INT SGL HM CLASS - REG								
		SGL door(s) with the following		650	IVE					
3	EΑ	HINGE	3CB1 4.5 X 4.5	652						
1		CLASSROOM LOCK	ND70TD SPA	626	SCH					
1		FSIC CORE	23-030	626	SCH					
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS REQ	689	LCN					
1	EA	MOUNTING PLATE	4040XP-18 (AS REQ'D)	689	LCN					
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE					
1	EA	WALL STOP	WS406/407CCV	626	IVE					
1	EA	GASKETING	488SBK PSA	BK	ZER					
	HW Set #: 08 - INT SGL HM CLASS - PA/NO KP/FS Provide each SGL door(s) with the following:									
3	EA	HINGE	3CB1HW 4.5 X 4.5	652	IVE					
1			ND70TD SPA	626	SCH					
1	EA	CLASSROOM LOCK FSIC CORE	23-030	626	SCH					
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS	689	LCN					
			REQ							
1	EA	MOUNTING PLATE	4040XP-18 (AS REQ'D)	689	LCN					
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE					
1	EA	FLOOR STOP	FS436/FS438 (AS REQ'D)	626	IVE					
1	EA	GASKETING	488SBK PSA	BK	ZER					
HW Set #: 09 - INT SGL HM 🖒 STORE - REG/KP/WS										
	de each :	SGL door(s) with the following								
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE					
1	EA		ND80TD SPA	626	SCH					
1	EA	FSIC CORE	23-030	626	SCH					
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS REQ	689	LCN					
1	EA	MOUNTING PLATE	4040XP-18 (AS REQ'D)	689	LCN					
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE					
1	EA	WALL STOP	WS406/407CCV	626	IVE					
1	EA	GASKETING	488FSBK PSA	BK	ZER					
HW Set #: 10 - INT SGL HM STORE - HREG/KP/WS										
		SGL door(s) with the following								
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE					
1	EA	PASSAGE SET	ND10S SPA	626	SCH					
1	EA	SURFACE CLOSER	4040XP STD H	689	LCN					
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE					
1	EA	WALL STOP	WS406/407CCV	626	IVE					
1	EA	GASKETING	488SBK PSA	BK	ZER					

PORTERVILLE ANIMAL SHELTER FACILITY 100% CD SET – OCTOBER 27, 2020

		INT SGL HM STORE - NO CL SGL door(s) with the following:	OSER/NO KP/WS						
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA	PASSAGE SET	ND10S SPA	626	SCH				
1	EA	WALL STOP	WS406/407CCV	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
HW Set #: 11A - INT SGL HM STORE - NO CLOSER/NO KP/WS Provide each SGL door(s) with the following:									
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA	PASSAGE SET	ND10S SPA	626	SCH				
1	EA	WALL STOP	WS406/407CCV	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
HARD	WARE S	SPECIFIED FOR WIDE STILE	ALUMINUM STOREFRONT - PLEASE VERIFY	STILES					
HW Set #: 12 - INT SGL HM STORE - REG/KP/WS Provide each SGL door(s) with the following:									
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH				
1	EA	FSIC CORE	23-030	626	SCH				
1	EA	WALL STOP	WS406/407CCV	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
HW Set #: 13 - STANDALONE KEYPAD CYLINDRICAL LOCKSET Provide each SGL door(s) with the following:									
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA	ELEC CLASSROOM LOCK	CO-100-CY-70-KP-RHO-R 4B BATTERY OPERATED	626	SCH				
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS REQ	689	LCN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	EA	WALL STOP	WS406/407CCV	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				
	et #: 14	SGL door(s) with the following:							
3	EA	HINGE	3CB1 4.5 X 4.5	652	IVE				
1	EA	CLASSROOM DEAD LOCK		626	SCH				
1	EA	PUSH PLATE	8200 8" X 16" CFC	630	IVE				
1	EA	PULL PLATE	8302 10" 4" X 16" CFT	630	IVE				
1	EA	SURFACE CLOSER	4040XP STD REG OR PA AS	689	LCN				
ı	EA	SURFACE CLOSER	REQ	009	LCIN				
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE				
1	EA	MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE				
1	EA	WALL STOP	WS406/407CCV	626	IVE				
1	EA	GASKETING	488SBK PSA	BK	ZER				

HW Set #: 15

Provide each RU door(s) with the following:
ALL HARDWARE PROVIDED BY ROLL-UP DOOR MANUFACTURER

SECTION 08 80 00 GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

- Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 70 00 Decorative Metal: For glazed handrail and gate assembly for Lobby 'play-pen.'
- B. Section 07 92 00 Joint Sealants: Sealants for other than glazing purposes.
- C. Section 08 11 13 Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- D. Section 10 28 00 Toilet, Bath, and Laundry Accessories: Mirrors.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. 16 CFR 1201 Safety Standard for Architectural Glazing Materials.
- C. ANSI Z97.1 American National Standard for Safety Glazing Materials Used in Buildings -Safety Performance Specifications and Methods of Test.
- D. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- E. ASTM C864 Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- F. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- G. ASTM C1036 Standard Specification for Flat Glass.
- H. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
- I. ASTM C1193 Standard Guide for Use of Joint Sealants.
- J. ASTM C1376 Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
- K. ASTM E1300 Standard Practice for Determining Load Resistance of Glass in Buildings.
- L. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
- M. GANA (GM) GANA Glazing Manual.
- N. GANA (SM) GANA Sealant Manual.
- O. GANA (LGRM) Laminated Glazing Reference Manual.
- P. IGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
- Q. NFRC 100 Procedure for Determining Fenestration Product U-factors.
- R. NFRC 200 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- S. NFRC 300 Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
- B. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 12 by 12 inch (300 by 300 mm) in size of glass units.
- E. Samples: Submit 6 inch (150 mm) long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Float Glass Manufacturers:
 - 1. AGC Glass North America, Inc: www.agcglass.com/#sle.
 - 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 3. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 4. Pilkington North America Inc: www.pilkington.com/na/#sle.
 - 5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
 - 6. Substitutions: See Division 01 section for requirements and procedures.
 - B. Laminated Glass Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc. www.viracon.com/#sle.
 - 3. Substitutions: See Division 01 section for requirements and procedures.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

- 1. Design Pressure: Calculated in accordance with ASCE 7.
- 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
- 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7.
- 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
- 5. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
 - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I Transparent Flat, Class 1 Clear, Quality Q3.
 - 2. Kind HS Heat-Strengthened Type: Complies with ASTM C1048.
 - 3. Kind FT Fully Tempered Type: Complies with ASTM C1048.
 - 4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.04 INSULATING GLASS UNITS

- A. If required for replacing existing glass, match existing unit.
- B. Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 - 3. Metal Edge Spacers: Aluminum, bent and soldered corners.
 - 4. Spacer Color: Black.
 - Edge Seal:
 - Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
 - 6. Color: Black.
 - 7. Purge interpane space with dry air, hermetically sealed.

2.05 GLAZING UNITS

- A. Monolithic Interior Vision Glazing:
 - Applications: Interior glazing unless otherwise indicated.
 - Glass Type: Annealed float glass, unless tempered if required by AHJ for specific locations.
 - 3. Tint: Clear.
 - Thickness: 1/4 inch (6.4 mm), nominal.
- B. Type G-5 Monolithic Safety Glazing: Non-fire-rated.
 - 1. Applications:
 - a. Glazed lites in doors, except fire doors.
 - b. Glazed sidelights to doors, except in fire-rated walls and partitions.

- c. Other locations required by applicable federal, state, and local codes and regulations.
- d. Other locations indicated on drawings.
- 2. Glass Type: Fully tempered safety glass as specified.
- 3. Tint: Clear.
- 4. Thickness: 1/4 inch (6.4 mm), nominal.

2.06 GLAZING COMPOUNDS

- A. Type GC-2 Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- B. Type GC-5 Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

C. Manufacturers:

- 1. BASF Corporation: www.basf.com/#sle.
- Bostik Inc: www.bostik-us.com/#sle.
- 3. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
- 4. Momentive Performance Materials, Inc: www.momentive.com/#sle.
- 5. Pecora Corporation: www.pecora.com/#sle.
- 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
- 7. Substitutions: See Division 01 section for requirements and procedures.

2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Silicone, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
 - 1. Width: As required for application.
 - 2. Thickness: As required for application.
 - 3. Spacer Rod Diameter: As required for application.
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application Interior Glazing. Set glazing infills from interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT) (EXTERIOR CONDITIONS TO MATCH EXISTING)

- A. Application Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- D. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.
- E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.
 - 1. Place glazing tape on glazing pane of unit with tape flush with sight line.
- G. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.
- H. Apply cap bead of butyl type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 CLEANING

- A. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.
- B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- C. Remove non-permanent labels immediately after glazing installation is complete.
- D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
 - 1. Fluid Applied Flooring.
- B. Removal of existing floor coverings.
- Preparation of existing concrete floor slabs for installation of floor coverings.
- D. Testing of concrete floor slabs for moisture and alkalinity (pH).
- E. Patching compound.
- F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 Cast-in-Place Concrete: Concrete and vapor varrier for patching existing slabs where needed.
- B. Section 03 54 00 Cementitious Underlayment: Self-leveling underlayment applied as remediation treatment.
- C. Section 09 67 00 Fluid-Applied Flooring: Repair products and proceudres for use at fluid-applied flooring.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).
- C. ASTM C472 Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.
- D. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- E. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- F. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- G. RFCI (RWP) Recommended Work Practices for Removal of Resilient Floor Coverings.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Visual Observation Report: For existing floor coverings to be removed.
- C. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
 - 1. Moisture and alkalinity (pH) limits and test methods.
 - 2. Manufacturer's required bond/compatibility test procedure.
- D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
 - Manufacturer's qualification statement.

- Manufacturer's statement of compatibility with types of flooring applied over remedial product.
- 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
- 4. Manufacturer's installation instructions.
- 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

E. Testing Agency's Report:

- 1. Description of areas tested; include floor plans and photographs if helpful.
- 2. Summary of conditions encountered.
- 3. Moisture and alkalinity (pH) test reports.
- 4. Copies of specified test methods.
- 5. Recommendations for remediation of unsatisfactory surfaces.
- 6. Product data for recommended remedial coating.
- 7. Submit report to Architect.
- 8. Submit report not more than two business days after conclusion of testing.
- F. Adhesive Bond and Compatibility Test Report.
- G. Copy of RFCI (RWP).

1.06 QUALITY ASSURANCE

- A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
 - 1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
 - 1. Provide access for and cooperate with testing agency.
 - 2. Confirm date of start of testing at least 10 days prior to actual start.
 - 3. Allow at least 4 business days on site for testing agency activities.
 - 4. Achieve and maintain specified ambient conditions.
 - Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
 - Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
 - 2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
 - Products:
 - TEC, an H.B. Fuller Construction Products Brand; TEC Feather Edge Skim Coat: www.tecspecialty.com/#sle.
 - b. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com/#sle.
 - c. Substitutions: See Division 01 section for requirements and procedures.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

- A. Perform following operations in the order indicated:
 - 1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
 - Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
 - Removal of existing floor covering.
 - 2. Preliminary cleaning.
 - 3. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.
 - 4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
 - 6. Specified remediation, if required.
 - 7. Patching, smoothing, and leveling, as required.
 - 8. Other preparation specified.
 - 9. Adhesive bond and compatibility test.
 - 10. Protection.

B. Remediations:

- Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this
 condition before doing any other remediation; re-test after correction.
- 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
- 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.
- B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.
- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet (1.4 kg per 93 square meters) per 24 hours.
- F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
 - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
 - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

- Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Gypsum sheathing.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 21 00 Thermal and Acoustical Insulation: Acoustic insulation.
- C. Section 07 25 00 Weather Barriers: Water-resistive barrier over sheathing.
- D. Section 07 84 00 Firestopping: Top-of-wall assemblies at fire rated walls.
- E. Section 07 92 00 Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- F. Section 09 22 16 Non-Structural Metal Framing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM C475/C475M Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- C. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board.
- D. ASTM C1047 Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.
- E. ASTM C1280 Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing.
- F. ASTM C1396/C1396M Standard Specification for Gypsum Board.
- G. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
- H. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- I. GA-216 Application and Finishing of Gypsum Panel Products.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum three years of experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Fire Rated Partitions: UL listed assemblies as indicated on Drawings; 1 hour rating.
 - 2. Fire-Resistance-Rated Ceilings: One (1) hour fire rating.

2.02 METAL FRAMING MATERIALS

A. Non-structural Steel Framing for Application of Gypsum Board: As specified in Section 09 22 16.

2.03 BOARD MATERIALS

- A. Manufacturers Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Continental Building Products: www.continental-bp.com/#sle.
 - 4. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 5. National Gypsum Company: www.nationalgypsum.com/#sle.
 - 6. PABCO Gypsum: www.pabcogypsum.com/#sle.
 - 7. USG Corporation: www.usg.com/#sle.
 - 8. Substitutions: See Division 01 section for requirements and procedures.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch (16 mm).
 - b. Ceilings: 5/8 inch (16 mm).
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Backing Board For Non-Wet Areas Subject to Wash-down: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 - 1. Application: Areas to receive regular wash-down.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - 4. Type: Type X, in locations indicated.
 - 5. Type X Thickness: 5/8 inch (16 mm).
 - 6. Edges: Tapered.
 - 7. Products:
 - a. American Gypsum Company; M-Bloc.
 - b. American Gypsum Company; M-Bloc Type X.
 - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board.
 - d. Georgia-Pacific Gypsum; DensArmor Plus.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
 - f. Substitutions: See Division 01 section for requirements and procedures.
- D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Ceilings, unless otherwise indicated.
 - 2. Thickness: 1/2 inch (13 mm) unlewss otherwise indicated on Drawings.
 - 3. Edges: Tapered.
 - 4. Products:

- a. CertainTeed Corporation; Interior Ceiling Drywall.
- b. Continental Building Products; Sagcheck.
- c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
- d. Substitutions: See Division 01 section for requirements and procedures.
- E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
 - 1. Application: Exterior sheathing, unless otherwise indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
 - 4. Type X Thickness: 5/8 inch (16 mm).
 - 5. Edges: Square.
 - Glass Mat Faced Products:
 - a. American Gypsum Company; M-Glass Exterior Sheathing Type X.
 - b. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing.
 - c. Continental Building Products; Weather Defense Sheathing Type X.
 - d. Georgia-Pacific Gypsum; DensGlass Sheathing.
 - e. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing.
 - f. Substitutions: See Division 01 section for requirements and procedures.

2.04 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Insulation: As specified in Section 07 21 00.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: www.liquidnails.com/#sle.
 - c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
 - d. Substitutions: See Division 01 section for requirements and procedures.
- C. Water-Resistive Barrier: As specified in Section 07 25 00.
- D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
- E. Decorative Metal Trim:
 - 1. Material: Extruded aluminum alloy 6063-T5 temper.
 - 2. Finish: Anodized, clear.
 - 3. Type: Profile as selected from manufacturer's standard range.
- F. Moisture Guard Trim: ASTM C1047, rigid plastic, 48 inch (1219.2 mm) length, applied to bottom edge of gypsum board.
 - 1. Height: 1/2 inch (12.7 mm).
 - 2. Depth: 1/2 inch (12.7 mm).
 - 3. Products:
 - a. Waterguard USA; Waterguard: www.waterguard-usa.com/#sle.
 - b. Substitutions: See Division 01 section for requirements and procedures.
- G. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.03 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Seal joints, cut edges, and holes with water-resistant sealant.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.
 - Double-Layer Application: Install base layer using screws or nails. Install face layer using adhesive.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.
- E. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.05 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 3: Walls to receive textured wall finish.
 - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
 - 2. Taping, filling and sanding is not required at base layer of double layer applications.

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

SECTION 09 22 16 NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 Metal Fabrications: Metal fabrications attached to stud framing.
- B. Section 06 10 00 Rough Carpentry: Wood blocking within stud framing.
- C. Section 07 21 00 Thermal and Acoustical Insulation: Acoustic insulation.
- D. Section 07 62 00 Sheet Metal Flashing and Trim: Head and sill flashings
- E. Section 07 84 00 Firestopping: Sealing top-of-wall assemblies at fire rated walls.
- F. Section 07 92 00 Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- G. Section 08 31 00 Access Doors and Panels.
- H. Section 09 21 16 Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute.
- C. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- E. ASTM A1003/A1003M Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
- F. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
- G. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- H. ASTM C1002 Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, accessories, and items of other related work.
 - 2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Framing, Connectors, and Accessories:
 - 1. CEMCO: www.cemcosteel.com/#sle.
 - 2. ClarkDietrich: www.clarkdietrich.com/#sle.
 - 3. Jaimes Industries: www.jaimesind.com/#sle.
 - 4. Marino: www.marinoware.com/#sle.
 - 5. R-stud. LLC: www.rstud.com/#sle.
 - 6. SCAFCO Corporation: www.scafco.com/#sle.
 - 7. Simpson Strong Tie: www.strongtie.com/#sle.
 - 8. Steel Construction Systems: www.steelconsystems.com/#sle.
 - 9. Super Stud Building Products, Inc: www.buysuperstud.com/#sle.
 - 10. The Steel Network, Inc: www.SteelNetwork.com/#sle.
 - 11. Substitutions: See Division 01 section for requirements and procedures.

2.02 FRAMING MATERIALS

- A. Fire Rated Assemblies: Comply with applicable code and as follows:
 - 1. Fire Rated Partitions and Ceilings: Listed assembly by UL, assembly numbers as indicated on Drawings; 1 hour rating.
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
 - 1. Studs: C shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C shaped.
 - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
 - Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating.
 - 3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems indicated on drawings.
 - 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet (3660 mm).
 - a. Products:
 - 1) ClarkDietrich; BlazeFrame RipTrak: www.clarkdietrich.com/#sle.
 - 2) Super Stud Building Products, Inc; Slotted Deflection Track: www.buysuperstud.com/#sle.
 - 3) Substitutions: See Division 01 section for requirements and procedures.
- D. Non-Loadbearing Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.

- 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall study for lateral bracing.
- 4. Sheet Metal Backing: 0.036 inch (0.9 mm) thick, galvanized.
- 5. Fasteners: ASTM C1002 self-piercing tapping screws.
- 6. Anchorage Devices: Powder actuated.
- 7. Acoustic Insulation: As specified in Section 07 21 00.
- 8. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- Comply with requirements of ASTM C754.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Align and secure top and bottom runners at 24 inches (600 mm) on center.
- E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- F. Install studs vertically at spacing indicated on drawings.
- G. Align stud web openings horizontally.
- H. Secure studs to tracks using crimping method. Do not weld.
- I. Stud splicing is not permissible.
- Fabricate corners using a minimum of three studs.
- K. Double stud at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.
- L. Brace stud framing system rigid.
- M. Coordinate erection of studs with requirements of door frames; install supports and attachments.
- N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- O. Blocking: Use steel channels secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- P. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches (150 mm).

3.03 CEILING AND SOFFIT FRAMING

- A. Comply with requirements of ASTM C754.
- B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- C. Install furring independent of walls, columns, and above-ceiling work.
- D. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

- E. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.
- F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.
- H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.
- I. Laterally brace suspension system.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

SECTION 09 51 00 ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 07 21 00 Thermal and Acoustical Insulation: Acoustical insulation.
- B. Section 09 21 16 Gypsum Board Assemblies: Drywall ceilings.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- E. ASTM C636/C636M Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- F. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
- G. ASTM E1264 Standard Classification for Acoustical Ceiling Products.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Locations of lighting fixtures, sprinkler heads, HVAC grilles, and other items located in the ceiling shall be coordinated to ensure layout accommodates all penetrations and accessories in accordance with approved shop drawings.
- B. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- C. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches (150 mm) long, of suspension system main runner, cross runner, and perimeter molding.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Manufacturer's Qualification Statement.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 BASIS OF PERFORMANCE

- A. Basis of Cost:
 - Manufacturer and Colors: As indicated on Finish Schedule and Finish Legend on Drawings.
- B. Coordination Requirements:
 - Coordinate with lighting fixtures, air distribution equipment, and fire and smoke detectors and alarm.

2.02 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Basis of Design: Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. Acoustic Ceiling Products, Inc: www.acpideas.com/#sle.
 - 3. CertainTeed Corporation: www.certainteed.com/#sle.
 - 4. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
 - 5. USG Corporation: www.usg.com/ceilings/#sle.
 - 6. Substitutions: See Division 01 section for requirements and procedures.
- B. Suspension Systems:
 - Same as for acoustical units.

2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:
 - 1. Local authorities having jurisdiction.

2.04 ACOUSTICAL UNITS

- A. Acoustical Units General: ASTM E1264, Class A.
- B. Acoustical Panels: Painted mineral fiber, with the following characteristics:
 - 1. Classification: ASTM E1264 Type III.
 - 2. Size: 24 by 24 inches (610 by 610 mm).
 - 3. Thickness: 3/4 inch (19 mm).
 - 4. Panel Edge: Square.
 - 5. Color: White.
 - 6. Suspension System: Exposed grid.
 - 7. Basis of Design: Armstrong World Industries, Inc.; Calla Square Lay-in.

2.05 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
 - 1. Materials:
 - a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
- B. Exposed Suspension System: Hot-dipped galvanized steel grid and cap.

- 1. Application(s): Seismic.
- Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
- 3. Profile: Tee; 15/16 inch inch (24 mm) face width.
- 4. Finish: Baked enamel.
- 5. Color: White.
- 6. Basis of Design: Armstrong World Industries, Inc.; Prelude XL 15/16 Exposed Tee suspension system.

2.06 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch (2 mm) galvanized steel wire.
- C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- E. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch (19 mm) clearance between grid ends and wall.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
- . Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Lay directional patterned units with pattern parallel to longest room axis.
- D. Fit border trim neatly against abutting surfaces.

- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- G. Lay acoustical insulation for a distance of 48 inches (1219 mm) either side of acoustical partitions as indicated.
- H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

SECTION 09 65 00 RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient base.
- B. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 09 05 61 Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
- C. ASTM F1861 Standard Specification for Resilient Wall Base.
- D. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 inches (300 mm) long in size illustrating color and pattern for each resilient flooring product specified.
- D. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- E. Manufacturer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
 - Manufacturers:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.

- c. Roppe Corp: www.roppe.com/#sle.
- d. Substitutions: See Division 01 section for requirements and procedures.
- 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
- 3. Height: 4 inch (100 mm).
- 4. Thickness: 0.125 inch (3.2 mm).
- 5. Finish: Satin.
- 6. Length: Roll.
- 7. Color: As indicated on drawings.
- 8. Accessories: Premolded external corners and internal corners.

2.02 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

- A. Clean substrate.
- B. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Spread only enough adhesive to permit installation of materials before initial set.
- D. Fit joints and butt seams tightly.
- E. Set material in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - RESILIENT BASE

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

3.05 CLEANING

- Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

SECTION 09 67 00 FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

- A. Section 03 54 00 Cementitious Underlayment: Cementitious compunds to level or create slopes in existing conrete floors.
- B. Section 07 92 00 Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.
- C. Section 09 05 61 Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.
- D. Section 09 05 61 Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ICRI 310.2R Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 4 by 4 inch (100 by 100 mm) in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Manufacturer's Qualification Statement.
- G. Applicator's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - 2. Extra Top Coat Materials: 2 gallons (8 liters).

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
 - 1. Minimum three years of documented experience.
 - 2. Approved by manufacturer.
- C. Supervisor Qualifications: Trained by product manufacturer, under direct full time supervision of manufacturer's own foreman.

1.06 MOCK-UP

- A. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.
 - 1. Number of Mock-Ups to be Prepared: One.

- 2. Use same materials and methods for use in the work.
- 3. Locate where directed.
- 4. Minimum Size: 48 inches by 48 inches (1220 mm by 1220 mm).
- B. See Section 01 40 00 Quality Requirements for additional requirements.
- C. Obtain approval of mock-up by Architect before proceeding with work.
- D. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

- A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).
- B. Store materials in area of installation for minimum period of 24 hours prior to installation.
- C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 FLUID-APPLIED FLOORING SYSTEMS

- A. Fluid-Applied Flooring: Epoxy base coat(s), with broadcast aggregate.
 - 1. Aggregate: Quartz granules.
 - 2. System Thickness: 1/8 inch (3.2 mm), nominal, when dry.
 - 3. Texture: Slip resistant.
 - 4. Sheen: High gloss.
 - 5. Color: As selected by Architect.
 - 6. Basis of Design Product: Petra Polyymers; PetraQuartz.
 - 7. Products:
 - a. Key Resin Company: www.keyresin.com/#sle.
 - b. PPG Paints Megaseal Fluid Applied Flooring: www.ppgpaints.com/#sle and www.ppgpmc.com/home.aspx/#sle.
 - c. Sherwin-Williams Company: www.protective.sherwin-williams.com/#sle.
 - d. Sika Corporation: www.sikafloorusa.com/#sle.
 - e. Substitutions: See Division 01 section for requirements and procedures.

2.02 ACCESSORIES

- A. Cant Strips: Molded material compatible with flooring.
- B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- C. For underlayment to level or create slope for existing concrete floors, see Section 03 54 00 Cementitious Underlayment.
- D. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

- 1. Test in accordance with Section 09 05 61.
- Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
- 3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Prepare concrete surfaces according to ICRI 310.2R, and manufacturer's recommended concrete preparation, including mechanical profiling of surface.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is
- D. Perform flooring manufacturer's required surface preparation again at all repairs, until all areas achieve the same level of preparation.
- E. Vacuum clean substrate.
- F. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

- A. Install access panel recess frames.
- B. Install cant strips at base of walls where flooring is to be extended up wall as base.
- C. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness indicated.
- C. Finish to smooth level surface.
- D. Cove at vertical surfaces.

3.05 PROTECTION

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

SECTION 09 91 13 EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Trash enclosure gates.
- D. Do Not Paint or Finish the Following Items:
 - Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 6. Floors, unless specifically indicated.
 - Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 09 91 23 Interior Painting.
- B. Section 32 31 19 Decorative Metal Fences and Gates.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- C. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- D. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual.
- E. SCAQMD 1113 Architectural Coatings.
- F. SSPC-SP 1 Solvent Cleaning.
- G. SSPC-SP 2 Hand Tool Cleaning.
- H. SSPC-SP 6 Commercial Blast Cleaning.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.

- 1. Where sheen is specified, submit samples in only that sheen.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - 3. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - a. Within specified MPI systems, provide only manufacturer's premium architectural grade coatings in complete and compatible systems.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Colors: As indicated in Finish Legend on Drawings.

2.02 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.
 - a. Products:
 - Behr Premium Interior/Exterior Direct-To-Metal Paint Semi-Gloss [No. 3200]. (MPI #163)
 - 2) Rodda Multi Master DTM Acrylic Semi-Gloss Enamel, 548901. (MPI #163)
 - 3) Substitutions: See Division 01 section for requirements and procedures.

2.03 PRIMERS

 Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.04 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Galvanized Surfaces:

- 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- 2. Prepare surface according to SSPC-SP 2.

G. Ferrous Metal:

- 1. Solvent clean according to SSPC-SP 1.
- 2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Sand metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

SECTION 09 91 23 INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
 - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
- D. Do Not Paint or Finish the Following Items:
 - Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - Items indicated to remain unfinished.
 - Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Floors, unless specifically indicated.
 - 7. Glass.
 - 8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 01 61 16 Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 05 50 00 Metal Fabrications: Shop-primed items.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. 40 CFR 59, Subpart D National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- C. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- D. ASTM D4258 Standard Practice for Surface Cleaning Concrete for Coating.
- E. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.
- F. CARB (SCM) Suggested Control Measure for Architectural Coatings; California Air Resources Board.
- G. MPI (APL) Master Painters Institute Approved Products List; Master Painters and Decorators Association.
- H. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual.
- SCAQMD 1113 Architectural Coatings.
- J. SSPC-SP 1 Solvent Cleaning.
- K. SSPC-SP 2 Hand Tool Cleaning.
- L. SSPC-SP 6 Commercial Blast Cleaning.

1.05 SUBMITTALS

A. See Division 01 sections, for submittal procedures.

- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.
 - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
- D. Samples: Submit two paper chip samples, 8-1/2 by 11 inch (215 by 280 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- F. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- G. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
 - B. Label each container with color in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum five years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.

- D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Paints:
 - 1. Base Manufacturer: Sherwin Williams Company.
 - 2. Behr Process Corporation: www.behr.com/#sle.
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- B. Primer Sealers: Same manufacturer as top coats.
- C. Substitutions: See Division 01 section for requirements and procedures.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 - a. Within specified MPI systems, provide only manufacturer's premium architectural grade coatings in complete and compatible systems.
 - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
 - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
 - 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).
 - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: As indicated in Finish Legend on Drawings.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 1) Behr Marquee Interior Matte [No. 1450]. (MPI #138)

- 2) Behr Premium Plus Interior Satin Enamel [No. 7050]. (MPI #140)
- 3) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss.
- 4) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel, 90-1110 Series, Satin.
- PPG Paints Pitt-Tech Plus Interior/Exterior WB DTM Enamel 4216 HP Series, Semi-Gloss.
- 6) PPG Paints Break-Through Interior/Exterior Satin Water-Borne Acrylic, V51-410 Series.
- 7) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
- 8) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, Semi-Gloss. (MPI #141)
- 9) Sherwin-Williams ProMar 200 HP Series, Low Gloss Eg-Shel. (MPI #138)
- 10) Sherwin-Williams ProMar 200 HP Series, Eg-Shel. (MPI #139)
- 11) Substitutions: See Division 01 section for requirements and procedures.
- 3. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
 - c. Semi-Gloss: MPI gloss level 5; use this sheen at wet locations.
- 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Transparent Finish on Concrete Floors.
 - 2 coats sealer.
 - 2. Sealer: Water Based Sealer for Concrete Floors; MPI #99.
 - a. Products:
 - 1) Behr Premium Wet-Look Sealer High Gloss [No. 985]. (MPI #99)
 - 2) Behr Premium Wet-Look Sealer Low-Lustre [No. 986]. (MPI #99)
 - 3) PPG Paints: 4-6200XI Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer Satin. (MPI #99)
 - Sherwin-Williams H&C Clarishield Water-Based Wet-Look Concrete Sealer. (MPI #99)
 - 5) Substitutions: See Division 01 section for requirements and procedures.

C. Plastic Laminate:

- 1. Primer applied per manufacturer's direction:
 - a. Product:
 - 1) Rust-Oleum XIM-03 UMA Primer Sealer Bonder in white.
 - 2) Architectural quality topcoat as recommended by manufacturer and compliance with requirements of this section.
 - (a) If compatible and approved by manufacturer of primer, use specified system for interior surfaces in this section.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum Wallboard: 12 percent.
 - 2. Plaster and Stucco: 12 percent.
 - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 - 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean concrete according to ASTM D4258. Allow to dry.
- H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.

M. Ferrous Metal:

- 1. Solvent clean according to SSPC-SP 1.
- Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges
 to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel
 surfaces. Re-prime entire shop-primed item.
- 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- N. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

- O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.
- P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

3.06 SCHEDULE - PAINT SYSTEMS

- A. Gypsum Board: Finish surfaces exposed to view.
 - 1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
 - 2. Interior Walls: GI-OP-3A, semi-gloss.
- B. Wood: Finish surfaces exposed to view.
 - 1. Interior trim and frames: WI-OP-3A, semi-gloss.

SECTION 10 14 00 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.

1.02 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. 36 CFR 1191 Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines.
- C. ADA Standards Americans with Disabilities Act (ADA) Standards for Accessible Design.
- D. ICC A117.1 Accessible and Usable Buildings and Facilities.

1.03 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 BASIS OF PERFORMANCE

A. Design and Performance Requirements:

1. Provide identification and exiting signage as required by authorities having jurisdiction, and as indicated on Drawings.

2.02 MANUFACTURERS

A. Flat Signs:

- 1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
- 2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com/#sle.
- 3. FASTSIGNS: www.fastsigns.com/#sle.
- 4. Inpro: www.inprocorp.com/#sle.
- 5. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
- 6. Seton Identification Products: www.seton.com/aec/#sle.
- 7. Substitutions: See Division 01 section for requirements and procedures.

B. Dimensional Letter Signs:

- 1. A.R.K. Ramos Architectural Signage Systems; Cast Aluminum Letters: www.arkramos.com/#sle.
- 2. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
- 3. FASTSIGNS: www.fastsigns.com/#sle.
- 4. Inpro: www.inprocorp.com/#sle.
- 5. Substitutions: See Division 01 section for requirements and procedures.

2.03 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
 - 1. Sign Type: Flat signs with engraved panel media as specified.
 - Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
 - 3. Character Height: 1 inch (25 mm).
 - 4. Sign Height: 2 inches (50 mm), unless otherwise indicated.
 - Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
 - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 - 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Interior Directional and Informational Signs:
 - 1. Sign Type: Same as room and door signs.
 - 2. Sizes: As indicated on drawings.
 - 3. Allow for 20 signs 4 inches high by 16 inches long.
 - 4. Wording of signs is scheduled on drawings.
 - 5. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.
- D. Exterior Metal Panels/Plaques: UV resistant digital printed aluminum composite panels; individual signs attached with magnetic tape to fixed panel.
 - 1. Dimensions and Number of Signs: As indicated on drawings.
 - 2. Color: Color as selected.
- E. Other Dimensional Letter Signs: Wall-mounted.

- Interior: Allow for total of 50 letters, 6 inches (150 mm) high, metal, as indicated on drawings.
- 2. Interior: See Drawings for signage detail.

2.04 SIGN TYPES

- A. Flat Signs: Signage media without frame.
 - 1. Edges: Square.
 - 2. Corners: Radiused.
 - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
 - 4. Wall and Ceiling Mounting of Two-Sided Signs: Aluminum wall bracket, powder coated, color selected from manufacturer's standard colors, attached with screws in predrilled mounting holes, set in clear silicone sealant.
 - 5. Suspended Mounting: Stainless steel suspension cables, cable clamps, and ceiling fastener suitable for attachment to ceiling construction indicated.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: DIN, Blender Pro, or other sans serif font approved by Architect.
 - 2. Character Case: Upper case only.
 - 3. Background Color: Grey.
 - 4. Character Color: Contrasting color.

2.05 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
 - 1. Total Thickness: 1/16 inch (1.6 mm).

2.06 DIMENSIONAL LETTERS

- A. Metal Letters:
 - 1. Metal: Aluminum casting.
 - 2. Metal Thickness: 1/8 inch minimum (3 mm).
 - 3. Letter Height: As indicated on drawings.
 - 4. Text and Typeface:
 - a. Character Font: DIN, Blender Pro, or other sans serif font approved by Architect.
 - b. Character Case: Upper case only.
 - 5. Finish: Brushed, satin.
 - 6. Mounting: Tape adhesive.

2.07 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

SECTION 10 21 13.17 PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 Metal Fabrications: Concealed steel support members.
- B. Section 06 10 00 Rough Carpentry: Blocking and supports.
- C. Section 10 28 00 Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

- A. See Section Division 01 sections, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 by 6 inch (150 by 150 mm) in size illustrating panel finish, color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Phenolic Toilet Compartments:
 - 1. Accurate Partitions Corp., an ASI Group Company.
 - 2. American Sanitary Partition Corporation.
 - 3. Ampco by AJW.
 - 4. Bobrick Washroom Equipment, Inc.
 - Bradley Corporation.
 - 6. General Partitions Mfg. Corp.
 - 7. Scranton Products.
 - 8. Substitutions: See Division 01 section for requirements and procedures.

2.02 PHENOLIC TOILET COMPARTMENTS

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-to-ceiling.
- B. Doors:
 - 1. Thickness: 3/4 inch (19 mm).
 - 2. Width: 24 inch (610 mm).
 - 3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
 - Height: 58 inch (1473 mm).
- C. Panels:
 - 1. Thickness: 1/2 inch (13 mm).
 - 2. Height: 58 inch (1473 mm).

- 3. Depth: As indicated on drawings.
- D. Pilasters:
 - 1. Thickness: 3/4 inch (19 mm).
 - 2. Width: As required to fit space; minimum 3 inch (76 mm).
- E. Basis of Design: Bobrick Soild Color Reinforced Composite SierraSeries 1092 Overhead Braced. Color as selected by Architect.
 - 1. Substitutions: See Division 01 section for requirements and procedures.

2.03 ACCESSORIES

- A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.
 - Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
 - 2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.
- C. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- D. Hardware: Polished stainless steel:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Door Latch: Slide type with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for outswinging doors.
- E. Toilet Partition Suspension Members: As specified in Section 05 50 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch (6 mm).
- B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

SECTION 10 26 00 WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.
- B. Protective wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 05 50 00 Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.
- B. Section 06 10 00 Rough Carpentry: Blocking for wall and corner guard anchors.
- C. Section 08 71 00 Door Hardware: Standard protection plates and trim.
- D. Section 09 21 16 Gypsum Board Assemblies: Placement of supports in stud wall construction.
- E. Section 09 22 16 Non-Structural Metal Framing: Placement of supports in stud wall construction.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM D256 Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- C. ASTM D543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- E. ASTM F476 Standard Test Methods for Security of Swinging Door Assemblies.
- F. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.
- D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
 - 1. Submit two sections of corner guards, 24 inches (610 mm) long.
 - 2. Submit two samples of protective wall covering, 6 by 6 inches (152 by 152 mm) square.
- E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - 2. Extra Stock Materials: 24 square feet (2.2 square meters) of each kind of protective wall covering.
- H. Maintenance Data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.06 WARRANTY

- See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Corner Guards:
 - 1. Babcock-Davis: www.babcockdavis.com/#sle.
 - 2. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 3. Inpro: www.inprocorp.com/#sle.
 - 4. Koroseal Interior Products: www.koroseal.com/#sle.
 - 5. Nystrom, Inc: www.nystrom.com/#sle.
 - 6. Trim-Tex, Inc: www.trim-tex.com/#sle.
 - 7. Substitutions: See Division 01 section for requirements and procedures.
- B. Protective Wall Covering:
 - 1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c-sgroup.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Pawling Corp: www.pawling.com/#sle.
 - 4. Crane Composites Co. .
 - 5. Substitutions: See Division 01 section for requirements and procedures.

2.02 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.
- B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.
- C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.
- D. Fire Spread and Smoke Generation: Class A per ASTM E84.

2.03 PRODUCT TYPES

- A. Corner Guards Surface Mounted:
 - 1. Material: High impact vinyl with full height extruded aluminum retainer.
 - 2. Performance: Resist lateral impact force of 100 lbs (445 N) at any point without damage or permanent set.
 - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - 4. Width of Wings: 2 inches (51 mm).
 - 5. Corner: Square.
 - 6. Color: As selected from manufacturer's standard colors.
 - 7. Length: One piece.
- B. Protective Wall Covering:
 - 1. Material: Fiberglass reinforced plastic; with stain, abrasion, and moisture resistance.

- 2. Thickness: 0.090 inch (2.3 mm).
- 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- 4. Color: Morning Mist Gray #636.
- 5. Pattern: None.
- 6. Texture: Sandstone.
- 7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
 - a. Inside Corner Trim: Standard angle
 - b. Outside Corner Trim: Standard angle.
- 8. Mounting: Adhesive.
- Bais of Design: Crane Composites Co; Varietex STA Sandstone Class A rated iberglass Reinforced Plastic Wall Panels.
- C. Adhesives and Primers: As recommended by manufacturer.
- D. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.
- E. See Section 06 10 00 for wood blocking for wall and corner guard anchors.
- F. See Section 09 22 16 for supports in stud wall construction.

2.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Form end trim closure by capping and finishing smooth.

2.05 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 Quality Requirements, for additional requirements.
- B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
 - Test painted or wall covering surfaces for adhesion in inconspicuous area, as
 recommended by manufacturer. Follow adhesive manufacturer's recommendations for
 remedial measures at locations and/or application conditions where adhesion test's results
 are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches (102 mm) above finished floor to 42 inches high (1066 mm high).
- C. Position protective wall covering no less than 1 inch (25.4 mm) above finished floor to allow for floor level variation.
 - 1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
 - 2. Apply adhesive with 1/8 inch (3.2 mm) V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
 - 3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
 - 4. Use a roller to ensure maximum contact with adhesive.
 - 5. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/4 inch (6 mm).
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.04 CLEANING

- A. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.
- B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

Commercial toilet accessories.

1.02 RELATED REQUIREMENTS

A. Section 10 21 13.17 - Phenolic Toilet Compartments.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A269/A269M Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- C. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- D. ASTM B456 Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- E. ASTM C1036 Standard Specification for Flat Glass.
- F. ASTM C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. Basis of Design: Bobrick Washroom Equipment, Inc.
 - 2. AJW Architectural Products: www.ajw.com/#sle.
 - 3. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 4. Bradley Corporation: www.bradleycorp.com/#sle.
 - 5. Georgia-Pacific Professional: www.blue-connect.com/#sle.
 - 6. Substitutions: See Division 01 section for requirements and procedures.

2.02 MATERIALS

- A. Accessories General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide three keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. See Drawings for Toilet Accessory schedule with specific model numbers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section 09 22 16 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

SECTION 10 44 00 FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 06 10 00 Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 09 91 23 Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. FM (AG) FM Approval Guide.
- C. NFPA 10 Standard for Portable Fire Extinguishers.
- D. UL (DIR) Online Certifications Directory.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business: www.ansul.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 3. Nystrom, Inc: www.nystrom.com/#sle.
 - 4. Oval Brand Fire Products: www.ovalfireproducts.com/#sle.
 - 5. Potter-Roemer: www.potterroemer.com/#sle.
 - 6. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
 - 7. Substitutions: See Division 01 section for requirements and procedures.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 5 pound (2.27 kg).
 - 3. Size and classification as scheduled.
 - 4. Finish: Baked polyester powder coat, color as selected.
 - 5. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets and on wall brackets.

SECTION 11 11 36 VEHICLE CHARGING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric vehicle charging units.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for pedestal-mounted charging units.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ISO/IEC 14443-4 Cards and Security Devices for Personal Identification Contactless Proximity Objects Part 4: Transmission Protocol.
- C. ISO/IEC FDIS 15963-2 Information Technology Radio Frequency Identification for Item Management Part 2: Unique Identification for RF Tags Registration Procedures.
- D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NFPA 70 National Electrical Code.
- F. SAE J1772 SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler.
- G. UL 2202 Standard for Electric Vehicle (EV) Charging System Equipment.
- H. UL 2231-1 Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: General Requirements.
- UL 2231-2 Standard for Safety for Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems.
- J. UL 2594 Standard for Electric Vehicle Supply Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

- 1. Coordinate this work with other installers to provide required electric power for specified charging units and accessory equipment being installed at designated locations.
- 2. Coordinate this work with other installers to provide readily accessible location for disconnection as indicated and as required by NFPA 70.
- 3. Notify Architect of any conflicts with or deviations from Contract Documents, and obtain documented directions before proceeding with this work.

B. Preinstallation Meetings:

- 1. Conduct meeting with facility representatives to review charging unit and accessory equipment locations, and require attendance by each affected installer.
- C. Sequencing: Do not install charging unit until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's standard catalog and data sheets for charging units and installed accessories; include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Manufacturer's Installation Instructions: Submit necessary application conditions and limitations of use stipulated by product testing agency; include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- D. Manufacturer's detailed field testing procedures.
- E. Field quality control test reports.

- F. Maintenance Contracts.
- G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company with minimum three years documented experience with similar charging units; manufacturer's authorized installer.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Maintain at project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - Electric Vehicle Charging Units: ChargePoint, Inc, as indicated below; www.chargepoint.com/#sle.
- B. Other Acceptable Manufacturers Electric Vehicle Charging Units:
 - FLO (FLO Services USA Inc. in USA, and Services FLO Inc. in Canada): www.flo.com/#sle.
 - 2. Blink Changing Co,; Blink IQ 200 Dual Port
 - 3. Substitutions: See Section 01 60 00 Product Requirements.
- C. Source Limitations: Furnish electric vehicle charging units and accessory equipment produced by a single manufacturer and obtained from a single supplier.

2.02 ELECTRIC VEHICLE CHARGING UNITS

- A. Provide electric vehicle charging units in compliance with NFPA 70 and including required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides functional intent indicated.
- B. Electric Vehicle Charging Units General Requirements:
 - 1. Listed and labeled as complying with UL 2594 or UL 2202.
 - 2. Provide personnel protection, including charge circuit interruption device (CCID), in accordance with UL 2231-1 and UL 2231-2.

- 3. Enclosure Environment Type: In compliance with NEMA 250, Type 3R or Type 4, unless otherwise indicated.
- 4. Service Conditions: Provide charging units suitable for operation between minus 22 and 122 degrees F (minus 30 and 50 degrees C) without derating.
- C. Basis of Design Electric Vehicle Charging Unit: ChargePoint, Inc; CT4000 Family Level 2 Charging Station; Model CT4021, 6 feet (1830 mm) dual-port bollard-mount with 18 feet (5.5 m) cable and overhead cable management system; SAE J1772 connector(s): www.chargepoint.com/#sle.
 - 1. Electrical Output: Standard power output of 7.2 kW (30 A at 240 VAC) per port.
 - 2. Network Connectivity: Supports remote station monitoring and configuration; cellular wide area network (WAN), Wi-Fi local area network (LAN); provide integral cellular gateway modem GW1 (USA) as required for connectivity of all stations; each station must be located within 150 feet (45 m) line-of-sight of a gateway station; maximum of 10 stations per Wi-Fi group.
 - 3. Power Management: Provide power management kit to enable specified power management features; Model CT4000-PMGMT.
 - Power Share: Enables connection of dual-port stations to a single branch circuit, with maximum power output divided between ports when both are used.
 - b. Power Select: Enables configuration of lower than maximum power output.
 - 4. Bollard-Mount Stations: Provide bollard concrete mounting kit as applicable; Model CT4001-CCM.
 - 5. Software: Cloud-based; supports management of driver authentication, payment methods, and pricing models; allows driver to access station availability, wait times, charging status and to join station waitlist.
 - 6. Features: Color liquid crystal display (LCD); card reader with ISO/IEC FDIS 15963-2 (vicinity card), ISO/IEC 14443-4 (proximity card), and NFC support; locking holster(s); integral surge protection; customizable signage/branding areas.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings of charging units are consistent with indicated requirements.
- C. Verify that charging unit locations indicated are free from obstructions and meet manufacturer's minimum clearance requirements.
- D. Verify that mounting surfaces are ready to receive charging units.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to charging units.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Construct cast-in-place concrete bases for pedestal-mounted charging units in accordance with Section 03 30 00.
- C. Install charging units plumb and level.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Program system parameters according to requirements of Owner.

- E. Confirm network connectivity.
- F. Test system for proper operation.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's authorized representative.
 - 4. Location: At project site.

3.06 PROTECTION

A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for service and maintenance of charging units for one year from Date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

SECTION 12 36 00 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

- A. Section 06 41 00 Architectural Wood Casework.
- B. Division 22 for related plumbing items.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- C. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
- D. AWI/AWMAC/WI (AWS) Architectural Woodwork Standards.
- E. AWMAC/WI (NAAWS) North American Architectural Woodwork Standards, U.S. Version 3.1.
- F. NEMA LD 3 High-Pressure Decorative Laminates.
- G. PS 1 Structural Plywood.

1.04 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification:
 - Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 2. Provide designated labels on shop drawings as required by certification program.
 - 3. Provide designated labels on installed products as required by certification program.
 - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD 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 absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
 - Manufacturers:
 - 1) Formica Corporation: www.formica.com/#sle.
 - 2) Lamin-Art, Inc: www.laminart.com/#sle.
 - 3) Panolam Industries International, Inc; Nevamar Hi-Wear: www.panolam.com/#sle.
 - 4) Panolam Industries International, Inc; Pionite Hi-Wear: www.panolam.com/#sle.
 - 5) Wilsonart: www.wilsonart.com/#sle.
 - 6) Substitutions: See Division 01 section for requirements and procedures.
 - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
 - c. NSF approved for food contact.
 - d. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - e. Laminate Core Color: Same as decorative surface.
 - f. Finish: As directed by Architect.
 - g. Surface Color and Pattern: As indicated in Finish Legend on Drawings.
 - 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch (32 mm) thick; covered with matching laminate.
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 Countertops, Custom Grade.
- C. Stainless Steel Countertops: ASTM A666, Type 304, stainless steel sheet; 16 gage, 0.0625 inch (1.59 mm) nominal sheet thickness.
 - 1. Finish: 4B satin brushed finish.
 - 2. Exposed Edge Shape: Marine edge with return; edge raised 3/16 inch (5 mm) above counter with 45 degree transition, minimum 1 inch (25 mm) flat rim; 1-1/2 inch (38 mm) high turndown, 1/2 inch (12 mm) return to face of case; reinforced with hardwood or steel.
 - 3. Back and End Splashes: Same material; welded 1/4 inch (6 mm) radius coved joint to countertop; square top edge with 1 inch (25 mm) wide top surface and minimum 1/2 inch (12 mm) turndown.
 - 4. Splash Dimensions: 6 inch (150 mm) high by 1 inch (25 mm) thick, unless otherwise indicated.
 - 5. Splash Depth Where Faucets are Mounted in Splash: 2 inches (50 mm).
 - 6. Sinks: Same material, same thickness; flush welded to counter; bottom sloped to outlet; radiused interior corners; drain outlet located in back corner.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

- Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
 - a. Rout a 1/8 inch (3 mm) drip groove at underside of exposed overlapping edges, set back 1/2 inch (13 mm) from face of edge.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 - 2. Height: 4 inches (102 mm), unless otherwise indicated.
- C. Stainless Steel: Fabricate tops up to 144 inches (3657 mm) long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
 - 1. Weld joints; grind smooth and polish to match.
 - 2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.
 - 3. Provide wall clips for support of back/end splash turndowns.
 - 4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.
 - 5. Integral sinks: Fabricate with corners rounded and coved, double-walls for sink compartment partitions. Factory-punch holes for fittings, and weld sinks to countertops.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).
- C. Attach stainless steel countertops using stainless steel fasteners and clips.
- D. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
- B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
- C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 13 19 00 ANIMAL ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Animal enclosures for cats and dogs.

1.02 RELATED REQUIREMENTS

- A. Division 01 sections for project administration and management requirements.
- B. Section 01 74 19 Construction Waste Management and Disposal.
- C. Division 23 for Plumbing requirements.

1.03 REFERENCE STANDARDS

A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of animal enclosures with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Provide product data for all products, components, and assemblies specified in this section.
- C. Shop Drawings: Indicate layout and utility connection details.
- D. Samples: Submit two pieces, 6 by 6 inch (150 by 150 mm) in size, illustrating surface finish color and texture.
- E. Certificate: Certify that products of this section meet or exceed specified requirements.
- F. Manufacturer's Instructions: Indicate installation and connection requirements, including seismic bracing requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Maintenance Data: Manufacturer's recommended maintenance instructions.
- J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- K. Specimen Warranty.
- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - 2. Spare Parts: One of each type of hardware used in kennel types.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver kennels and accessories to project site in manufacturer's original packing.
- B. Store kennels and accessories under cover and elevated above grade.

1.08 WARRANTY

- A. See Division 01 section for requirements and procedures, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Basis of Design:
 - Manufacturer: Mason Company, Telephone: (800)543-5567, www.masonco.com. Contact: Charlie Sallee, Senior Sales Consultant - West Region, Office: 800-543-5567 Ext. #218; www.masonco.com; csallee@masonco.com.
 - a. K-9 Cabin Double Stacked Systems.
 - b. Ultrabase Above Floor System.
 - c. Luxury Cat Condos (Owner provided, Contractor installed).
 - d. Quiet Cottages Fiberglass Cages.
 - 2. Substitutions: See Division 01 section for requirements and procedures.
- B. Coordination Requirements:
 - 1. Coordinate enclosures with utility connections for drains.

2.02 DOG ENCLOSURES

- A. Freestanding above floor kennels: Mason Ultrabase Above Floor System:
 - 1. Base unit with PVC drain piping.
 - 2. Legs: Steel tubing with adjustable leveling.
 - 3. Resting Bench: FRP surface.
 - 4. Gate: Stainless steel swing gate with feeder bowl.
 - 5. Side Walls: Lower FRP panel 70 inches high with stainless steel mesh upper.
 - 6. Accessories: Poly-metal panel mounted cross door, 29 by 17 inches, with weight-assisted handle and aluminum cable guard.
 - 7. Colors shall be as selected by Architect.
 - 8. Base screen panel: Stainless steel screening panel.
- B. Double stacked systems: Mason K-9 Cabin Double Stacked Systems.
 - 1. Provide units with integral drains.
 - 2. Panels: FRP panels.
 - 3. Gates: Stainless steel gates.
 - Accessories:
 - a. Aluminum drain cover.
 - b. Feeder bowls.
 - 5. Colors shall be as selected by Architect.

2.03 CAT ENCLOSURES

- A. Cat enclosures in guest accessible feline areas: Mason Luxury Cat Condos.
 - 1. Unit will be Owner provided, but contractor installed.
- B. Feline Isolation area enclosures: Mason Quiet Cottages Fiberglass Cages, Models 2 & 6.
 - 1. Gates: Stainless steel swing gates.
 - 2. Provide double stack configured units, 27-13/16 inch wide by 32-1/2 inch deep.
 - 3. Accessories: Swivel type casters.
 - 4. Colors: To be selected by Architect.

2.04 ACCESSORIES

A. Fasteners: Provide all fasterners needed for assembly and securing enclosures to substrates.

PART 3 EXECUTION

3.01 EXECUTION REQUIREMENTS

A. General: Comply with manufacturer's installation instructions and all seismic bracing requirements.

3.02 EXAMINATION

A. Verification of Conditions: Verify that all conditions are acceptable prior to instalation and connection of enclosures.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch vertically or horizontally.

3.05 ADJUSTING

A. Adjust doors and moving parts for smooth operation.

3.06 CLEANING

- A. Clean all surfaces of construction dust and dirt.
- B. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 Closeout Submittals, for closeout submittals.
- B. Demonstrate proper operation of equipment to Owner's designated representative.

3.08 PROTECTION

A. Protect installed kennels from subsequent construction operations.

SECTION 13 21 26 COLD STORAGE ROOMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Owner furnished, Contractor Installed prefabricated insulated cold storage rooms with wall, floor, and ceiling panels.
- B. Door, frame, and hardware.

1.02 RELATED REQUIREMENTS

- A. Section 07 92 00 Joint Sealants: Sealing between cold storage room enclosure and adjacent construction.
- B. Division 26 sections for electrical connections and appurtenances.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants.
- D. PS 1 Structural Plywood.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination with Electrical: Coordinate location and characteristics of electrical service.
- B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- Product Data: Provide data on connection hardware and fixtures, joint details, and other non-Owner-provided items.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- D. Installer's Qualification Statement.
- E. Operation Data: Include operating equipment, service and lubrication schedules.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Wrap and crate finished components and assemblies at factory to prevent damage or marring of surfaces during shipping and handling.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cold Storage Rooms:
 - Onwer supplied items: Mopec: KE301 Morgue Freezer (3 Body).

2.02 COLD STORAGE ROOMS

- A. Cold Storage Rooms: Factory-fabricated packaged units, comprised of modular panels, equipment, and fittings.
 - 1. Exposed components are non-combustible.

2. Walk-in freezer shall be provided by Owner, but installed by Contractor.

2.03 COMPONENTS

- A. Wall Panels:
 - 1. Exterior Sheet: 0.0179 inch (0.455 mm)(26 gauge) minimum thickness, sheet steel.
 - 2. Interior Sheet: 0.0179 inch (0.455 mm)(26 gauge) minimum thickness, sheet steel.
 - 3. Core: Insulation bonded to exterior and interior sheets.
- B. Ceiling Panels: Same construction as walls except exterior sheets of 0.0179 inch (0.455 mm)(26 gauge) minimum thickness, sheet steel.
- C. Floor Panels:
 - 1. Top Sheet: 0.747 inch (1.897 mm)(14 gauge) minimum thickness, steel.
 - 2. Bottom Sheet: 0.0179 inch (0.455 mm)(26 gauge) minimum thickness, steel.
 - Core: 5/8 inch (16 mm) thick plywood laminated between top sheet and insulation; all bonded.
- D. Insulation Thickness: 3 inch (76.2 mm) minimum.
- E. Doors: Overlap type for 48 by 78 inch (1210 by 1980 mm) minimum opening, similar construction of walls with edges closed; 2-1/2 inch (63.5 mm) thick insulation.
- F. Hardware: Forged steel, nylon bearing self closing hinges, roller catch latch and keeper; cylinder lock and inside safety release mechanism.
- G. Door Gaskets: Resilient hollow neoprene; electric heated at freezer doors; organic grease and oil resistant, replaceable and adjustable, concealed magnetic strip to maintain air tight seal.
- H. Shelving and Supports: Stainless steel construction, open rod construction, free standing style.
- I. Light Fixtures: Vapor tight, incandescent with 150 watt lamp, operating toggle switch on exterior wall of room with pilot light, wired in rigid conduit.

2.04 MATERIALS

- A. Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, with AZ55/AZM165 coating; 0.030 inch (0.76 mm) minimum thickness.
- B. Insulation: Polyurethane foamed-in-place, density 2.2 lb/cu ft (61 g/cu m), K factor of 0.12 (ksi factor of 0.02), self extinguishing type.
- C. Accessories: Thresholds, closure plates, ramps, hanger rods, tie down plates, bolts, screws, and washers; non-corrosive.
- D. Plywood: PS 1 Grade C-D sanded, preservative treated for fungus resistance.
- E. Sealant: ASTM C920, elastomeric sealant capable of performing under long-term cold temperature exposure. Refer to Section 07 92 00 for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces, prepared openings, and roughed-in utilities are ready to receive work and opening dimensions are as indicated on drawings.

3.02 INSTALLATION

- A. Assemble and install components in accordance with manufacturer's instructions.
- B. Set floor panels in place and align. Connect to floor drains. Seal joints continuously and lock panels tightly together.
- C. Set wall attachments on floor and anchor securely.
- D. Cut holes, install anchors, and seal room panels for plumbing, power, and lighting.
- E. Assemble wall panels; lock in place with cam locks, and brace securely until ceiling panels are installed.
- F. Install ceiling panels; lock into wall panels. Provide and install supplementary ceiling hanger supports to building structure above.

- G. Install sill plate at door opening.
- H. Hang doors, and adjust to operate smoothly.
- I. Install ceiling trim, ceiling fascia, cover plates between top of room and finished ceiling and end closure plates between room and adjacent wall.
- J. Seal joints and services through walls with sealant to provide moisture and vapor seal.

3.03 FIELD QUALITY CONTROL

- A. Test and adjust control equipment to ensure performance complies with specified requirements.
- B. Operate each room and test full range of functions over a continuous 48 hour period, recording physical data on operating equipment. Continuously record temperature and humidity.
- C. Test each room for air tightness.
- D. Adjust and re-test any rooms not meeting requirements.
- E. Shut off equipment and controls and lock doors to prevent operation or access by unauthorized persons.

3.04 CLEANING

- A. Remove temporary protection from prefinished surfaces.
- B. Wash and clean floor, walls, and ceiling inside room and exposed surfaces on the outside.
- C. Clean fixtures and fittings.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate, in the presence of Owner, the operation, function, and maintenance of each room and its associated equipment.

SECTION 13 31 00 FABRIC STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Custom tensioned fabric structure, including fabric, structural steel supporting members, fittings, and accessories.
- B. Requirements for Design/Build design, permit submission, and construction.

1.02 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASCE 7 Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
- C. ASTM A36/A36M Standard Specification for Carbon Structural Steel.
- D. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- E. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- F. ASTM A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- G. ASTM A572/A572M Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- H. ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
- I. AWS D1.1/D1.1M Structural Welding Code Steel.
- J. SSPC-SP 6 Commercial Blast Cleaning.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Single, State of California-licensed fabric shade structure contractor shall be responsible for the design, wet-stamped engineering drawings, permit submission and acceptance, fabrication, supply, and erection of the work specified herein, including foundations.

1.04 PREINSTALLATION MEETINGS

- A. Pre-installation Meeting: Convene a pre-installation meeting at least two (2) weeks before start of installation of tensioned fabric structure.
 - 1. Require attendance of parties directly effecting work of this section, including Architect, Owner, Contractor, and Tensioned Fabric Installation Superintendent.
 - 2. Review proper handling of fabric, preparation, installation, adjusting, cleaning, and coordination with other work.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Submit manufacturer's product data, including test reports on fabric showing compliance with specified properties.
- C. Shop Drawings: Submit construction drawings including plans, elevations, details, dimensions, support steel sizing, cables and hardware, clamp/corner plates, fittings, fabric, fabric layout seams, and the following:
 - 1. Exact interface geometry determination and definitions.
 - 2. Coordination between fabric and structural supports
 - 3. Interfaces to foundation supports.
 - 4. Design loads used in structural calculations.
 - 5. Foundation reaction loads.

- 6. Stamp or seal of design engineer.
- D. Samples: Submit at least 6 inch by 6 inch (152 mm by 152 mm) sample of fabric and minimum 2 inch by 2 inch (50 mm by 50 mm) sample of powder coating color.
- E. Erection/Stressing Plan: Submit a compressive erection and stressing plan, including drawings and sketches that clearly show the proposed erection procedure for the fabric roof elements, cables, and structural steel during each stage of construction.
- F. Quality Control: Submit outline of manufacturer's Quality Control Program.
- G. Operating and Maintenance Data: Manufacturer's instructions for fabric repair, re-tensioning cables, and cleaning fabric.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm that is capable of assuming complete responsibility for design, engineering, fabrication, delivery, preparation, installation, adjusting, cleaning of structure, and the following:
 - 1. Having minimum of five years experience in design and fabrication of tensioned fabric structures of similar size and complexity to that specified.
 - 2. Employing a licensed professional engineer with minimum of five years experience in tensioned fabric structures using large displacement finite element techniques to perform or supervise the structural design and licensed in the State in which the Project is located.
 - 3. Employing a professional staff and qualified consultants experienced with tensioned fabric structures of similar size and complexity to that specified.
 - 4. Employing integrated CAD and finite element computer software programs to ensure adequacy of design and accurate 3-dimensional computer generated models for fabrication of structure; using CAD system to prepare construction drawings and interface with the plotting and cutting process, ensuring high precision fabric cutting.
 - 5. Providing installation directly supervised by a superintendent, directly employed by contractor, with five years of experience in installation of tensioned fabric structures of similar size and complexity to that specified.
- B. Installer Qualifications: Manufacturer or authorized by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Store materials in accordance with manufacturer's instructions, in a clean, dry, well ventilated area, above ground on blocking, and do not allow materials to become wet, stained, or dirty.
- C. Handle materials so as to protect materials, coatings, and finishes during handling and installation to prevent damage or staining.
 - 1. Handle fabric in accordance with manufacturer's instructions.
 - 2. Use care in handling of fabric to avoid damage to fabric material and coating.
 - 3. Do not damage, crush, or kink cables.

1.08 WARRANTY

- A. See Section 01 78 00 Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's standard ten year fabric warranty.
- C. Provide installer's written one year workmanship warranty.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Basis of Design:
 - Manufacturer: USA Shade & Fabric Structures; Shade Sail custom Design-Built for project.

a. Contact: USA SHADE & Fabric Structures

1085 N. Main Street, Suite C

Orange, CA 92867 Phone: 949-929-8173 Attn: Devin Christensen dchristensen@usa-shade.com

- 2. Basic layout and intent of fabric structures as indicated on Drawings.
- 3. Structures shall consist of (1) 4-Point Hypar Sail Model #CON-MAR-12-20 (1000) with powder coated steel columns with HDPE mesh fabric.
- 4. Structure shall be manufactured by one entity, whose responsibilities include City approved/permitted engineering drawings, fabric roof, steel cables, all fasteners, and erection of structure.
- 5. Fabric:
 - a. UV Shade Fabric:
 - 1) Colourshade® FR UV shade fabric is made of a UV-stabilized, high-density polyethylene (HDPE), as manufactured by Multiknit® (Pty) Ltd. HDPE mesh shall be a heat-stentered, three bar Rachel-knitted, lockstitch fabric with one monofilament and two tape yarns to ensure that the material will not unravel if cut. Raw fabric rolls shall be 9.8425 feet wide.
 - 2) Fabric Properties:
 - (a) ~ Life Expectancy: minimum 8 years with continuous exposure to the sun
 - (b) ~ Fading: minimum fading after 5 years (3 years for Red)
 - (c) ~ Fabric Mass: 5.31 oz/yd2 ~ 5.6 oz/yd2 (180gsm ~ 190gsm)
 - (d) ~ Fabric Width: 9.8425 feet (3m)
 - (e) ~ Roll Length: 164.04 feet (50m)
 - (f) ~ Roll Dimensions: 62.99 inches x 16.5354 inches (160cm x 42cm)
 - (g) ~ Roll Weight: +/- 66 lbs (+/- 30kg)
 - (h) ~ Minimum Temp: -13°F (-25°C)
 - (i) ~ Maximum Temp: +176°F (80°C)
 - 3) Fabric shall meet the following flame spread and fire propagation tests:
 - (a) ASTM E-84
 - (b) NFPA 701 Test Method 2
 - (c) California's Office of the State Fire Marshal, Registered Flame Resistant Product
 - b. Stitching & Thread:
 - 1) All sewing seams are to be double-stitched.
 - 2) The thread shall be GORE® TENARA® mildew-resistant sewing thread, manufactured from 100% expanded PTFE (Teflon™). Thread shall meet or exceed the following:
 - (a) Flexible temperature range
 - (b) Very low shrinkage factor
 - (c) Extremely high strength, durable in outdoor climates
 - (d) Resists flex and abrasion of fabric
 - (e) Unaffected by cleaning agents, acid rain, mildew, salt water, and is unaffected by most industrial pollutants
 - (f) Treated for prolonged exposure to the sun
 - (g) Rot resistant
 - c. Color: As selected by Architect.
- 6. Substitutions: See Division 01 section for requirements and procedures.
- B. Coordination Requirements:
 - 1. Installation of exterior lighting and controls with shade structural supports and foundations.

2.02 MANUFACTURERS

- A. Shade Structure Manfacturers/Fabricators:
 - Basis of Design: USA Shade & Fabric Structures; https://www.usa-shade.com/.

- 2. SoCal Shade Sales: https://shadesails.biz/
- 3. Tension Structures: https://www.tensionstructures.com/
- 4. GotShade: http://www.gotshadenow.com/
- 5. Substitutions: See Division 01 section for requirements and procedures.

2.03 TENSIONED FABRIC STRUCTURES

- A. Tensioned Fabric Structure: Provide a custom tensioned fabric structure consisting of fabric stretched on steel structural supports, with the following characteristics:
 - 1. Capable of withstanding loads specified in ASCE 7 and local building code without damage or failure; for designer's information, project falls under the following design categories:
 - a. Basic Wind Speed: 110 mph (177 km/h).
 - b. Exposure Category: C.
 - c. Importance Factor: 1.0.
 - d. Seismic:
 - 1) Site Soil Class: D Stiff Soil.
 - 2) ASCE 7 results:
 - (a) Ss: 0.599.
 - (b) S1: 0252.
 - (c) Fa: 1.321.
 - (d) Fv: 1.896.
 - (e) Sms: 0.791.
 - (f) Sm1: 0.478
 - (g) Sds: 0.527.
 - (h) Sd1: 0.318.
 - (i) TL: 12
 - (j) PGA: 0.221
 - (k) PGAm: 0.301
 - (I) Fpga: 1.357
 - 2. Capable of maintaining structural integrity in event of a tear propagating in fabric, without endangering occupants.
 - 3. Shape geometry selected for equilibrium based on stress in fabric.
 - 4. Having a smooth uniform fabric surface with even curved edges and interfaces and without wrinkles, cuts, abrasions, stains, marks, surface defects, or seaming aberrations.
 - 5. Configuration as indicated on drawings.
 - 6. Made of prefabricated components ready for installation.

2.04 MATERIALS

- A. Fabric: Per Basis of Design or approved equivalent.
- B. Supporting Steel Members: As specified in Section 05 12 00, unless otherwise specified in this section; steel members are hot-dipped galvanized after fabrication.
 - 1. Structural Steel: ASTM A36/A36M.
 - 2. Structural Pipe: ASTM A53/A53M, Type E or S, Grade B.
 - 3. Structural Tubing: ASTM A500/A500M, Grade C.
 - 4. Plates: ASTM A572/A572M, Grade 50.
 - 5. High-Strength Bolts: ASTM F3125/F3125M.
 - 6. Common Bolts: ASTM A307.
 - 7. Threaded Rod: ASTM A36/A36M.
 - 8. Anchor Bolts, Non-Headed: ASTM A307.
 - 9. Anchor Bolts, Threaded Rod: ASTM A36/A36M.
 - 10. Welding: Perform in accordance with AWS D1.1/D1.1M.
- C. Paint for Structural Steel Members, Tensioning Nuts, and Fabric Plates:
 - 1. Surface Preparation: Commercial blast cleaning complying with SSPC-SP6.
 - 2. Manufacturer's primer and Polyester-TGIC powder coating.
 - 3. Color as selected by Architect.

- Cables and End Fittings: Provide structural cables of same type having same modulus of elasticity.
 - 1. Cables: Stainless steel, Type 304 or 316.
 - 2. Cables in Contact with Fabric: PVC sleeved.
 - 3. Cable Length Tolerance: As indicated on drawings.
 - 4. Swaged and Speltered Fittings: Design and install to develop full breaking strength of cable.
 - 5. Thimble End Fittings: Design and install to develop a minimum of 90 percent of breaking strength of cable.
 - 6. Swaged End Fittings, Pins, Nuts, and Washers: Stainless steel.
 - 7. Tensioning Nuts and Fabric Plates: Galvanized steel, finished with two coats of epoxy paint.
- E. Shackles, Rigging Screws, Clamps, and Tensioning Hardware: Stainless steel architectural finished material only.
- F. Interior Lighting: Pre-drill base plates to allow conduit to be installed and cabling to run inside support steel for mounting lights under canopy.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine area to receive structure; notify Architect if area is not acceptable, and do not begin installation until unacceptable conditions have been corrected.
- B. Examine foundations and anchor bolts for location and elevation; notify Architect of inaccuracies, and do not begin installation until unacceptable conditions have been corrected.

3.02 PREPARATION

- A. Prepare an erection plan for all structural and fabric installation activity, including a detailed sequence of the work.
- B. Prepare a clear, flat, smooth, and clean layout area on ground of sufficient size for assembly of fabric panels; prepare area adjacent to location of structure installation.
- C. Check contact surfaces to remove sharp objects, dirt, grease, oil, and other causes for rips, scratching, or other damage to fabric panels during installation.
- D. Use temporary ground sheets where fabric panels are to be dragged across a surface to prevent chaffing or other damage to fabric panel surface.

3.03 INSTALLATION

- A. Comply with pre-established erection plan.
- B. Do not undertake erection of fabric during inclement weather conditions; installer has sole responsibility to determine when conditions are safe for erection.
- C. Install structure in accordance with manufacturer's instructions at location indicated on drawings.

D. Concrete Foundations:

- 1. Install concrete foundations and anchor bolts as specified in Section 03 30 00 and as indicated on drawings.
- 2. Ensure exposed concrete surfaces are smooth, uniform and clean, with no "bug holes," air voids, or other surface blemishes.
- 3. Ensure concrete has obtained specified minimum compressive strength before erection of support steel.

E. Support Steel:

- 1. Erect support steel as required by design and in accordance with code and as indicated on drawings.
- 2. Erect support steel plumb, level, and square, to correct location and elevation.
- 3. Do not perform field welding without approval of Architect; use experienced welders.

- F. Install structure in necessary sequence and with sufficient bracing to ensure stability throughout installation.
- G. Architect will inspect installed concrete foundations, support steel, cables, and fittings before installation of fabric only to ensure compliance with data submittals.
- H. Install and tension fabric in accordance with manufacturer's instructions.
 - Use care in installation of fabric to avoid damage to base material, coating, and surface treatment.
 - 2. Ensure surfaces of fabric are smooth, uniform, and clean, with even curved edges and interfaces, and with no cuts, scratches, abrasions, stains, marks, blemishes, or welding irregularities.
- Repair or replace defective or damaged materials, coatings, and finishes as directed by Architect.

3.04 ADJUSTING

A. Make final adjustments to structure as required for structural integrity, geometric shape, and free from objectionable wrinkles when viewed from the normally occupied space.

3.05 CLEANING

A. Clean structure in accordance with fabric manufacturer's instructions.

END OF SECTION

SECTION 21 13 13 - WET PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - Pipes, fittings, and specialties.
 - 2. Specialty valves.
 - 3. Sprinklers.
 - 4. Alarm devices.
 - 5. Manual control stations.
 - 6. Control panels.
 - 7. Pressure gauges.

1.3 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet pipe sprinkler system piping designed to operate at a working pressure higher than standard 175 psig, but not higher than 300 psig.
- B. Standard-Pressure Sprinkler Piping: Wet pipe sprinkler system piping designed to operate at a working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories.
- B. Sustainable Design Submittals:
 - Product Data: For adhesives, indicating Volatile Organic Compound (VOC) content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For wet pipe sprinkler systems.
 - 1. Include plans, elevations, sections and attachment and bracing details.
 - 2. Include diagrams for power, signal and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other (where necessary), using input from installers of the items involved:

- 1. Domestic water piping.
- 2. Compressed-air piping.
- 3. HVAC hydronic piping.
- 4. Conduits.
- Structural devices.
- B. Qualification Data: For qualified Installer and/or professional engineer.

C. Design Data:

- 1. Approved Sprinkler Piping Drawings: Working plans, prepared according to National Fire Protection Association Standard No. 13 (NFPA 13), that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable. Hydraulic calculations to be provided by the contractor with a current flow test.
- 2. Water flow test to have been conducted within 12 months of the date of the contractor submittal.
- D. Welding certificates (If required).
- E. Field Test Reports:
 - Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 - 2. Fire hydrant flow test report.
- F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench for each type sprinkler. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to 2010 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.

- C. All grooved 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.
 - 1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Sprinkler system equipment, specialties, accessories, installation and testing shall comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. High-Pressure Piping System Component: Listed for 300-psig working pressure.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and American Society of Civil Engineers/Structural Engineering Institute Standard 7 (ASCE/SEI 7).

2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight Schedule 40, Black-Steel Pipe: American Society of Testing and Materials (ASTM) A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.
- C. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- D. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.
- E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Ductile Iron Unions: UL 860.
- G. Cast Iron Flanges: ASME 16.1, Class 125.
- H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 - Pipe-Flange Gasket Materials: American Water Works Association (AWWA) C110, rubber, flat face. 1/8 inch thick.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

- I. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
 - Welding Filler Metals: Comply with American Welding Society (AWS) D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Pressure Rating: 175-psig minimum.
 - 2. Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
 - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.
- K. Steel Pressure-Seal Fittings: UL 213, Factory Mutual System (FM) Global-approved, 175-psig pressure rating with steel housing, rubber O-rings and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.3 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
 - Standard-Pressure Piping Specialty Valves: 175-psig (1,200-kPa) minimum.
 - 2. High-Pressure Piping Specialty Valves: 300 psig.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
 - 1. Standard: UL 193.
 - 2. Design: For horizontal or vertical installation.
 - 3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, and fill-line attachment with strainer.
 - 4. Drip cup assembly pipe drain with check valve to main drain piping.
 - 5. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Automatic (Ball Drip) Drain Valves:
 - 1. Standard: UL 1726.
 - 2. Pressure Rating: 175-psig minimum.
 - 3. Type: Automatic draining, ball check.
 - 4. Size: National Pipe Standard (NPS) 3/4.
 - 5. End Connections: Threaded.

2.4 AIR VENT

- A. Automatic Air Vent:
 - 1. Description: Automatic air vent that automatically vents trapped air without human intervention
 - 2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.

- 3. Vents oxygen continuously from system.
- 4. Float valve to prevent water discharge.
- 5. Minimum Water Working Pressure Rating: 175 psig.

2.5 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

- Standard: UL 213.
- 2. Pressure Rating: 175psig.
- 3. Body Material: Ductile-iron housing with Ethylene Propylene Diene Monomere (EPDM) seals and bolts and nuts.
- 4. Type: Mechanical-tee and -cross fittings.
- 5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
- 6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
- 7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

- 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- 2. Pressure Rating: 175 psig.
- 3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
- 4. Size: Same as connected piping.
- 5. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

- 1. Standard: UL 199.
- 2. Pressure Rating: 175 psig.
- 3. Body Material: Brass.
- 4. Size: Same as connected piping.
- 5. Inlet: Threaded.
- 6. Drain Outlet: Threaded and capped.
- 7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

- 1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- 2. Pressure Rating: 175 psig.
- 3. Body Material: Cast- or ductile-iron housing with sight glass.
- 4. Size: Same as connected piping.
- 5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

- 1. Standard: UL 1474.
- 2. Pressure Rating: 175 psig.
- 3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
- 4. Size: Same as connected piping.
- 5. Length: Adjustable.
- 6. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

- 1. Standard: UL 1474.
- 2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
- 3. Pressure Rating: 175 psig.
- 4. Size: Same as connected piping, for sprinkler.

2.6 SPRINKLERS

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- C. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.
- D. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Early-Suppression, Fast-Response Applications: UL 1767
 - 2. Nonresidential Applications: UL 199
 - 3. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- E. Sprinkler Finishes: As requested / approved by owner / architect.
- F. Special Coatings: corrosion-resistant paint.
- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: As requested / approved by owner / architect.
 - 2. Sidewall Mounting: As requested / approved by owner / architect.
- H. Sprinkler Guards:
 - 1. Standard: UL 199.
 - 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Notification Appliances:
 - 1. Electric Bell:
 - a. Standard: UL 464.
 - b. Type: Vibrating, metal alarm bell.
 - c. Size: 6-inch minimum diameter.
 - d. Voltage: 24 V dc.
 - e. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.
- C. Water-Flow Indicators:
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 4. Type: Paddle operated.
 - 5. Pressure Rating: 250 psig.
 - 6. Design Installation: Horizontal or vertical.
- D. Pressure Switches:

- 1. Standard: UL 346.
- 2. Type: Electrically supervised water-flow switch with retard feature.
- 3. Components: Single-pole, double-throw switch with normally closed contacts.
- 4. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

- Standard: UL 346.
- 2. Type: Electrically supervised.
- 3. Components: Single-pole, double-throw switch with normally closed contacts.
- 4. Design: Signals that controlled valve is in other than fully open position.
- 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 PRESSURE GAUGES

- A. Standard: UL 393.
- B. Dial Size: 3½- to 4½-inch diameter.
- C. Pressure Gauge Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 WATER-SUPPLY CONNECTIONS

A. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for outside underground piping connections.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2½ and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install alarm devices in piping systems.
- J. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- K. Install pressure gauges on riser or feed main, at each sprinkler test connection Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they are not subject to freezing.
- L. Fill sprinkler system piping with water.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves.
- N. Install sleeve seals for piping penetrations of concrete walls and slabs.
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2½ and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt and debris from inside and outside of pipes, tubes and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
 - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection, where necessary.

E. Air Vent:

- 1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
- 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of 2 ft x 2 ft acoustical ceiling panels, and along quarter-point centered locations of 2 ft x 4 ft acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and with the assistance of a factory-authorized service representative as-required:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire alarm tests. Operate as required.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain sprinkler system and pressure-maintenance pumps.

3.11 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
 - 3. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 - 4. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2½ and larger, shall be one of the following:
 - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
 - 2. Standard-weight, black-steel pipe with cut-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

3.12 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
 - 5. Special Applications: Extended-coverage, flow-control, Attic sprinklers, Combustible concealed sprinklers and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Concealed Sprinklers: As indicated on drawings or as approved by Architect or owner.
 - 2. Flush Sprinklers: As indicated on drawings or as approved by Architect or owner.
 - 3. Recessed Sprinklers: As indicated on drawings or as approved by Architect or owner.
 - 4. Upright, Pendent and Sidewall Sprinklers: As indicated on drawings or as approved by Architect or owner.

3.13 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative (if required):
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.14 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.15 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and control panels (if applicable).

END OF SECTION

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SECTION 220523 - GENERAL DUTY VALVES

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Bronze angle valves.
 - 2. Cast-iron angle valves.
 - 3. Copper-alloy ball valves.
 - 4. Ferrous-alloy ball valves.
 - 5. Ferrous-alloy butterfly valves.
 - 6. Bronze check valves.
 - 7. Gray-iron swing check valves.
 - 8. Ferrous-alloy wafer check valves.
 - 9. Spring-loaded, lift-disc check valves.
 - 10. Bronze gate valves.
 - 11. Bronze globe valves.
 - 12. Cast-iron plug valves.
 - 13. Resilient-seated, cast-iron, eccentric plug valves.
- B. Related Sections include the following:
 - 1. Division 22 piping Sections for general-duty and specialty valves for site construction piping.
 - 2. Division 22 Section "Mechanical Identification" for valve tags and charts.
 - 3. Division 23 Section "HVAC Instrumentation and Controls" for control valves and actuators.
 - 4. Division 22 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

- A. The following are standard abbreviations for valves:
 - 1. CWP: Cold working pressure.
 - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 3. NBR: Acrylonitrile-butadiene rubber.
 - 4. PTFE: Polytetrafluoroethylene plastic.
 - 5. SWP: Steam working pressure.
 - 6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.1 for power piping valves and ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water, sanitary waste, and storm drainage piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
 - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
 - 2. Gear Drive: For quarter-turn valves NPS 8 and larger.
 - 3. Handwheel: For valves other than quarter-turn types.
 - 4. Lever Handle: For guarter-turn valves NPS 6 and smaller, except plug valves.
 - 5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- I. Valve Grooved Ends: AWWA C606.
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
 - 2. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type 1, Bronze Angle Valves with Metal Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Stockham Div.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Red-White Valve Corp.

Or approved equal

- 2. Type 2, Bronze Angle Valves with Nonmetallic Disc:
 - a. American Valve, Inc.
 - b. Cincinnati Valve Co.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Div.
 - f. Grinnell Corporation.
 - g. Hammond Valve.
 - h. NIBCO INC.
 - i. Powell, Wm. Co.

Or approved equal

- 3. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.

Or approved equal

- C. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- D. Type 1, Class 125, Bronze Angle Valves: Bronze body with bronze disc.
- E. Type 1, Class 150, Bronze Angle Valves: Bronze body with bronze disc.
- F. Type 1, Class 200, Bronze Angle Valves: Bronze body with bronze disc.
- G. Type 2, Class 125, Bronze Angle Valves: Bronze body with Stainless steel disc.

- H. Type 2, Class 150, Bronze Angle Valves: Bronze body with Stainless steel disc.
- I. Type 2, Class 200, Bronze Angle Valves: Bronze body with Stainless steel disc.
- Type 3, Class 125, Bronze Angle Valves: Bronze body with bronze disc and renewable seat.
- K. Type 3, Class 150, Bronze Angle Valves: Bronze body with bronze disc and renewable seat.
- L. Type 3, Class 200, Bronze Angle Valves: Bronze body with bronze disc and renewable seat.

2.4 CAST-IRON ANGLE VALVES

- A. Available Manufacturers:
 - 1. Type II, Cast-Iron Angle Valves with Metal Seats:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Div.
 - d. NIBCO INC.
 Or approved equal
- B. Cast-Iron Angle Valves, General: MSS SP-85, Type II.
- Class 125, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.
- D. Class 250, Cast-Iron Angle Valves: Bronze mounted with gray-iron body and bronze seats.

2.5 COPPER-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. One-Piece, Copper-Alloy Ball Valves:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. DynaQuip Controls.
 - f. Grinnell Corporation.
 - g. Jamesbury, Inc.
 - h. Kitz Corporation of America.
 - i. Legend Valve & Fitting, Inc.
 - j. NIBCO INC.
 - k. Watts Industries, Inc.; Water Products Div.

Or approved equal

- 2. Two-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. DynaQuip Controls.
 - f. Flow-Tek, Inc.
 - g. Grinnell Corporation.
 - h. Hammond Valve.
 - i. Honeywell Braukmann.
 - j. Jamesbury, Inc.
 - k. Jomar International, LTD.
 - I. Kitz Corporation of America.
 - m. Legend Valve & Fitting, Inc.
 - n. Milwaukee Valve Company.
 - o. Nexus Valve Specialties.
 - p. NIBCO INC.
 - q. R & M Energy Systems (Borger, TX).
 - r. Red-White Valve Corp.
 - s. Richards Industries; Marwin Ball Valves.
 - t. Watts Industries, Inc.; Water Products Div

Or approved equal

- 3. Three-Piece, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. DynaQuip Controls.
 - c. Grinnell Corporation.
 - d. Hammond Valve.
 - e. Jamesbury, Inc.
 - f. Kitz Corporation of America.
 - g. NIBCO INC.
 - h. PBM, Inc.
 - i. Red-White Valve Corp.
 - j. Worcester Controls.
 - Or approved equal
- 4. Safety-Exhaust, Copper-Alloy Ball Valves:
 - a. Conbraco Industries, Inc.; Apollo Div.
 - b. DynaQuip Controls.
 - c. Grinnell Corporation.
 - d. Hammond Valve.
 - e. Jamesbury, Inc.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - Or approved equal
- C. Copper-Alloy Ball Valves, General: MSS SP-110.

- D. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, and 400-psig minimum CWP rating.
- E. Two-Piece, Copper-Alloy Ball Valves: Brass or bronze body with regular-port, chromeplated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowoutproof stem.
- F. Three-Piece, Copper-Alloy Ball Valves: Brass or bronze body with full regular-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
- G. Safety-Exhaust, Copper-Alloy Ball Valves: Two-piece bronze body with exhaust vent opening, chrome-plated ball with vent, blowout-proof stem, locking handle, and working pressure rating.

2.6 FERROUS-ALLOY BALL VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. American Valve, Inc.
 - 2. Conbraco Industries, Inc.; Apollo Div.
 - 3. Cooper Cameron Corp.; Cooper Cameron Valves Div.
 - 4. Crane Co.; Crane Valve Group; Stockham Div.
 - 5. Flow-Tek, Inc.
 - 6. Foster Valve Co.
 - 7. Hammond Valve.
 - 8. Jamesbury, Inc.
 - 9. Jomar International, LTD.
 - 10. Kitz Corporation of America.
 - 11. KTM Products, Inc.
 - 12. McCANNA, Incorporated.
 - 13. Milwaukee Valve Company.
 - 14. NIBCO INC.
 - 15. PBM, Inc.
 - 16. Richards Industries; Marwin Ball Valves.
 - 17. Worcester Controls.
 OR APPROVED EQUAL
- C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.
- D. Ferrous-Alloy Ball Valves: Class 150, full or regular port.
- E. Ferrous-Alloy Ball Valves: Class 300, full or regular port.

2.7 FERROUS-ALLOY BUTTERFLY VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Flangeless, Ferrous-Alloy Butterfly Valves:

- a. American Valve, Inc.
- b. Bray International, Inc.
- c. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- d. Crane Co.; Crane Valve Group; Center Line.
- e. Crane Co.; Crane Valve Group; Stockham Div.
- f. Dover Corp.; Dover Resources Company; Norriseal Div.
- g. General Signal; DeZurik Unit.
- h. Grinnell Corporation.
- i. Hammond Valve.
- j. Kitz Corporation of America.
- k. Legend Valve & Fitting, Inc.
- I. Metraflex Co.
- m. Milwaukee Valve Company.
- n. Mueller Steam Specialty.
- o. NIBCO INC.
- p. Process Development & Control.
- q. Red-White Valve Corp.
- r. Techno Corp.
- s. Tyco International, Ltd.; Tyco Valves & Controls.
- t. Watts Industries, Inc.; Water Products Div.

OR APPROVED EQUAL

2. Single-Flange, Ferrous-Alloy Butterfly Valves:

- a. American Valve, Inc.
- b. Bray International, Inc.
- c. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- d. Crane Co.; Crane Valve Group; Center Line.
- e. Crane Co.; Crane Valve Group; Jenkins Valves.
- f. Crane Co.; Crane Valve Group; Stockham Div.
- g. Dover Corp.; Dover Resources Company; Norriseal Div.
- h. General Signal; DeZurik Unit.
- i. Grinnell Corporation.
- j. Hammond Valve.
- k. Kitz Corporation of America.
- I. Legend Valve & Fitting, Inc.
- m. Metraflex Co.
- n. Milwaukee Valve Company.
- o. Mueller Steam Specialty.
- p. NIBCO INC.
- q. Process Development & Control.
- r. Red-White Valve Corp.
- s. Techno Corp.
- t. Tyco International, Ltd.; Tyco Valves & Controls.
- u. Watts Industries, Inc.; Water Products Div.

Or approved equal

3. Flanged, Ferrous-Alloy Butterfly Valves:

- a. Bray International, Inc.
- b. Cooper Cameron Corp.; Cooper Cameron Valves Div.
- c. Grinnell Corporation.
- d. Mueller Steam Specialty.

- e. Tyco International, Ltd.; Tyco Valves & Controls. Or approved equal
- 4. Grooved-End, Ductile-Iron Butterfly Valves:
 - a. Central Sprinkler Co.; Central Grooved Piping Products.
 - b. Grinnell Corporation.
 - c. Hammond Valve.
 - d. McWane, Inc.; Kennedy Valve Div.
 - e. Milwaukee Valve Company.
 - f. Mueller Steam Specialty.
 - g. NIBCO INC.
 - h. Victaulic Co. of America.
 Or approved equal
- C. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
- D. Flangeless, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem.
- E. Flangeless, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem.
- F. Flangeless, 200-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem.
- G. Flangeless, 250-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one one- or two-piece stem.
- H. Flangeless, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem.
- I. Single-Flange, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- J. Single-Flange, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- K. Single-Flange, 200-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- L. Single-Flange, 250-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- M. Single-Flange, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer-lug type with one- or two-piece stem.
- N. Flanged, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.
- O. Flanged, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.

- P. Flanged, 200-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.
- Q. Flanged, 250-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.
- R. Flanged, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one- or two-piece stem.
- S. Grooved-End, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.
- T. Grooved-End, 300-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.

2.8 HIGH-PRESSURE BUTTERFLY VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Bray International, Inc.
 - 2. Cooper Cameron Corp.; Cooper Cameron Valves Div.
 - 3. Crane Co.; Crane Valve Group; Flowseal.
 - 4. General Signal; DeZurik Unit.
 - 5. Grinnell Corporation.
 - 6. Jamesbury, Inc.
 - 7. Pratt, Henry Company.
 - 8. Process Development & Control.
 - 9. Tyco International, Ltd.; Tyco Valves & Controls.
 - Xomox Corporation. Or approved equal
- C. High-Pressure Butterfly Valves, General: MSS SP-68.
- D. Flangeless, Class 150, High-Pressure Butterfly Valves: Wafer type.
- E. Single-Flange, Class 150, High-Pressure Butterfly Valves: Wafer type.
- F. Flangeless, Class 300, High-Pressure Butterfly Valves: Wafer-lug type.
- G. Single-Flange, Class 300, High-Pressure Butterfly Valves: Wafer-lug type.

2.9 BRONZE CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.

- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. Red-White Valve Corp.
- e. Walworth Co.
 Or approved equal
- 2. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Walworth Co.
 Or approved equal
- 3. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Red-White Valve Corp. Or approved equal
- 4. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:
 - a. Grinnell Corporation.
 - b. Kitz Corporation of America.
 - c. Milwaukee Valve Company.
 Or approved equal
- 5. Type 3, Bronze, Swing Check Valves with Metal Disc:
 - a. American Valve, Inc.
 - b. Cincinnati Valve Co.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Div.
 - f. Grinnell Corporation.
 - g. Hammond Valve.
 - h. Kitz Corporation of America.
 - i. Legend Valve & Fitting, Inc.
 - j. Milwaukee Valve Company.
 - k. NIBCO INC.
 - I. Powell, Wm. Co.
 - m. Red-White Valve Corp.
 - n. Walworth Co.
 - o. Watts Industries, Inc.; Water Products Div.
 Or approved equal
- 6. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.

- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. McWane, Inc.; Kennedy Valve Div.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Red-White Valve Corp.
- k. Walworth Co.
- I. Watts Industries, Inc.; Water Products Div. Or approved equal
- C. Bronze Check Valves, General: MSS SP-80.
- Type 1, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
- E. Type 1, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.
- F. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
- G. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat
- H. Type 1, Class 200, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
- Type 1, Class 200, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.
- J. Type 2, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- K. Type 2, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- L. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- M. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- N. Type 2, Class 200, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- O. Type 2, Class 200, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
- P. Type 3, Class 125, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.
- Q. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.

- R. Type 3, Class 200, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.
- S. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
- T. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
- U. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.10 GRAY-IRON SWING CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type I, Gray-Iron Swing Check Valves with Metal Seats:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Flomatic Valves.
 - f. Grinnell Corporation.
 - g. Hammond Valve.
 - h. Kitz Corporation of America.
 - i. Legend Valve & Fitting, Inc.
 - j. Milwaukee Valve Company.
 - k. Mueller Co.
 - NIBCO INC.
 - m. Powell, Wm. Co.
 - n. Red-White Valve Corp.
 - o. Walworth Co.
 - p. Watts Industries, Inc.; Water Products Div. Or approved equal
 - 2. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Div.
 - c. Mueller Co.
 - d. Watts Industries, Inc.; Water Products Div. Or approved equal
 - 3. Grooved-End, Ductile-Iron Swing Check Valves:
 - a. Grinnell Corporation.
 - b. Mueller Co.
 - c. Victaulic Co. of America. Or approved equal
- C. Gray-Iron Swing Check Valves, General: MSS SP-71.

- D. Type I, Class 125, gray-iron, swing check valves with metal seats.
- E. Type I, Class 250, gray-iron, swing check valves with metal seats.
- F. Type II, Class 125, gray-iron, swing check valves with composition to metal seats.
- G. Type II, Class 250, gray-iron, swing check valves with composition to metal seats.
- H. 175-psig CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.
- 300-psig CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.11 FERROUS-ALLOY WAFER CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Single-Plate, Ferrous-Alloy, Wafer Check Valves:
 - a. Gestra, Inc.
 - b. McWane, Inc.; Kennedy Valve Div.
 - c. Mueller Co.
 - d. Techno Corp.
 - e. Tyco International, Ltd.; Tyco Valves & Controls.
 - f. Wheatley Gaso, Inc.
 Or approved equal
 - 2. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Div.
 - c. Flomatic Valves.
 - d. Gestra, Inc.
 - e. Grinnell Corporation.
 - f. Gulf Valve Co.
 - g. Metraflex Co.
 - h. Mueller Steam Specialty.
 - i. NIBCO INC.
 - j. Red-White Valve Corp.
 - k. SSI Equipment, Inc.
 - I. Techno Corp.
 - m. Val-Matic Valve & Mfg. Corp.
 - n. Valve and Primer Corp.
 - o. Watts Industries, Inc.; Water Products Div.
 Or approved equal
 - 3. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Gulf Valve Co.

- c. Valve and Primer Corp.
 Or approved equal
- 4. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Gulf Valve Co.
 - c. Techno Corp.
 Or approved equal
- C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
- D. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
- E. Single-Plate, Class 250 or 300, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
- F. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
- G. Single-Plate, Class 250 or 300, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
- H. Single-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
- I. Single-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
- J. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
- K. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
- L. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
- M. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
- N. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
- O. Dual-Plate, Class 250 or 300, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.

2.12 SPRING-LOADED, LIFT-DISC CHECK VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type I, Wafer Lift-Disc Check Valves:
 - a. Mueller Steam Specialty.

Or approved equal

- 2. Type II, Compact-Wafer, Lift-Disc Check Valves:
 - a. Durabla Fluid Technology, Inc.
 - b. Flomatic Valves.
 - c. GA Industries, Inc.
 - d. Grinnell Corporation.
 - e. Hammond Valve.
 - f. Metraflex Co.
 - g. Milwaukee Valve Company.
 - h. Mueller Steam Specialty.
 - i. Multiplex Manufacturing Co.
 - j. NIBCO INC.
 - k. SSI Equipment, Inc.
 - I. Val-Matic Valve & Mfg. Corp.
 - m. Valve and Primer Corp.
 Or approved equal
- 3. Type III, Globe Lift-Disc Check Valves:
 - a. Durabla Fluid Technology, Inc.
 - b. Flomatic Valves.
 - c. GA Industries. Inc.
 - d. Grinnell Corporation.
 - e. Hammond Valve.
 - f. Metraflex Co.
 - g. Milwaukee Valve Company.
 - h. Multiplex Manufacturing Co.
 - i. NIBCO INC.
 - j. SSI Equipment, Inc.
 - k. Val-Matic Valve & Mfg. Corp.
 - I. Valve and Primer Corp.
 Or approved equal
- 4. Type IV, Threaded Lift-Disc Check Valves:
 - a. Check-All Valve Mfg. Co.
 - b. Durabla Fluid Technology, Inc.
 - c. Grinnell Corporation.
 - d. Legend Valve & Fitting, Inc.
 - e. Metraflex Co.
 - f. Milwaukee Valve Company.
 - g. Mueller Steam Specialty.
 - h. NIBCO INC.
 - i. Watts Industries, Inc.; Water Products Div.
 Or approved equal
- C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
- D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.

- E. Type I, Class 250, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
- F. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- G. Type II, Class 250, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.
- H. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
- I. Type III, Class 250, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
- J. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.
- K. Type IV, Class 150, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.13 BRONZE GATE VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type 1, Bronze, Nonrising-Stem Gate Valves:
 - a. American Valve, Inc.
 - b. Cincinnati Valve Co.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Div.
 - f. Grinnell Corporation.
 - g. Hammond Valve.
 - h. Kitz Corporation of America.
 - i. Legend Valve & Fitting, Inc.
 - j. Milwaukee Valve Company.
 - k. NIBCO INC.
 - I. Powell, Wm. Co.
 - m. Red-White Valve Corp.
 - n. Walworth Co.
 - o. Watts Industries, Inc.; Water Products Div. Or approved equal
 - 2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
 - a. American Valve, Inc.
 - b. Cincinnati Valve Co.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.

- e. Crane Co.; Crane Valve Group; Stockham Div.
- f. Grinnell Corporation.
- g. Hammond Valve.
- h. Kitz Corporation of America.
- i. Milwaukee Valve Company.
- j. NIBCO INC.
- k. Powell, Wm. Co.
- I. Red-White Valve Corp.
- m. Walworth Co.

Or approved equal

- 3. Type 3, Bronze, Rising-Stem, Split-Wedge Gate Valves:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Grinnell Corporation.
 - d. NIBCO INC.

Or approved equal

- C. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- D. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge.
- E. Type 1, Class 150, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge.
- F. Type 1, Class 200, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge.
- G. Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge.
- H. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge.
- I. Type 2, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge.
- J. Type 3, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge.
- K. Type 3, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge.
- L. Type 3, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge.

2.14 CAST-IRON GATE VALVES

A. Available Manufacturers:

B. Manufacturers:

- 1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.
 - g. Kitz Corporation of America.
 - h. Legend Valve & Fitting, Inc.
 - i. Milwaukee Valve Company.
 - NIBCO INC.
 - k. Powell, Wm. Co.
 - I. Red-White Valve Corp.
 - m. Walworth Co.
 - n. Watts Industries, Inc.; Water Products Div. Or approved equal
- 2. Type I, Cast-Iron, Rising-Stem Gate Valves:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.
 - g. Kitz Corporation of America.
 - h. Legend Valve & Fitting, Inc.
 - i. Milwaukee Valve Company.
 - j. NIBCO INC.
 - k. Powell, Wm. Co.
 - I. Red-White Valve Corp.
 - m. Walworth Co.
 - n. Watts Industries, Inc.; Water Products Div.
 Or approved equal
- C. Cast-Iron Gate Valves, General: MSS SP-70, Type I.
- D. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
- E. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
- F. Class 125, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, nonrising stem, and solid-wedge disc.
- G. Class 125, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, rising stem, and solid-wedge disc.

- H. Class 250, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
- I. Class 250, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
- J. Class 250, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, nonrising stem, and solid-wedge disc.
- K. Class 250, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, rising stem, and solid-wedge disc.

2.15 BRONZE GLOBE VALVES

- A. Available Manufacturers:
 - 1. Type 1, Bronze Globe Valves with Metal Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.
 - g. Kitz Corporation of America.
 - h. Legend Valve & Fitting, Inc.
 - i. Milwaukee Valve Company.
 - j. NIBCO INC.
 - k. Powell, Wm. Co.
 - I. Red-White Valve Corp.
 - m. Walworth Co.
 - Or approved equal
 - 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.
 - e. Grinnell Corporation.
 - f. Hammond Valve.
 - g. Kitz Corporation of America.
 - h. McWane, Inc.; Kennedy Valve Div.
 - i. Milwaukee Valve Company.
 - j. NIBCO INC.
 - k. Powell, Wm. Co.
 - I. Red-White Valve Corp.
 - m. Walworth Co.
 - Or approved equal
 - 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Div.
- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Walworth Co.

Or approved equal

- B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.
- C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.
- D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.
- E. Type 1, Class 200, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.
- F. Type 2, Class 125, Bronze Globe Valves: Bronze body with nonmetallic PTFE or TFE disc and union-ring bonnet.
- G. Type 2, Class 150, Bronze Globe Valves: Bronze body with nonmetallic PTFE or TFE disc and union-ring bonnet.
- H. Type 2, Class 200, Bronze Globe Valves: Bronze body with nonmetallic disc and union-ring bonnet.
- I. Type 3, Class 125, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.
- J. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.
- K. Type 3, Class 200, Bronze Globe Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet.

2.16 CAST-IRON GLOBE VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Type I, Cast-Iron Globe Valves with Metal Seats:
 - a. Cincinnati Valve Co.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Crane Co.; Crane Valve Group; Jenkins Valves.
 - d. Crane Co.; Crane Valve Group; Stockham Div.

- e. Grinnell Corporation.
- f. Hammond Valve.
- g. Kitz Corporation of America.
- h. Milwaukee Valve Company.
- i. NIBCO INC.
- j. Powell, Wm. Co.
- k. Red-White Valve Corp.
- I. Walworth Co.

Or approved equal

- C. Cast-Iron Globe Valves, General: MSS SP-85.
- D. Type I, Class 125, Cast-Iron Globe Valves: Gray-iron body with bronze seats.
- E. Type I, Class 250, Cast-Iron Globe Valves: Gray-iron body with bronze seats.

2.17 CAST-IRON PLUG VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Lubricated-Type, Cast-Iron Plug Valves:
 - a. Milliken Valve Co., Inc.
 - b. Nordstrom Valves, Inc.
 - c. Olson Technologies; Homestead Div.
 - d. R & M Energy Systems (Tomball, TX).
 - e. Walworth Co.

Or approved equal

- 2. Nonlubricated-Type, Cast-Iron Plug Valves:
 - a. General Signal; DeZurik Unit.
 - b. Grinnell Corporation.
 - c. Mueller Flow Technologies.
 - d. Tyco International, Ltd.; Tyco Valves & Controls.
 - e. Wheatley Gaso, Inc.
 - f. Xomox Corporation.

Or approved equal

- C. Cast-Iron Plug Valves, General: MSS SP-78.
- D. Class 125 or 150, lubricated-type, cast-iron plug valves.
- E. Class 250 or 300, lubricated-type, cast-iron plug valves.
- F. Class 125 or 150, nonlubricated-type, cast-iron plug valves.
- G. Class 250, nonlubricated-type, cast-iron plug valves.

2.18 RESILIENT-SEATED, CAST-IRON, ECCENTRIC PLUG VALVES

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. General Signal; DeZurik Unit.
 - 2. Milliken Valve Company.
 - 3. Olson Technologies; Homestead Div.
 - 4. Pratt, Henry Company.
 - 5. Val-Matic Valve & Mfg. Corp.
 - 6. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

Or approved equal

- C. Resilient-Seated, Cast-Iron, Eccentric Plug Valves, NPS 3 and Larger: MSS SP-108, and rated for 175-psig minimum CWP.
 - 1. Resilient Seating Material: Suitable for potable-water service, unless otherwise indicated.

2.19 CHAINWHEEL ACTUATORS

- A. Available Manufacturers:
- B. Manufacturers:
 - 1. Babbitt Steam Specialty Co.
 - 2. Roto Hammer Industries, Inc.
- C. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.
 - 2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 3. Chain: Stainless steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, gate, or plug valves.
 - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
 - 3. Pump Discharge: Spring-loaded, lift-disc check valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Chilled-Water Piping: Use the following types of valves:
 - 1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
 - 3. Ball Valves, NPS 2 and Smaller: One-piece, 400-psig CWP rating, copper alloy.
 - 4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
 - 5. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
 - 6. High-Pressure Butterfly Valves, NPS 3 and Larger: Single-flange, Class 150.
 - 7. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating
 - 8. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
 - 9. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
 - 10. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
 - 11. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
 - 12. Wafer Check Valves, NPS 2-1/2 and Larger: Single-plate, , Class 125 or 150 ferrous alloy.
 - 13. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
 - 14. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type 11 or II, Class 125, cast iron.
 - 15. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 16. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron
 - 17. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 18. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron
 - 19. Plug Valves, NPS 2 and Larger: Class 125 or 150, lubricated-type, cast iron.

- 20. Resilient-Seated, Eccentric Plug Valves, NPS 3 and Larger: 175-psig CWP rating, cast iron.
- D. Low-Pressure, Compressed-Air Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
 - 2. Equipment-Isolation Ball Valves, NPS 2 and Smaller: Safety-exhaust, bronze.
 - 3. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
 - 4. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous allov, with liner.
 - 5. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
 - 6. High-Pressure Butterfly Valves, NPS 3 and Larger: Single-flange, Class 150.
 - 7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
 - 8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
 - 9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
 - 10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
 - 11. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 125, cast iron.
 - 12. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 13. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron.
 - 14. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 15. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.
- E. Medium-Pressure, Compressed-Air Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 and Smaller: One-piece, 400-psig CWP rating, copper alloy.
 - 2. Equipment-Isolation Ball Valves, NPS 2 and Smaller: Safety-exhaust, bronze.
 - 3. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
 - 4. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig 200-psig CWP rating, ferrous alloy, with NBR liner.
 - 5. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
 - 6. High-Pressure Butterfly Valves, NPS 3 and Larger: Single-flange, Class 150.
 - 7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
 - 8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
 - 9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
 - 10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
 - 11. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
 - 12. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 125, cast iron.
 - 13. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 14. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron.
 - 15. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 16. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

F. Condenser Water Piping: Use the following types of valves:

- 1. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
- 2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
- 3. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
- 4. High-Pressure Butterfly Valves, NPS 3 and Larger: Single-flange, Class 150.
- 5. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
- Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
- 7. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
- 8. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
- 9. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
- 10. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
- 11. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 125, cast iron.
- 12. Gate Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
- 13. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron.
- 14. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
- 15. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.
- 16. Plug Valves, NPS 2 and Larger: Class 125 or 150, lubricated-type, cast iron.
- 17. Resilient-Seated, Eccentric Plug Valves, NPS 3 and Larger: 175-psig CWP rating, cast iron.

G. Domestic Water Piping: Use the following types of valves:

- 1. Angle Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
- 2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 125, cast iron.
- 3. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
- 4. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
- 5. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 150-psig CWP rating, ferrous alloy, with EPDM liner.
- 6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating
- 7. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
- 8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
- Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
- 10. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.
- 11. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
- 12. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 125. cast iron.
- 13. Gate Valves, NPS 2 and Smaller: Type 1, Class 150, bronze.
- 14. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron.
- 15. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
- 16. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.

- 17. Plug Valves, NPS 2 and Larger: Class 125 or 150, lubricated-type with FDA-approved-material sealant, cast iron.
- 18. Resilient-Seated, Eccentric Plug Valves, NPS 3 and Larger: 175-psig CWP rating, cast iron.
- H. Heating Water Piping: Use the following types of valves:
 - 1. Angle Valves, NPS 2 and Smaller: Type 2, Class 200, bronze.
 - 2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 250, cast iron.
 - 3. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
 - 4. Ball Valves, NPS 2-1/2 and Larger: Class 300, ferrous alloy.
 - 5. Butterfly Valves, NPS 2-1/2 and Larger: Flanged, 300-psig CWP rating, ferrous alloy, with EPDM liner.
 - 6. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
 - Lift Check Valves, NPS 2 and Smaller: Type 2, Class 200, horizontal vertical, bronze.
 - 8. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
 - 9. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
 - Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 300-psig CWP rating.
 - 11. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 200.
 - 12. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 and Larger: Type I or II, Class 250, cast iron.
 - 13. Gate Valves, NPS 2 and Smaller: Type 2, Class 200, bronze.
 - 14. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, , bronze-mounted cast iron.
 - 15. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
 - 16. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 250, bronze-mounted cast iron.
 - 17. Plug Valves, NPS 2 and Larger: Class 250 or 300, lubricated nonlubricated-type, cast iron.
 - 18. Resilient-Seated, Eccentric Plug Valves, NPS 3 and Larger: 175-psig CWP rating, cast iron.
- I. Sanitary Waste Piping: Use the following types of valves:
 - 1. Ball Valves, NPS 2 and Smaller: Two-piece, 400-psig CWP rating, copper alloy.
 - 2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
 - 3. Swing Check Valves, NPS 2 and Smaller: Type 3, Class 125, bronze.
 - 4. Swing Check Valves, NPS 2-1/2 and Larger: Type I, Class 125, gray iron.
 - 5. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psig minimum CWP rating.
 - 6. Gate Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
 - 7. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, , bronze-mounted cast iron
 - 8. Globe Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
 - 9. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, cast iron.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 22 & 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
- B. Related Sections include the following:
 - 1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP 90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- C. Design seismic restraint hangers and supports for piping and equipment.
- D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of pipe hanger, channel support system component and thermal hanger shield insert indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.
- C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.6 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and trapeze by a qualified professional engineer.
- C. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
- D. 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 hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - I. Piping Technology & Products, Inc.

Or approved equal

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- 2. Channel Support Systems:
 - a. B Line Systems, Inc.
 - b. Grinnell Corp.; Power Strut Unit.
 - c. GS Metals Corp.
 - d. Michigan Hanger Co., Inc.; O Strut Div.
 - e. National Pipe Hanger Corp.
 - f. Thomas & Betts Corp.
 - g. Unistrut Corp.
 - h. Wesanco, Inc.

Or approved equal

- 3. Thermal Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.

Or approved equal

- 4. Powder Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.

Or approved equal

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP 58, factory fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
 - 3. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 - 4. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal Hanger Shield Inserts: 100 psi (690 kPa) minimum compressive strength insulation, encased in sheet metal shield.
 - 1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
 - 3. Material for Cold Piping: Water repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
 - 4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water repellent treated, ASTM C 533, Type I calcium silicate.
 - 5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
 - 6. Material for Hot Piping: Water repellent treated, ASTM C 533, Type I calcium silicate.
 - 7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
 - 8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
 - 9. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

- A. Powder Actuated Drive Pin Fasteners: Powder actuated type; drive pin attachments with pull out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical Anchor Fasteners: Insert type attachments with pull out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

- Grout: ASTM C 1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic cement grout.
 - 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 - 2. Properties: Non-staining, non-corrosive, and nongaseous.
 - 3. Design Mix: 5000 psi (34.5 MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP 69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
 - 2. Yoke Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
 - 3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off center closure for hanger installation before pipe erection.
 - 6. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
 - 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
 - 9. Adjustable Swivel Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).

- 10. Split Pipe Ring with or without Turnbuckle Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
- 11. Extension Hinged or Two Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
- U Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
- Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast iron floor flange and with U bolt to retain pipe.
- 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion type support for pipes, NPS 2 1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast iron floor flange.
- 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
- Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2 1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
- Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
 - 2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

- E. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top Beam C Clamps (MSS Type 19): For use under roof installations with bar joist construction to attach to top flange of structural shape.
 - 3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C Clamps (MSS Type 23): For structural shapes.
 - 7. Top Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side Beam Clamps (MSS Type 27): For bottom of steel I beams.
 - 9. Steel Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I beams for heavy loads.
 - Linked Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I beams for heavy loads, with link extensions.
 - 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

- 12. Welded Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb (340 kg).
 - b. Medium (MSS Type 32): 1500 lb (675 kg).
 - Heavy (MSS Type 33): 3000 lb (1350 kg).
- 13. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Steel Pipe Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
 - Thermal Hanger Shield Inserts: For supporting insulated pipe, 360 degree insert of high density, 100 psi (690 kPa) minimum compressive strength, water repellent treated calcium silicate or cellular glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360 degree sheet metal shield.
- H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - Restraint Control Devices (MSS Type 47): Where indicated to control piping movement.
 - 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1 1/4 inches (32 mm).
 - 3. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 - 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 - 5. Variable Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

- 6. Variable Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- 7. Variable Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
- 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP 69 and MSS SP 89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field assembled channel systems.
 - 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D 1.1.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP 69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- E. Install powder actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
- F. Install mechanical anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- K. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal hanger shield insert with clamp sized to match OD of insert.
 - Do not exceed pipe stress limits according to ASME B31.9.
 - 2. Install MSS SP 58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - Option: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP 58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
 - Option: Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3 1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
- b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
- c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
- d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
- e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
- 5. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
- 6. Insert Material: Length at least as long as protective shield.
- 7. Thermal Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC PA 1 requirements for touching up field painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 07 00 - EQUIPMENT INSTALLATION

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes blanket, board, and block insulation; insulating cements; field_applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
 - 1. Division 23

1.3 SUBMITTALS

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
 - 1. Field application for each equipment type.
 - 2. Removable insulation sections at access panels.
 - 3. Application of field_applied jackets.
 - 4. Special shapes for cellular glass insulation.
- C. Samples: For each type of insulation and field_applied jacket. Identify each Sample, describing product and intended use. Submit 12_inch_ (300_mm_) square sections of each sample material.
 - 1. Manufacturer's Color Charts: Show the full range of colors available for each type of field_applied finish material indicated.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- E. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

- 3. Fire_Test_Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame_spread rating of 25 or less, and smoke developed rating of 50 or less.
 - 2. Insulation Installed Outdoors: Flame_spread rating of 75 or less, and smoke developed rating of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with equipment Installer for insulation application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Mineral_Fiber Insulation:
 - a. CertainTeed Manson.
 - b. Knauf FiberGlass GmbH.
 - c. Owens Corning Fiberglas Corp.
 - d. Schuller International, Inc.

Or approved equal

- 2. Cellular Glass Insulation:
 - a. Pittsburgh_Corning Corp.

Or approved equal

- 3. Flexible Elastomeric Thermal Insulation:
 - a. Armstrong World Industries, Inc.

b. Rubatex Corp.

Or approved equal

- 4. Closed_Cell Phenolic_Foam Insulation:
 - a. Kooltherm Insulation Products, Ltd.

Or approved equal

- Calcium Silicate Insulation:
 - a. Owens_Corning Fiberglas Corp.
 - b. Pabco.
 - c. Schuller International, Inc.

Or approved equal

2.2 INSULATION MATERIALS

- A. Mineral_Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all_service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- 3. Mineral_Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all_service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- C. Cellular_Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
 - 1. Block Insulation: ASTM C 552, Type I.
 - 2. Special Shaped Insulation: ASTM C 552, Type III.
 - 3. Board Insulation: ASTM C 552, Type IV.
- D. Flexible Elastomeric Thermal Insulation: Closed_cell, sponge_ or expanded_rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Adhesive: As recommended by insulation material manufacturer.
 - 2. Ultraviolet Protective Coating: As recommended by insulation manufacturer.
- E. Closed Cell Phenolic Foam Insulation: Block insulation of rigid, expanded, closed cell structure. Comply with ASTM C 1126, Type II, Grade 1.

Calcium Silicate Insulation: Flat_, curved_, and grooved block sections of noncombustible, inorganic, hydrous calcium silicate with a no asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.

2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.
 - Adhesive: As recommended by insulation material manufacturer. PVC Jacket color: white or gray,
 - 2. PVC Jacket Color: Color-code to match connected piping jackets based on materials contained within the piping system.
- D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209 (ASTM B 209M), and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
 - 1. Finish: Smooth finish.
 - 2. Finish: Cross-crimp corrugated finish.
 - 3. Finish: Stucco-embossed finish.
 - 4. Finish: Factory-painted finish.
 - 5. Moisture Barrier: 1 mil (0.025mm) thick, heat-bonded polyethylene and Kraft paper

2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL_C_20079H, Type I for cloth and Type II for tape. Woven glass fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
 - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
 - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
 - 2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
 - 3. Aluminum: 0.007 inch (0.18 mm) thick.
 - 4. Brass: 0.010 inch (0.25 mm) thick.
 - 5. Nickel Copper Alloy: 0.005 inch (0.13 mm) thick.
- C. Wire: 0.080_inch (2.0_mm), nickel copper alloy; 0.062_inch (1.6_mm), soft annealed, stainless steel; or 0.062_inch (1.6_mm), soft annealed, galvanized steel.

- D. Weld Attached Anchor Pins and Washers: Copper coated steel pin for capacitor discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
 - Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.
- E. Adhesive Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated
 - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.
- F. Self Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

END OF SECTION

SECTION 221116 - DOMESTIC WATER PIPING

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Related Sections include the following:
 - 1. Division 22 Section "Water Distribution" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 NOT USED

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Samples: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components.
- C. Comply with NSF 61, "Drinking Water System Components Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade [A], Schedule 40, galvanized. Include ends matching joining method.
 - Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
 - 6. Steel-Piping, Grooved-End Fittings: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106, galvanized steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - a. Grooved-End-Pipe Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts
 - 7. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
 - 8. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

2.4 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.

- 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
 - a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.5 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "General Duty Valves for Plumbing Piping."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 02 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- E. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Water Distribution."
- F. Domestic Water Piping on Service Side of Water Meter inside the Building: Use any of the following piping materials for each size range:
 - 1. NPS 4 to NPS 6: Steel pipe; gray-iron, threaded fittings; and threaded joints.
 - 2. NPS 4 to NPS 6: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

- 3. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
- 4. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- 5. NPS 8: Steel pipe; gray-iron, threaded fittings; and threaded joints.
- 6. NPS 8: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 7. NPS 8: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- 8. NPS 10 and NPS 12: Steel pipe; gray-iron, threaded fittings; and threaded joints.
- 9. NPS 10 and NPS 12: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- G. Under-Building-Slab and 5' from bldg, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Hard copper tube, Type K; copper pressure fittings; and soldered joints.
- H. Aboveground Domestic Water Piping: Use any of the following piping materials for each size range:
 - NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 3. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 4. NPS 2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 5. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 6. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 7. NPS 4 to NPS 6: Steel pipe; gray-iron, threaded fittings; and threaded joints.
 - 8. NPS 4 to NPS 6: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
 - 9. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 10. NPS 4 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
 - 11. NPS 8: Steel pipe; gray-iron, threaded fittings; and threaded joints.

- 12. NPS 8: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- 13. NPS 8: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- 14. NPS 10 and NPS 12: Steel pipe; gray-iron, threaded fittings; and threaded joints.
- 15. NPS 10 and NPS 12: Steel pipe with grooved ends; steel-piping, grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.
- C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 - 2. Install stop-and-waste drain valves where indicated.
- E. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger.
- F. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- F. Install water-pressure regulators downstream from shutoff valves.
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.

- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
 - 1. Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 - 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
 - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

- 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
 - Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

- b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
- d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION

SECTION 221316 - SANITARY WASTE STORM AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following for soil, waste, and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
 - 3. Encasement for underground metal piping.

1.3 NOT USED

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
 - 2. Sanitary Sewer, Force-Main Piping: 50 psig.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
 - Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
 - 2. Sovent Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and

vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
 - A. Pipe and Fittings: ASTM A 74, Service class(es).
 - B. Gaskets: ASTM C 564, rubber.
 - C. Lead and Oakum: ASTM B 29, pure lead and oakum or hemp fiber.
- 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS
 - A. Pipe and Fittings: ASTM A 888 or CISPI 301.
 - B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Not Used
 - 2. Heavy-Duty, Shielded, Stainless-Steel Couplings four bands for underground installation and two bands for above ground installation: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
 - a. Available Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.

2.5 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Standard Weight or Schedule 40, galvanized. Include ends matching joining method.
- B. Drainage Fittings: ASME B16.12, threaded, cast-iron drainage pattern.
- C. Pressure Fittings:
 - Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.
 - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125.
- D. Grooved-Joint Systems:
 - 1. Available Manufacturers:
 - a. Anvil International.
 - b. Star Pipe Products; Star Fittings Div.
 - c. Victaulic Company.
 - d. Ward Manufacturing, Inc.

Or approved equal

- 2. Grooved-End, Steel-Piping Fittings: ASTM A 47/A 47M, malleable-iron casting; ASTM A 106, galvanized-steel pipe; or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
- 3. Grooved-End, Steel-Piping Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

2.6 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

- 2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end, unless grooved or flanged ends are indicated.
 - 1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 2. Gaskets: AWWA C111, rubber.
- C. Grooved-Joint Systems:
 - 1. Available Manufacturers:
 - a. Victaulic Company.

- 2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
- Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- D. Flanges: ASME 16.1, Class 125, cast iron.

2.7 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Hard Copper Tube: ASTM B 88, Types K, L and M, water tube, drawn temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
 - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

2.8 SPECIAL PIPE FITTINGS

A. Sovent Drainage System Fittings: ASME B16.45 or ASSE 1043, cast-iron aerator and deaerator fittings.

- B. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. Dallas Specialty & Mfg. Co.
 - b. Fernco, Inc.
 - c. Logan Clay Products Company (The).
 - d. Mission Rubber Co.
 - e. NDS, Inc.
 - f. Plastic Oddities, Inc.

- 2. Sleeve Materials:
 - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- C. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Mission Rubber Co.
- D. Rigid, Unshielded, Nonpressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 1. Available Manufacturers:
 - a. ANACO.

Or approved equal

- E. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - 1. Available Manufacturers:

- a. Cascade Waterworks Mfg. Co.
- b. Dresser, Inc.; DMD Div.
- c. EBAA Iron Sales, Inc.
- d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
- e. JCM Industries, Inc.
- f. Romac Industries, Inc.
- g. Smith-Blair, Inc.
- h. Viking Johnson.

- 2. Center-Sleeve Material: Manufacturer's standard.
- 3. Gasket Material: Natural or synthetic rubber.
- 4. Metal Component Finish: Corrosion-resistant coating or material.
- F. Flexible Ball Joints: Ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include gasketed ball-joint section and ductile-iron gland, rubber gasket, and steel bolts.
 - 1. Available Manufacturers:
 - a. EBAA Iron Sales, Inc.

Or approved equal

- G. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
 - 1. Available Manufacturers:
 - a. EBAA Iron Sales, Inc.
 - b. Romac Industries, Inc.
 - c. Star Pipe Products; Star Fittings Div.

Or approved equal

H. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.

- 1. Available Manufacturers:
 - a. SIGMA Corp.

I. Tubular Fittings: ASTM F 409, ABS and PVC drainage-pattern tube and tubular fittings with ends as required for application.

2.9 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch minimum thickness.
- B. Form: Sheet.
- C. Color: natural.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
 - 4. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 5. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

- 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
- 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
- 3. Steel pipe, drainage fittings, and threaded joints.
- 4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
- 5. Copper DWV tube, copper drainage fittings, and soldered joints.
 - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
- E. Aboveground, vent piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Steel pipe, drainage fittings, and threaded joints.
- F. Above and belowground, sovent drainage system with soil, waste, and vent piping materials indicated.
- G. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
 - 4. Cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
- H. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and compression joints.
 - 2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."
- B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- E. Install underground, steel, force-main piping. Install encasement on piping according to ASTM A 674 or AWWA C105.
- F. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside the building between wall and floor penetrations and connection to sanitary sewer piping outside the building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- G. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- H. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
 - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- I. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- J. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - Install encasement on underground piping according to ASTM A 674 or AWWA C105.
- L. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- M. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- N. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

- 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
- 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
- 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- O. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- P. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 23 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

3.5 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 23 Section "Valves."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Install gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Install gate valve for piping NPS 2-1/2 and larger.

- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
 - Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 23 Section "Mechanical Vibration Controls and Seismic Restraints."
- B. Pipe hangers and supports are specified in Division 23 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs according to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 23 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 2: 84 inches with 3/8-inch rod.
 - 2. NPS 3: 96 inches with 1/2-inch rod.
 - 3. NPS 4: 108 inches with 1/2-inch rod.
 - 4. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical stainless-steel piping every 10 feet.
- L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
 - 6. NPS 8: 10 feet with 3/4-inch rod.
- M. Install supports for vertical copper tubing every 10 feet.

 N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
 - 1. Sanitary Sewer: To exterior force main or sanitary manhole.
 - 2. Sewage Pumps: To sewage pump discharge.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

- Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
- 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
- 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 6. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 4. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 224000 - PLUMBING FIXTURES AND EQUIPMENT

1.1 DESCRIPTION

1. Domestic water, sewer and fuel gas systems, including piping, equipment and all necessary accessories as designated in this section.

1.2 WORK INCLUDED

- 1. Furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all plumbing work as indicated on drawings and specified herein.
- 2. All permits, inspections and licenses required by the legally constituted authorities having jurisdiction for installation of the work according to the plans and specifications shall be obtained and paid for as a part of the work of this section.
- 3. The contractor shall provide and keep current a complete set of record drawings, which show any deviations from the original drawings, depth of buried pipe and exact installed location of piping, equipment, valves and fixtures. Upon completion of work, the complete set of record drawings shall be delivered to the Engineer.

1.3 RELATED WORK

- 1. Penetrations in rated enclosures.
- 2. Preparation and finish painting.
- Electrical
- 4. Mechanical

1.4 QUALITY ASSURANCE

1. Work covered by this Section shall conform to the latest requirements of the following standards:

Current California Plumbing Code

SMACNA Seismic Restrain Manual, Guidelines for Mechanical Systems

National Fire Protection Agency

- 2. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the city.
- 3. The contractor shall guarantee the entire plumbing system unconditionally for a period of one year after final acceptance. If any part of the plumbing system fails to function properly during this period, the contractor shall perform any work necessary to restore the plumbing

system to working order at no expense to the owner and the contractor shall be responsible for any damage caused by the failure of the plumbing system to function properly.

1.5 UTILITIES

- 1. Verify services and meters provided by utility companies are adequate to suit the demand shown on the drawings.
- 2. Gas Service and Meter Assembly: The contractor shall coordinate with the gas utility provider for the installation of new gas service including complete meter assembly of the capacity and location indicated on the drawings. All items served by the gas meter shall be operated at full fire. Any adjustments required downstream of the meter assembly shall be the responsibility of the contractor. Any adjustments required at the meter assembly or upstream of the meter assembly shall be the responsibility of the gas utility. The owner shall pay all fees charged by the gas utility.
- 3. Gas Service and Meter Assembly: The contractor shall coordinate with the gas utility provider to verify the existing meter assembly is adequate for the additional gas load shown on the drawings and immediately notify the Engineer in writing if it is not.
- 4. Sanitary Sewer: The contractor shall be responsible for soil and waste piping within the building and outside the building to a point five feet from the foundation.
- 5. Storm Drain: The contractor shall be responsible for storm drain piping within the building and outside the building to a point five feet from the foundation.
- 6. Domestic Water: The contractor shall be responsible for domestic water piping within the building and outside the building to a point five feet from the foundation.

1.6 SITE INSPECTION

1. The contractor shall inspect the site of work prior to submitting bid. Failure to inspect the site shall not relieve the contractor of the responsibility to furnish or perform any work that may be required due to unusual site conditions.

1.7 SUBMITTALS

- 1. See architect's specifications for submittal procedures and requirements in addition to those listed in this section.
- 2. Submittal Requirements:

Provide all at one time and prior to installation a valid submittal on all fixtures, material, equipment and devices. Each submitted item shall be indexed and referenced to identification numbers on fixture and equipment schedules.

Submittals will be verified for general conformance. Acceptance of submittals does not include number of items or supercede requirements of these specifications for quality or method of installation.

Submittals and shop drawings shall be approved only to the extent of information provided. Accessories, controls, finishes and materials not submitted shall be furnished and installed as specified. Approval of submittals or shop drawings shall not relieve the contractor of the

responsibility to install all components as specified or shown on the plans and all components necessary for a complete, working system.

3. Substitution Requirements:

Items proposed by the contractor as a substitution for that which is specified here or in the drawings shall be clearly labeled as such.

Provide calculations, test results and any additional data necessary for the engineer to determine the acceptability of the proposed substitution.

The contractor shall be responsible for any additional work caused by the use of substitute items.

Items substituted without the approval of the engineer shall be replaced with specified items at the contractor's expense.

The architect or Engineer shall determine the suitability of proposed substitutions.

The entire cost of changes necessary for the substitution shall be the responsibility of the contractor. No additional cost shall be born by the owner.

4.	Manufacturer's Literature and Data:
	Piping
	Valves.
	Strainers.
	Pressure Gages.
	Hot Water Temperature Maintenance Heat Tracing
	Cleanouts.

All items listed in Part 2 - Products.

5. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

PART 2 - PRODUCTS

2.1 SANITARY, WASTE, STORM WATER DRAIN AND VENT PIPING

- Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 5 feet outside of building foundation and interior waste and vent piping above grade.
 - a) Pipe shall be plain end (no-hub), ASTM A74, CISPI-301, service class.
 - b) Fittings shall be stainless steel clamp-type couplings with elastomeric sealing sleeve per ASTM 564.
 - c) Steel Pipe and Fittings: Shall be used for exposed soil, waste, vent and storm water piping and may be used for such piping when concealed above grade.
 - d) Pipe: Galvanized ASTM A53, standard weight.
 - e) Fittings:
 - 1) Soil, Waste and Drain Piping: Cast iron, ANSI B16.12, threaded, galvanized
 - 2) Sanitary Vent Piping: Malleable iron, ANSI B16.3, or cast iron, ANSI B16.4. All piping shall be of the same kind. Couplings of vent piping may be standard couplings furnished with pipe.

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Copper Tube, (DWV): May be used for piping above ground, except for urinal drains.

Tube: ASTM B306.

Fittings: Solder type.

Joints: ASTM B32, 50/50, special alloy, lead free. Solder using non-corrosive flux.

2.2 DOMESTIC WATER PIPING

1. Pipe: Copper tube, ASTM B88, Type L, hard drawn, seamless. For pipe 6" and larger, stainless, steel ASTM A312, schedule 10 may be used.

2. Fittings:

Copper Tube: Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, MSS SP72 & SP 110, Solder or braze joints.

Stainless steel: Butt-welded fittings, Type 316, Schedule 10, conforming to ANSI B16.9.

3. Solder: ASTM B32 Composition Sb5 HA or HB. Provide non-corrosive flux.

2.3 FUEL GAS PIPING

1. Pipe:

Concealed, above grade: Black steel, ASTM A53, schedule 40.

Exposed, above grade: Galvanized steel, ASTM A53, schedule 40.

Below grade: Type PE2406, medium density polyethylene per ASTM D 2513 as manufactured by Performance Pipe or equal.

2. Fittings:

- a) Steel, up to 2": malleable Iron, threaded, ANSI B16.3.
- b) Steel, 2-1/2" and over: steel, welded, schedule 40.
- c) Exposed steel fittings shall be galvanized.
- d) Polyethylene: Socket fusion.

2.4 CONDENSATE DRAINAGE PIPING

- 1. Pipe: Copper tube, ASTM B88, Type M, hard drawn, seamless.
- 2. Fittings: Wrought copper conforming to ANSI and B16.22.

2.5 INDIRECT WASTE OTHER THAN CONDENSATE DRAINAGE PIPING

- 1. Pipe: Copper tube, ASTM B88, Type L, hard drawn, seamless.
- 2. Fittings: Wrought copper conforming to ANSI and B16.22.

2.6 SUBSURFACE DRAINAGE PIPING

- 1. Piping: SDR-35 perforated pipe with solid wall fittings and solvent weld joints.
- 2 Filter Wrap: Mirafi N series nonwoven polypropylene geotextile wrap.

2.7 EXPOSED PIPING IN FINISHED ROOMS

- 1. Piping: Use full iron pipe size chrome plated brass piping for exposed water, waste and fuel gas piping connecting fixtures, casework, cabinets and equipment when not concealed by apron including those furnished by the Owner or specified in other sections. Chrome-plated pipe covers shall be permitted for waste and gas piping.
- Fittings: ANSI B16.15 cast bronze threaded fittings with chrome finish.
- 3. Valves: Chrome finish

2.8 PUMPED WASTE, DRAIN AND SEWAGE PIPING:

- 1. Pipe: Galvanized steel, ASTM A53, schedule.
- 2. Fittings: Galvanized, threaded, ANSI B16.3.

2.9 VALVES AND FITTINGS

- 1. Domestic Water Shut-off:
 - 2.9.1.1 Below Grade, 2-1/2" and Smaller: Gate valve per MSS-SP 80, bronze body, rising stem, solid wedge, body bonnet, threaded inlet and outlet, class 125, malleable or ductile iron hand wheel.
 - 2.9.1.2 Below Grade, 3" and Larger: Gate valve per MSS-SP 70, cast iron body with stainless steel trim, outside screw and yoke, solid wedge, bolted bonnet, flanged inlet and outlet, class 125, malleable or ductile iron hand wheel.
 - 2.9.1.3 Above Grade, 2" and Smaller: Ball valve per MSS SP-110, bronze, 2-piece, full-port, blowout-proof adjustable stem packing, stainless steel trim, vented ball, threaded inlet and outlet.
 - 2.9.1.4 Above Grade, 2-1/2" and Larger: Butterfly valve, MSS-SP 67, ductile iron body, extended stainless steel neck, molded-in seat liner, aluminum bronze disk, lug style, suitable for bi-directional dead-end service without downstream flange.

2. Gas Shut-off:

Above Grade, 2" and Smaller: Ball valve per MSS-SP 110, brass, 2-piece, full-port, blowout-proof stem, adjustable packing nut, PTFE seats, chrome-plated brass ball, threaded inlet and outlet, CSA approved.

Above Grade, 2-1/2" and Larger: CSA approved.

Below Grade: Type PE2406, medium density polyethylene per ASTM D 2513 and ANSI B16.40 as manufactured by Nordstrom or equal.

3. Check:

Domestic Water, 2-1/2" and Smaller: Y-pattern swing-type per MSS-SP 80, bronze, class 125, TFE seat disc.

Domestic Water, 3" and Larger: Swing-type per MSS-SP 71, cast iron body with bronze trim, class 125, flanged.

Pump Discharge: Spring-actuated.

Sewage and Storm Drain Pump Discharge: Swing check with outside lever and spring.

4. Unions:

Copper Tubing: Union per MSS-SP 123, cast bronze, non-ferrous, solder joint.

Black Steel Pipe: 250 pound, screwed, black, malleable iron with brass to iron seat ground joint.

Galvanized Steel Pipe: 250 pound, screwed, galvanized, malleable iron with brass to iron seat ground joint.

2.10 CLEANOUTS

- 1. Same size as the pipe, up to 4 inches; not less than 4 inches for larger pipe. Cleanouts for chemical waste drain pipe shall be of same material as the pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Provide a minimum clearance of 24 inches for the rodding.
- 2. In Floors: Floor cleanouts shall have cast iron body and frame with square adjustable scoriated secured nickel bronze top. Unit shall be vertically adjustable for a minimum of 2 inches. When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts. Cleanouts shall consist of "Y" fittings and 1/8 bends with brass or bronze screw plugs. Cleanouts in resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion.
- 3. Provide cleanouts at or near the base of the vertical stacks with the cleanout plug located approximately 24 inches above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. Extend the cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 6 by 6 inches at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed roughing work, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required by the authority having jurisdiction.
- 4. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.11 TRAPS

 Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed traps shall be polished chromium plated brass. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints shall not be permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.12 STRAINERS

- Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.
- 2. Gas Lines: "Y" type with removable mesh lined brass strainer sleeve.
- 3. Water: Basket or "Y" type with easily removable cover and brass strainer basket.
- 4. Body: Smaller than 3 inches, brass or bronze; 3 inches and larger, cast iron.

2.13 PRESSURE GAUGES FOR WATER AND SEWAGE USAGE

1. ANSI B40.1 all metal case 114 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to psi.

2.14 DIELECTRIC FITTINGS

1. Provide dielectric couplings or unions between ferrous and non-ferrous pipe.

2.15 STERILIZATION CHEMICALS

- 1. Liquid Chlorine: ASTM E1120.
- 2. Hypochlorite: ASTM E1229, or Fed. Spec. AA-1427C, grade B.

2.16 HOT WATER TEMPERATURE MAINTENANCE HEAT TRACING

1. Electric heat tracing, automatic self-regulating type, UL listed, tinned copper braid shield, able to crossover itself without overheating, parallel circuit design able to be cut to any length at job site and shall be corrosive and chemical resistant. Heat tracing shall maintain hot water temperature as scheduled on drawings. Heat tracing shall be complete with power connection kits, splice kits, tee kits, end seal kits and accessories required for a complete operable system. See Schedule for capacity.

2.17 GAS EQUIPMENT CONNECTORS

1. Flexible connectors with Teflon core, interlocked stainless steel protective casing, AGA certified design.

2.18 WATER HAMMER ARRESTER:

1. Closed copper tube chamber with permanently sealed 60 psig air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements (PDI WH 201). Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water

hammer arrestors at all solenoid valves, at all groups of two or more flush valves and at all quick opening or closing valves.

2.19 PIPE HANGERS, SUPPORTS AND ACCESSORIES

- 1. General: Support systems shall conform to MSS-SP 69
- 2. Copper Pipe: Provide copper-platted hangers and supports for copper pipe.
- 3. Insulated Pipe: Provide saddle or shield for insulated piping.
- 4. Horizontal Piping: Support system shall consist of threaded rods and clevis hangers, swivel pipe rings or channel iron trapeze systems.
- 5. Vertical Piping: Two-bolt riser clamps.
- 6. Building Attachments: Cast-in-place threaded inserts where possible.
- 7. Roof Pipe Supports: Closed-cell polyethylene foam with integral strut channel.

2.20 INSULATION

- 1. General: Insulation shall have a flame spread of 25 or less and a smoke density of 50 or less.
- 2. Hot Water Piping: Preformed, flexible, elastomeric cellular insulation per ASTM C-534, preformed mineral fiber insulation per ASTM C-547 or extruded preformed flexible cellular polyolefin thermal insulation per ASTM C-1427.
- 3. Condensate Drainage: Flexible, closed-cell elastomeric insulating tape.
- Indirect Waste from Refrigerated Equipment: Flexible, closed-cell elastomeric insulating tape.
- 5. Fixture Supplies and Traps: Fixtures complying with and installed in compliance with the Americans with Disabilities Act shall be provided with molded vinyl insulation as manufactured by Truebro or equal for exposed hot water piping, tailpiece and trap assembly. Tape wrapping shall not be permitted.

2.21 ACCESS PANELS

- 1. Walls: Stainless steel, 12"x12".
- 2. Ceilings: Steel, primered, 18"x18".

2.22 YARD BOXES AND VAULTS

- 1. Rectangular, concrete with vandal-resistant cast iron cover with service clearly indicated.
- 2. Size shall be adequate for full operation and removal of valve.

PART 3 - EXECUTION

3.1 INSTALLATION

General:

In the event a field condition arises which makes it impossible to install the work as indicated, submit, in writing, the proposed deviation to the Engineer for his approval. Only when the Engineer 's approval is given in writing, shall the Contractor proceed with installation of the work.

If the Contractor deviates from the contract documents and such deviation is not necessitated by field conditions as indicated above, the Contractor shall be required to re-install the work to comply with what has been indicated on the contract drawings. If reinstallation of the work is impracticable and the installation is in accordance with all governing authorities, the Engineer may permit the installation to remain. Costs incurred to revise the contract drawings by the Engineer for re-submittal to authorities having jurisdiction indicating the installed condition shall be the responsibility of the Contractor.

The Contractor shall carefully investigate the conditions surrounding installation of his work, furnishing the necessary piping, fittings, valves, traps, and other devices required to complete the installation.

Prior to trenching and installation of any piping, the contractor shall determine by physical excavation the exact depth and location of existing piping to be connected to. If the actual depth of piping is insufficient to install piping as shown on drawings, the contractor shall immediately notify the Engineer .

2. Piping:

All piping shall be concealed in finished portions of the building unless otherwise noted on the drawings.

All piping encased in concrete shall be double half lap wrapped with 1/8" thick insulation. The contractor shall coordinate blocked-out areas in footings and dropped footings where necessary for installation of pipe. No piping shall lay in the lower 9" of any footing.

Closet bends, trap arms and similar connections installed below the floor shall be adequately supported and anchored to prevent movement in any direction.

Piping installed above grade shall be secured to directly to structural framing with pipe clamps or indirectly using Unistrut or other similar product.

Install branch piping for water, waste and fuel gas, from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Owner or specified in other sections.

Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

All pipe runs shall be laid out to avoid interference with other work.

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Below grade, nonmetallic pipe shall be installed with 14-guage copper tracer wire with polyethylene insulation. THHN and/or nylon insulated wire shall not be permitted.

Corrosion protection: ASTM A674.

Waste, Storm Water Drain and Vent Drain:

3" and Smaller: Minimum slope of 2%.

4" and Larger: Minimum slope of 1%.

Domestic Water:

Where possible, slope all lines to facilitate drainage. Provide drain valves at bottom of risers. All unnecessary traps in circulating lines shall be avoided.

Connect branch lines at bottom of main serving fixtures below and slope down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

Install threaded adapters at fixture supplies. Adapters shall be bolted securely to backing plates installed between wall studs.

Fuel Gas:

Entire fuel gas piping installation shall be in accordance with requirements of NFPA 54.

Install fuel gas piping with plugged drip pockets at low points.

Polyethylene Pipe: Fusion joining procedures shall be qualified in accordance with US DOT regulations. Any person making or inspecting fusion joints shall be qualified per US DOT regulations.

Valves and Fittings:

Unions or flanges shall be installed on one side of all screwed shut-off valves, at both sides of automatic valves, on all by-pass piping and at all equipment connections. Install valves with stem in horizontal position whenever possible. All valves shall be easily accessible. Install valve in each water connection to fixture. Angle stops and internal stops shall be acceptable.

Install union and shut-off valve on pressure piping at connections to equipment.

Install chrome-plated cast escutcheon with setscrew at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

Backflow prevention devices at interior locations shall be installed in a readily accessible location, 5 (five) feet above finish floor.

Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant.

4. Pipe Hangers, Supports and Accessories:

- General: Furnish and install all miscellaneous ironwork, including angles, channels, etc. required to appropriately support the various piping systems.
- Spacing and locations shall, at minimum, meet the requirements of the California Plumbing Code.
- Lateral Support shall be in accordance with SMACNA Guidelines for Seismic Restraint of Piping Systems.
- Water Piping: Brace properly so as to prevent movement due to action of quick-closing valves.
- Supports shall be sized to fit pipe size exactly. For insulated pipes, supports shall be sized to fit size of insulation exactly.
- Supports for horizontal piping shall be supported from structural framing members.

5. Fixtures

Install fixtures at exact height and location shown on architectural drawings.

Fixtures, supplies, traps and trap outlets shall be installed square with the wall. Supplies and traps shall be centered on fixture, except water supplies to single-temperature fixtures. No offsets, angles or bends shall be permitted in the supplies, trap or trap arm unless otherwise indicated on the drawings.

Caulk joint between fixture and finished surface so as to be smooth, even and watertight.

Sleeves:

Sleeves for pipe through exterior walls shall have minimum 2" weep ring as manufactured by Link Seal or approved equal. Pipe shall be sealed with Link Seal Modular seal with EPDM seal elements.

Isolate pipes through floor slabs with insulation unless conduit is specified.

Sleeves through fire rated walls shall be per U.L. Fire Resistance System numbers WL1146 for drywall construction and CAJ1044 for concrete construction. See architectural plans for locations of rated walls.

7. Access:

Install equipment, piping, fixtures, valves, etc. to permit access for normal maintenance.

Access Panels shall be located at concealed valves. Access panels shall be positioned such that the item served is visible, accessible and fully operable through the access panel.

8. Protection and Cleaning:

All work, equipment and materials shall be protected at all times. The contractor shall be responsible for all damage caused directly or indirectly by his employees.

Close all pipe openings with caps or plugs during installation; tightly cover and protect fixtures and equipment against dirt, water, chemical or mechanical damage.

At completion of work, thoroughly clean fixtures, equipment and exposed materials. All piping, equipment, valves and fittings shall be flushed thoroughly until free of scale, oil, silt, sand, sediment, pipe sealant and any foreign matter of any kind.

Surfaces in finish rooms shall be left clean and ready to be painted.

9. Coordination:

Coordinate location of piping, sleeves, inserts, hangers and equipment so as to avoid conflict with other trades, preserve headroom and keep openings, passages, windows and doors clear.

In advance of work, provide the general contractor written instructions indicating requirements for equipment, material installation or other work not specified in this scope of work.

Coordinate pipe routing to avoid electrical rooms, elevator equipment rooms, telecommunications rooms, data rooms, and other rooms dedicated to the housing of switchgear, panels or other electrical equipment. No piping shall be installed within or above the ceiling of such rooms.

Exact locations, elevations and mounting heights of fixtures shall be coordinated with the architectural plans.

10. Un-inspected Work

The contractor shall not cause or allow any of his work to be covered or enclosed prior to inspection, testing and approval by the city, Engineer or any authorized inspector having legal jurisdiction over his work.

If any work is covered prior to inspection, testing and approval, the contractor shall be responsible for uncovering such work for inspection, testing and approval and for recovering the work. All expenses incurred by other trades as a result shall be the responsibility of this contractor.

11. Excavation, Trenching and Backfilling:

Perform all trenching, excavation, shoring, backfilling and compaction necessary for work as shown on the drawings and specified herein.

The contractor shall coordinate the location of below-grade piping with the general contractor to determine necessary saw cutting, excavation, alterations and subsequent repair and restoration of affected surfaces.

Pipes shall be installed on a minimum 6" sand bed and covered with minimum 6" of sand.

Backfill shall be clean soil free from rocks and debris. Compact to within 90% of surrounding soil, or as directed by the structural engineer.

Water, soil, waste and gas piping shall have a minimum depth of 24" from finished grade to top of pipe. All other piping shall have a minimum depth of 18", unless otherwise noted on the drawings.

3.2 TESTS

- 1. General: Test system either in its entirety or in sections.
- 2. Soil, Waste, Storm Water Drain and Vent: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test, as directed.

Water Test: If entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least 10 foot head of water. In testing successive sections,

test at least upper 10 feet of next preceding section so that each joint or pipe except upper most 10 feet of system has been submitted to a test of at least a 10 foot head of water. Keep water in system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

- 3. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 100 psi for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested.
- 4. Fuel Gas System: NFPA 54.
- 5. All Other Piping Tests: Test new installed piping under 1 1/2 times actual operating conditions and prove tight.
- 6. Heat Tracing Systems Testing: Continuity test heat tracing systems and test insulation resistance per manufacturer's recommendations.

3.3 STERILIZATION

- 1. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.
- 2. Use either liquid chlorine or hypochlorite for sterilization.

3.4 PIPE AND EQUIPMENT IDENTIFICATION

- 1. Piping shall be labeled per ANSI standard 13.1.
- 2. Operating valves and service line shut-off valves shall be labeled with a brass tag indicated service and area served.

3.5 OPERATION INSTRUCTIONS

1. Prior to occupancy and final inspection, at one time coordinated with the city, the contractor shall provide the city with all maintenance and operation data and warranty information, two typewritten copies of instructions for the operation of all equipment, valves, fixtures, etc., instruct the owner or city in the operation of the entire plumbing system, including the location of all shut-off valves and deliver all special tools, keys, etc. required for the operation of plumbing systems and equipment.

END OF SECTION

SECTION 230010

GENERAL MECHANICAL REQUIREMENTS

1.1 DESCRIPTION OF WORK

- A. This Division requires the furnishing and installing of complete functioning systems, and each element thereof, as specified or indicated on the Drawings and Specifications or reasonably inferred; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include materials, labor, supervision, supplies, equipment, transportation, and utilities.
- B. Division 23 of the Specifications and Drawings numbered with prefixes M, MP or ME, or MEP generally describe these systems, but the scope of the Mechanical work includes all such work indicated in the Contract Documents: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing and Electrical Drawings and Specifications; and Addenda.
- C. The Drawings have been prepared diagrammatically intended to convey the scope of work, indicating the intended general arrangement of the equipment, fixtures, ductwork, piping, etc. without showing all the exact details as to elevations, offsets, control lines, and other installation requirements. The Contractor shall use the Drawings as a guide when laying out the work and shall verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

1.2 QUALITY ASSURANCE

- A. All work under this Division shall be executed in a thorough professional manner by competent and experienced workmen licensed to perform the Work specified.
- B. All work shall be installed in strict conformance with manufacturers' requirements and recommendations. Equipment and materials shall be installed in a neat and professional manner and shall be aligned, leveled, and adjusted for satisfactory operation.
- C. Material and equipment shall be new, shall be of the best quality and design, shall be current model of the manufacturer, shall be free from defects and imperfections and shall have markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Material and equipment of the same type shall be made by the same manufacturer whenever practicable.
- D. Unless specified otherwise, manufactured items shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this project.

1.3 CODES, REFERENCES AND STANDARDS

- A. Execute Work in accordance with the National Fire Protection Association and all Local, State, and National codes, ordinances and regulations in force governing the particular class of Work involved. Obtain timely inspections by the constituted authorities, and upon final completion of the Work obtain and deliver to the Owner executed final certificates of acceptance from the Authority Having Jurisdiction.
- B. Any conflict between these Specifications and accompanying Drawings and the applicable Local, State and Federal codes, ordinances and regulations shall be reported to the Architect in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specification Addenda required to resolve the conflict.
- C. The governing codes are minimum requirements. Where these Drawings and Specifications exceed the code requirements, these Drawings and Specification shall prevail.

D. All material, manufacturing methods, handling, dimensions, method or installation and test procedure shall conform to but not be limited to the following industry standards and codes:

BOCA **Building Officials Code Administration** CEC California Energy Code California Mechanical Code CMC Uniform Building Code **UBC** Uniform Mechanical Code **UMC UPC** Uniform Plumbing Code International Building Code **IBC** IFC International Fire Code **IFGC** International Fuel Gas Code American Disabilities Act ADA ADC Air Diffusion Council

AIA Guidelines for Design and Construction of Hospital and Healthcare

Facilities

AMCA Air Movement and Control Association, Inc.
ANSI American National Standards Institute

AHRI Air Conditioning, Heating and Refrigeration Institute

ASHRAE American Society of Heating Refrigerating and Air Conditioning

Engineers

ASME American Society of Mechanical Engineers
ASSE American Society of Sanitary Engineering
ASTM American Society of Testing Materials

AWS American Welding Society

AWWA American Water Works Association

CISPI Cast Iron Soil Pipe Institute
ETL Electrical Testing Laboratories

HI Hydraulic Institute

MSS Manufacturer's Standardization Society of the Valve and Fitting Industry

NBFU National Board of Fire Underwriters

NEC National Electrical Code

NFPA National Fire Protection Association

NEMA National Electrical Manufactures' Association

OSHA Occupational Safety and Health Act PDI Plumbing and Drainage Institute

SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.

UL Underwriter's Laboratories

E. Contractor shall comply with rules and regulations of public utilities and municipal departments affected by connections of services.

F. All mechanical work shall be performed in compliance with applicable safety regulations, including OSHA regulations. Safety lights, guards, shoring and warning signs required for the performance of the mechanical work shall be provided by the Contractor.

1.4 DEFINITIONS

A. General:

- 1. Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."
- 2. Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
- 3. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

- 4. Furnished by Owner or Furnished by Others: The item will be furnished by the Owner or Others. It is to be installed and connected under the requirements of this Division, complete and ready for operation, including items incidental to the Work, including services necessary for proper installation and operation. The installation shall be included under the guarantee required by this Division.
- 5. Engineer: Where referenced in this Division, "Engineer" is the Engineer of Record and the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions. When used in this Division, it means increased involvement by, and obligations to, the Engineer, in addition to involvement by, and obligations to, the "Architect".
- 6. AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.
- 7. CMATT: Certified Acceptance Mechanical Test Technician. A professional certified to perform acceptance tests and complete the documentation required for nonresidential acceptance tests as required by the California Building Energy Efficiency Standards. Technician shall be certified by an authorized mechanical acceptance test technician certification provider.
- 8. NRTL: Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other listed Manufacturers and models that meet the specified criteria.
- Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.
 - a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
- 10. Value Engineering: A systematic method to improve the "value" of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.
- B. The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified". The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.
- C. The following definitions apply to excavation operations:
 - Additional Excavation: Where excavation has reached required subgrade elevations, if unsuitable bearing materials are encountered, continue excavation until suitable bearing materials are reached. The Contract Sum may be adjusted by an appropriate Contract Modification.
 - 2. Bedding: Bedding as used in this section refers to the compacted sand or pea gravel installed in the bottom of a trench to immediately support and cover a pipe or duct.
 - 3. Subbase: as used in this Section refers to the compacted soil layer used in pavement systems between the subgrade and the pavement base course material.
 - 4. Subgrade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.

- 5. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect.
- 6. Building Fill: Building fill as used in this section refers to borrowed fill material of rock 1" and larger used to fill foundation excavations

1.5 COORDINATION

- A. The Contractor shall visit the site and ascertain the conditions to be encountered while installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provision for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, incorrect or faulty installation of Work under this Division or for additional compensation for Work covered by this Division.
- B. The Contractor shall refer to Drawings of the other disciplines and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. The Contractor shall make offsets required to clear equipment, beams and other structural members; and to facilitate concealing piping and ductwork in the manner anticipated in the design.
- C. The Contractor shall confirm and coordinate the final location and routing of all mechanical, electrical, plumbing, fire protection, control and audio-visual systems with all architectural features, structural components, and other trades. The contractor shall locate equipment, components, ductwork, piping, conduit, and related accessories to maintain the desired ceiling heights as indicated on the architectural drawings. The contractor shall inform the architect of any areas where conflicts may prevent the indicated ceiling height from being maintained. The contractor shall not proceed with any installation in such areas until the architect has given written approval to proceed or has provided modified contract drawings or written instructions to resolve the apparent conflict.
- D. The Contractor shall provide materials with trim which will fit properly the types of ceiling, wall, or floor finishes actually installed.
- E. The Contractor shall maintain a foreman on the jobsite at all times to coordinate his work with other contractors and subcontractors so that various components of the mechanical systems will be installed at the proper time, will fit the available space, and will allow proper service access to the equipment. Carry on the Work in such a manner that the Work of the other contractors and trades will not be handicapped, hindered, or delayed at any time.
- F. Work of this Division shall progress according to the "Construction Schedule" as established by the Prime Contractor and his subcontractors and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of schedule dates.

1.6 MEASUREMENTS AND LAYOUTS

A. The drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the building. Figured dimensions shall be taken in preference to scale dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing the Contract Documents. The Contractor will be held responsible for errors which could have been avoided by proper checking and inspection.

1.7 SUBMITTALS

- A. Refer to Division 01 and General Conditions for submittal requirements in addition to requirements specified herein.
- B. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.

- C. Assemble and submit for review manufacturer product literature for material and equipment to be furnished and/or installed under this Division. Literature shall include shop drawings, manufacturer product data, performance sheets, samples, and other submittals required by this Division as noted in Table 1 at the end of this Section. Provide the number of submittals required by Division 01; if hard-copy sets are provided, submit a minimum of seven (7) sets. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.
- D. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.
- E. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept. Highlight, mark, list or indicate the materials, performance criteria and accessories that are being proposed. Illegible submittals will be rejected and returned without review.
- F. Refer to individual Sections for additional submittal requirements.
- G. Transmit submittals as early as required to support the project schedule. Allow two weeks for Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal if required. Transmit submittals as soon as possible after Notice to Proceed and before Mechanical construction starts.
- H. Before transmitting submittals and material lists, verify that the equipment submitted is mutually compatible with and suitable for the intended use. Verify that the equipment will fit the available space and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.
- I. Submittals shall contain the following information:
 - 1. The project name.
 - 2. The applicable specification section and paragraph.
 - 3. Equipment identification acronym as used on the drawings.
 - 4. The submittal date.
 - 5. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
 - 6. Submittals not so identified will be returned to the Contractor without action.
- J. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with this Section and the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representatives. Contractor shall allow for the Engineer review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the submittal.
- K. The checking and subsequent acceptance by the Engineer and/or Architect of submittals shall not relieve responsibility from the Contractor for (1) deviations from Drawings and Specifications; (2) errors in dimensions, details, sizes of equipment, or quantities; (3) omissions of components or fittings; and (4) not coordinating items with actual building conditions and adjacent work. Contractor shall request and secure written acceptance from the Engineer and Architect prior to implementing any deviation.
- L. Provide welders' qualification certificates.

1.8 ELECTRONIC DRAWING FILES

A. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling

fee of \$200 for a drawing set up to 12 sheets and \$15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

1.9 SUBSTITUTIONS

- A. Refer to Division 01 and General Conditions for Substitutions in addition to requirements specified herein.
- B. Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution.
- C. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.

D. Request for Substitution:

- Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.
- 2. The burden of proof of the merit of the proposed substitution is upon the proposer.
- 3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
 - a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
 - b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
 - Proposed substitution has received necessary approvals of authorities having jurisdiction.
 - d. Same warranty will be furnished for proposed substitution as for specified Work.
 - e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
 - f. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

E. Substitution Consideration:

- 1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.
- 2. No substitutions will be considered prior to receipt of Bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of Bids.
- If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner. Verbal approval will not be given.
- 4. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.10 OPERATION AND MAINTENANCE MANUALS

- A. Refer to Division 01 and General Conditions for Operation and Maintenance Manuals in addition to requirements specified herein.
- B. Submit manuals prior to requesting the final punch list and before all requests for Substantial Completion.

- C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.
- D. Prior to Substantial Completion of the project, furnish to the Architect, for Engineer's review, and for the Owner's use, four (4) copies of Operation and Maintenance Manuals in labeled, hard-back three-ring binders, with cover, binding label, tabbed dividers and plastic insert folders for Record Drawings. Include local contacts, complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.
- E. Each manual shall contain data listed in Table 5.
- F. Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, Contractor shall submit the documents in accordance with this Section and the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the manuals have been posted. If electronic manual procedures are not defined in Division 01, Contractor shall include the website, user name and password information needed to access the manuals. For manuals sent by e-mail, Contractor shall copy the Architect and Engineer's designated representative.

1.11 SPARE PARTS

- A. Provide to the Owner the spare parts specified in the individual sections in Division 23 of this specification. Refer to Table 2 at the end of this Section for a list of specification sections in Division 23 that contain spare parts requirements.
- B. Owner or Owner's representative shall initial and date each section line in Table 2 when the specified spare parts for that section are received and shall sign at the bottom when all spare parts have been received.

1.12 RECORD DRAWINGS

- A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified herein.
- B. A set of work prints of the Contract Documents shall be kept on the jobsite during construction for the purpose of noting changes. During the course of construction, the Contractor shall indicate on these Documents changes made from the original Contract Documents. Particular attention shall be paid to those items which need to be located for servicing. Underground utilities shall be located by dimension from column lines.
- C. At the completion of the project, the Contractor shall obtain, at their expense, reproducible copies of the final drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done by a skilled drafter. Each sheet shall be marked "Record Drawing", along with the date. These drawings shall be delivered to the Architect/Engineer.

1.13 TRAINING

A. Provide training as indicated in each specific section. Schedule training with the Owner at least 7 days in advance. Video record the training sessions in format as agreed to with the Owner. Provide three copies of each session to the Owner and obtain written receipt from the Owner.

1.14 PAINTING

- A. Exposed ferrous surfaces, including pipe, pipe hangers, equipment stands and supports [and exposed insulated piping] shall be painted by the Contractor using materials and methods as specified under Division 09 of the Specifications; colors shall be as selected by the Architect.
- B. Factory finishes, shop priming and special finishes are specified in the individual equipment specification sections.
- C. Where factory finishes are provided and no additional field painting is specified, marred or damaged surfaces shall be touched up or refinished so as to leave a smooth, uniform finish.

1.15 DELIVERY, STORAGE AND HANDLING

- A. Refer to Division 01 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.
- B. Equipment and material shall be delivered to the job site in their original containers with labels intact, fully identified with manufacturer's name, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.
- C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, to include the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which become rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect.
- D. The Contractor shall be responsible for the safe storage of his own tools, material and equipment.

1.16 GUARANTEES AND WARRANTIES

- A. Refer to Division 01 and General Conditions for Guarantees and Warranties in addition to requirements specified herein.
- B. Each system and element thereof shall be warranted against defects due to faulty workmanship, design or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the Construction Documents or manufacturer's standard warranty. The Contractor shall remedy defects occurring within a period of one year from the date of Substantial Completion or as stated in the General Conditions.
- C. The following additional items shall be guaranteed:
 - 1. Piping shall be free from obstructions, holes or breaks of any nature.
 - 2. Insulation shall be effective.
 - 3. Proper circulation of fluid in each piping system.
- D. The above guarantees shall include both labor and material; and repairs or replacements shall be made without additional cost to the Owner.
- E. The remedial work shall be performed promptly, upon written notice from the Architect or Owner.
- F. At the time of Substantial Completion, deliver to the Owner warranties with terms extending beyond the one year guarantee period, each warranty instrument being addressed to the Owner and stating the commencement date and term. Refer to Table 3 at the end of this section for a list of specification sections in Division 23 that contain special warranties.

1.17 TEMPORARY FACILITIES

- A. Refer to Division 01 and General Conditions for Temporary Facilities requirements in addition to requirements specified herein.
- B. Temporary Utilities: The types of services required include, but are not limited to, water, sewerage, surface drainage and gas. When connecting to existing franchised utilities for required services, comply with service companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.
 - Provide the necessary backflow prevention devices where connecting to the potable water system. Protect water service from freezing by draining system or by providing adequate heat. Where non-potable water is used, mark each outlet with health hazard warning signs.
 - 2. Sewer Sediment: Maintain sewers and temporary connecting sewers in a clean, non-clogged condition during construction period.

- C. Construction Facilities: Provide facilities reasonably required to perform construction operations properly and adequately.
 - Enclosures: When temporary enclosures are required to ensure adequate workmanship, weather protection and ambient conditions required for the work, provide fire-retardant treated lumber and plywood; provide tarpaulins with UL label and flame spread of 15 or less; provide translucent type (nylon reinforced polyethylene) where daylighting of enclosed space would be beneficial for workmanship, and reduce use of temporary lighting.
 - 2. Heating: Provide heat, as necessary, to protect work, materials and equipment from damage due to dampness and cold. In areas where building is occupied, maintain a temperature not less than 65 degrees Fahrenheit. Use steam, hot water, or gas from piped distribution system where available. Where steam, hot water or piped gas are not available, heat with self-contained LP gas or fuel oil heaters, bearing UL, FM or other approval labels appropriate for application. Vent fuel-burning heaters, and equip units with individual-space thermostatic controls. Use electric-resistance space heaters only where no other, more energy-efficient, type of heater is available and allowable.

1.18 PROJECT CONDITIONS

- A. Conditions Affecting Work In Existing Buildings:
 - The Drawings describe the general nature of remodeling to the existing building. However, the Contractor shall visit the Site prior to submitting his bid to determine the nature and extent of work involved.
 - 2. Work in the existing building shall be scheduled with the Owner.
 - 3. Certain demolition work must be performed prior to the remodeling. The Mechanical Contractor shall perform the demolition which involves Mechanical systems, equipment, piping, equipment supports or foundations and materials.
 - 4. Mechanical Contractor shall remove articles which are not required for the new Work. Unless otherwise indicated, each item removed by the Mechanical Contractor during this demolition shall become his property and shall be removed by the Mechanical Contractor from the premises and dispose of them in accordance with applicable federal, state and local regulations.
 - 5. Mechanical Contractor shall relocate and reconnect Mechanical facilities that must be relocated in order to accomplish the remodeling shown in the Drawings or indicated in the Specifications. Where Mechanical equipment or materials are removed, the Mechanical Contractor shall cap unused piping beyond the floor line or wall line to facilitate restoration of finish.
 - 6. General Contractor shall install finish material.
 - 7. Obtain permission from the Architect for channeling of floors or walls not specifically noted on the Drawings.
 - 8. Protect adjacent materials indicated to remain. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
 - Locate, identify, and protect mechanical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
- B. Conditions Affecting Excavations: The following project conditions apply:
 - Maintain and protect existing building services which transit the area affected by selective demolition.
 - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

- C. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.
- D. Use of explosives is not permitted.
- E. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

PART 2 - PRODUCTS AND MATERIALS

2.1 NOT USED

2.2 SOIL MATERIALS

- A. Bedding Material: Provide clean sand, pea gravel or flowable fill material (per the geotechnical or structural engineer's recommendations).
- B. Subbase Material: Where applicable, provide natural soils with 10% by volume of rocks less than 2" diameter or artificially graded crushed aggregate. Corrosive fill materials shall be not be utilized. When CL clay, rock, or gravel is used, it shall not be larger than 2 inches in any dimension and shall be free of debris, waste, frozen materials, vegetable and other deleterious matter.
- C. Drainage Fill: Provide washed, evenly graded mixture of 3/4" open graded aggregate stone or gravel, around drainage pipes to a level above pipe as detailed by Architect. Provide open graded aggregate, crushed stone, crushed or uncrushed gravel with 100 percent passing a 1-1/2-inch sieve, and not more than 5 percent passing a No. 4 sieve for drainage fill to subgrade or around equipment structures.
- D. Filter Fabric: Flat needle punched PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

PART 3 - EXECUTION

3.1 PERMITS

A. Secure and pay for permits required in connection with the installation of the Mechanical Work. Arrange with the various utility companies for the installation and connection of required utilities for this facility and pay charges associated therewith including connection charges and inspection fees, except where these services or fees are designated to be provided by others.

3.2 ACCEPTANCE TESTING REQUIREMENTS

- A. Perform acceptance test procedures in accordance with the specifications listed in the Reference Joint Appendices for the Building Energy Efficiency Standards of California. Reference the Non-Residential Certificate of Compliance (NRCC) forms on the drawings for the systems which shall be tested.
- B. Submit Non-Residential Certificate of Acceptance (NRCA) forms for each system for which the CMATT is responsible.

3.3 EXISTING UTILITIES

- A. Schedule and coordinate with the Utility Company, Owner and with the Engineer connection to, or relocation of, or discontinuation of normal utility services from existing utility lines. Premium time required for any such work shall be included in the bid.
- B. Existing utilities damaged due to the operations of utility work for this project shall be repaired to the satisfaction of the Owner or Utility Company without additional cost.
- C. Utilities shall not be left disconnected at the end of a work day or over a weekend unless authorized by representatives of the Owner or Engineer.
- D. Repairs and restoration of utilities shall be made before workmen leave the project at the end of the workday in which the interruption takes place.

E. Contractor shall include in his bid the cost of furnishing temporary facilities to provide services during interruption of normal utility service.

3.4 SELECTIVE DEMOLITION

- A. Refer to Division 02 and General Conditions for Selective Demolition requirements in addition to the requirements specified herein.
- B. General: Demolish, remove, demount, and disconnect abandoned mechanical materials and equipment indicated to be removed and not indicated to be salvaged or saved.
- C. Materials and Equipment to Be Salvaged: Remove, demount, and disconnect existing mechanical materials and equipment indicated to be removed and salvaged, and deliver materials and equipment to the location designated for storage.
- D. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- E. Mechanical Materials and Equipment: Demolish, remove, demount, and disconnect the following items:
 - 1. Inactive and obsolete piping, fittings and specialties, equipment, ductwork, controls, and insulation.
 - a. Piping and ducts embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove exposed materials and materials above accessible ceilings. Drain and cap piping and ducts allowed to remain.
 - b. Perform cutting and patching required for demolition in accordance with Division 01, General Conditions and "Cutting and Patching" portion of this Section in Division 23.
- F. Provide schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 - Coordinate sequencing with construction phasing and Owner occupancy specified in Division 01 Section "Summary of Work."

3.5 EXCAVATION AND BACKFILLING

- A. Refer to Division 01, Division 02, and Division 31, Geotechnical Soils Report and General Conditions for Excavation and Backfilling in addition to the requirements specified herein.
- B. Perform excavation of every description, of whatever substance encountered and to the depth required in connection with the installation of the work under this Division. Excavation and Trenching shall be in conformance with applicable Division and section of the General Specifications.
- C. Roads, alleys, streets and sidewalks damaged during this work shall be restored to the satisfaction of Authorities Having Jurisdiction.
- D. Trenches close to walks or columns shall not be excavated without prior consultation with the Architect.
- E. Erect barricades around excavations and trenches for safety. Provide an adequate number of amber lights on or near the work and keep them burning from dusk to dawn. Contractor shall be held responsible for any damage that any parties may sustain due to neglecting the necessary precautions when performing the work.
- F. Slope sides of excavations and trenches to comply with Geotechnical Report, local, state and federal codes and ordinances. Shore and brace as required for stability of excavation.
- G. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local, state and federal codes and authorities. Maintain shoring and bracing in excavations and trenches regardless of time period excavations and trenches will be open.
 - 1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
- H. Install sediment and erosion control measures in accordance with local codes and ordinances.

- I. Dewatering of Excavation and Trenches: Prevent surface water and subsurface or ground water from flowing into excavations and trenches.
 - 1. Do not allow water to accumulate in excavation or trenches. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations and trenches.
 - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation and trench limits to convey surface water to collecting or run-off areas.
 - 3. Do not use trench excavations as temporary drainage ditches. In no case shall sewers be used as drains for such water.
- J. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
 - Locate and retain soil materials away from edge of excavations and trenches. Do not store
 within drip-line of trees indicated to remain.
 - 2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.
- K. Excavation for Underground Tanks, Basins, and Mechanical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
 - 1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
 - 2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.
- L. Trenching: Excavate trenches as follows:
 - 1. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches clearance on both sides of pipe and equipment.
 - 2. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations. Beyond building perimeter, excavate trenches to an elevation below frost line.
 - 3. Limit the length of open trench to that in which pipe can be installed, tested, and the trench backfilled within the same day.
 - 4. Where rock is encountered, carry excavation below required elevation and backfill with a layer of sand or pea gravel prior to installation of pipe. Provide a minimum of 6 inches of sand or pea gravel cushion between rock bearing surface and pipe.
 - 5. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment bedding on undisturbed soil.
- M. Cold Weather Protection: Protect excavation and trench bottoms against freezing when atmospheric temperature is less than 35°F.

N. Bedding:

- Fill bottom of pipe trench and fill unevenness with compacted bedding material to ensure continuous bearing of the pipe barrel on the bearing surface. Additional bedding installation requirements are in the following piping specifications. Compact bedding as described below.
- 2. Fill bottom of equipment trench and fill unevenness with compacted sand backfill to ensure continuous bearing of the equipment on the bearing surface. Compact bedding as described below
- O. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified in Part 2 of this Section.
 - 1. Under pipes, use bedding materials in layers to 6 inches above top of the pipe.

- Under walks and pavements, use a combination of subbase materials and excavated or borrowed materials.
- 3. Under building slabs, use subbase materials.
- Under piping and equipment, use bedding and subbase materials over rock bearing surface and for correction of unauthorized excavation.
- 5. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete protection slab. After installation and testing of pipes, provide a 4-inch thick concrete protection top slab prior to backfilling and placement of roadway subbase. Contractor shall coordinate with local AHJ as to requirements for colored concrete in this application.
- 6. Other areas, use excavated or borrowed materials where applicable.
- 7. Backfill excavations as promptly as work permits, but not until completion of the following:
 - a. Inspection, testing, approval, and locations of underground utilities have been recorded.
 - b. Removal of concrete formwork.
 - c. Removal of shoring and bracing, and backfilling of voids.
 - d. Removal of trash and debris.
- 8. Where gravel fill (drainage fill) is used as building fill material in lieu of natural soils, provide filter fabric material to line the trench to support the bedding fill material and subgrade materials to ensure that backfill materials will not segregate within the trench nor create voids and sags within the pipe trench.
- Ductwork under slab shall be backfilled with a minimum of 4" bedding material on all sides for protection from soils (per Code). Subbase materials shall be utilized above the bedding material to the subgrade level.
 - a. If concrete encasement is required, a minimum of 4" thickness all sides shall be provided unless otherwise noted. Contractor shall provide hold down straps as per manufacturer's recommendations.
 - b. If a concrete ballast pad is required, size of ballast pad shall be as noted on the drawings or as per manufacturer's recommendations.
- P. Backfill excavations as promptly as work permits, but not until completion of the following:
 - 1. Inspection, testing, approval, and locations of underground utilities have been recorded.
 - 2. Removal of concrete formwork.
 - 3. Removal of shoring and bracing, and backfilling of voids.
 - 4. Removal of trash and debris.
- Q. Subgrade Placement and Compaction: Place subgrade backfill materials in maximum layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- R. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- S. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.
- T. Placement and Compaction: Place bedding backfill materials in maximum layers of not more than 6 inches loose depth for material compacted by hand-operated tampers. Place subbase backfill materials in maximum layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

- 1. Use of pneumatic backhoe as compaction method is disallowed as an acceptable process for compaction of excavations or trenches.
- 2. For vertical and/or diagonal pipe installations greater than ½" rise/lf, thoroughly support pipes from permanent concrete structures or undisturbed earth at no less than 10-foot intervals, while placing backfill materials, so that pipes are not deflected, crushed, broken, or otherwise damaged by the backfill placement or settlement.
- Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- 4. Place backfill and/or drainage fill materials evenly adjacent to structures, piping, and equipment to required elevations. Coordinate with Architect and/or Civil Engineer backfill requirements prior to installation. Prevent displacement of pipes and equipment by carrying material uniformly around them to approximately same elevation in each layer or lift.
- Compaction: control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below:
- 6. Percentage of maximum density requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 or ASTM D 698 and not less than the following percentages of relative density, determined in accordance with ASTM D 4253, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).
 - a. Areas under Structures, Building Slabs and Steps, Pavements: Compact top 12 inches of subgrade and each layer of backfill or fill material to 95 percent maximum density for cohesive material listed, or 95 percent relative density for cohesionless material.
 - b. Areas Under Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material to 95 percent maximum density for cohesive material, or 95 percent relative density for cohesionless material.
 - c. Other Areas: Compact top 6 inches of subgrade and each layer of subbase backfill or fill material to 90 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.
- U. Subsidence: Where subsidence occurs at mechanical installation excavations and trenches during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.6 CUTTING AND PATCHING

- A. The Contractor shall do necessary cutting of walls, floors, ceilings and roofs.
- B. No structural member shall be cut without permission from Architect.
- C. Patch around openings to match adjacent construction.
- D. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

3.7 CLEANING

- A. Dirt and refuse resulting from the performance of the work shall be removed from the premises as required to prevent accumulation. The Mechanical Contractor shall cooperate in maintaining reasonably clean premises at all times.
- B. Immediately prior to the final inspection, the Mechanical Contractor shall clean material and equipment installed under the Mechanical Contract. Dirt, dust, plaster, stains, and foreign matter shall be removed from surfaces including components internal to equipment. Damaged finishes shall be touched-up and restored to their original condition.

3.8 SUBSTANTIAL COMPLETION REVIEW

- A. Prior to requesting inspection for "CERTIFICATE OF SUBSTANTIAL COMPLETION", the Contractor shall complete the following items:
 - 1. Submit complete Operation and Maintenance Manuals.
 - 2. Submit complete Record Drawings.
 - 3. Perform special inspections. Refer to Table 4 at the end of this section for a list of specification sections in Division 23 that contain special inspection requirements.
 - 4. Start-up testing of systems.
 - 5. Removal of temporary facilities from the site.
 - Comply with requirements for Substantial Completion in the "General Conditions".
- B. The Contractor shall request in writing a review for Substantial Completion. The Contractor shall give the Architect/Engineer at least seven (7) days notice prior to the review.
- C. The Contractor's written request shall state that the Contractor has complied with the requirements for Substantial Completion.
- D. Upon receipt of a request for review, the Architect/Engineer will either proceed with the review or advise the Contractor of unfulfilled requirements.
- E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above mentioned items, He shall reimburse the Architect/Engineer for time and expenses incurred for the visit.
- F. Upon completion of the review, the Architect/Engineer will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.
- G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.
- H. Prior to requesting a final review, the Contractor shall submit a copy of the final list of items to be completed or corrected. He shall state in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

END OF SECTION 230010

TABLE 1: MECHANICAL SPECIFICATION SHOP DRAWING SUBMITTAL REQUIREMENTS

SPECIFICA	ATION NUMBER/TITLE	CODE DESIGNATION
230010	Caparal Machanical Paguiraments	NONE
230015	General Mechanical Requirements Electrical Coordination for Mechanical Equipment	NONE
230500	Common Work Results for HVAC	A, B, G, N
230510	Basic Piping Materials and Methods	B, G
230513	Common Motor Requirements for HVAC Equipment	B
230514	Variable Frequency Drives	A, B, C, E, F, H, K, Q
230516	Expansion Fittings and Loops for HVAC Piping	A, B, F
230519	Meters and Gauges for HVAC Piping	B, H
230523	General-Duty Valves for HVAC Piping	B
230529	Hangers and Supports for HVAC Piping and Equipment	B, F, G, H
230548	Seismic Controls for Mechanical Systems	A, B, C, D, I, N
230550	Vibration Isolation for HVAC Piping and Equipment	A, B, C, F, I
230553	Identification for HVAC Piping and Equipment	B, L, N
230593	Testing, Adjusting and Balancing For HVAC	H, J
230700	HVAC Insulation	B, L
230800	Commissioning of HVAC Systems	C, J
230913	Instrumentation and Control Devices for HVAC	A, B, C, D, E, F, N, O, Q
230914	Refrigerant Monitoring Systems Vehicle Emission Monitoring Systems	A, B, C, E, F, Q
230915 230921	Pneumatic Control Systems	A, B, C, E, F, Q A, B, E, Q
230923	Direct-Digital Control for HVAC	A, B, C, D, E, F, J, K, L, N, O, Q
230924	Small Building Control System	A, B, E, F, Q
231113	Facility Fuel Oil Piping	A, B, C, E, F, G, K
232113	Hydronic Piping	B, C, D, F, G, H, J
232113.13		B, C, F, G, H
232114	Mechanically Joined Hydronic Piping Systems	B, C, F, G, H
232115	Ground Loop Heat Pump Piping	B, C, F, G, H
232116	Hydronic Specialties	A, B, C, F, G, H
232123	Hydronic Pumps	A, B, C, E, F
232133	Hydronic Packaged Pumping Systems	B, C, D, E, F, H, H, O, P, Q
232213	Steam and Condensate HVAC Piping	B, C, D, F, G, H, J
232216 232223	Steam and Condensate Piping Specialties	A, B, C, F, G, H
232223	Steam Condensate Pumps Refrigerant Piping	A, B, C, E, F, Q A, B, G
232313	VRF Refrigerant Piping	A, B, D, G, H, J
232500	HVAC Water Treatment	A, B, C, E, F, K, Q
232520	Pulsed Power Water Treatment System	A, B, C, E, F, H, J, K
232540	Silica Based Water Treatment System	A, B, C, E, F, H, J, J, O
232600	Nondestructive Pipe Testing	H, J
233113	Metal Ducts	A, B, D, G
233116	Non-Metal Ducts	A, B, C, F, M
223117	Fabric Ducts	A, B, C, F, M
233300	Air Duct Accessories	A, B, F, Q
233413	Axial HVAC Fans	A, B, C, F
233416	Centrifugal HVAC Fans	A, B, C, F, H
233423 233427	HVAC Power Ventilators	A, B, C, F A, B, C, E, F, H, K
233427	Laboratory Exhaust Fans Air Curtains	A, B, C, E, F, H, K A, B, C, D, E, F, I, K, L, Q
233600	Air Terminal Units	A, B, C, D, E, F, I, K, L, Q A, B, C, E, F
233713	Diffusers, Registers, and Grilles	A, B, C, F, M, N, Q
233723	HVAC Gravity Ventilators	A, B, C, F, M
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233813	Commercial Kitchen Hoods	A, B, C, D, E, F, G, J
233815	Grease Scrubbers	A, B, C, D, E, F, J, Q
234100	Particulate Air Filtration	A, B, C, E, F, L, Q
234200	Ultraviolet Light Emitters	A, B, C, E, F, Q
235100	Breechings, Chimneys, and Stacks	A, B, F, G, H, I
235113	Draft Control Devices	A, B, C, E, F, K
	ctric Boilers	B, C, E, F, K, Q
235216	Condensing Boilers	A, B, C, E, F, H, Q
235223	Cast-Iron Boilers	A, B, C, E, F, Q
	Finned-Copper Water-Tube Boilers Inclined Water-Tube Boilers	A, B, C, E, F, Q
	Bent Tube Boilers	A, B, C, E, F, K, Q
		A, B, C, E, F, K, Q
	Scotch Marine Boilers	A, B, C, E, F, Q
235243	Firebox Boilers	A, B, C, E, F, Q
235313	Boiler Feedwater Pumps	A, B, C, E, F, Q
235316	Deaerators	A, B, C, E, F, Q
235323	Boiler Accessories	A, B, C, E, F, Q
235400	Furnaces	B, C, E, F, K
235500	Fuel-Fired Heaters	B, C, E, F
235700	Heat Exchangers for HVAC	A, B, C, F, Q
236200	Packaged Compressor and Condenser Units	B, C, E, F, K, Q
236313	Air-Cooled Refrigerant Condensers	A, B, C, E, F, H
236333	Evaporative Refrigerant Condensers	A, B, C, D, E, F, Q
236416	Centrifugal Water Chillers	A, B, C, E, F, H, K, Q
236419	Reciprocating Water Chillers	A, B, C, E, F, K, Q
236423	Scroll Water Chillers	A, B, C, E, F, G, K,
236426	Rotary Screw Water Chillers	A, B, C, E, F, K, Q
236500	Cooling Towers	A, B, C, E, F, H, Q
236533	Liquid Coolers	A, B, C, D, E, F, H, Q
236534	Dry Coolers	A, B, C, D, E, F, H, Q
237200	Air-To-Air Energy Recovery Equipment	A, B, C, E, F, Q,
237313	Modular Indoor Central-Station Air-Handling Units	A, B, C, E, F, H, Q
237323	Custom Central Station Air Handling Units	A, B, C, E, F, H, Q
237333	Indirect-Fired Heating & Ventilating Units	A, B, C, D, E, F, K
237339	Direct-Fired Heating & Ventilating Units	A, B, C, D, E, F
237413	Outdoor Packaged Heating and Cooling Units	A, B, C, E, F, K, Q
237433	Dedicated Outdoor Air Units	A, B, C, E, F, K, Q
237439	Indoor Packaged Heating and Cooling Units	A, B, C, E, F, K, Q
237443	Evaporative Condensing Rooftop Units	A, B, C, E, F, K, Q
238120	Evaporative Cooling Units	
238123	Computer Room Air Conditioners	A, B, C, E, F, Q A, B, C, E, F, K
238126	Split System Air Conditioners	A, B, C, E, F, K A, B, C, E, F, K
238127	Variable Refrigerant Flow (VRF) Split AC Systems	A, B, C, D, E, F, H, I, J, K, M,
238146	Water-Source Unitary Heat Pumps	A, B, C, E, F, K, Q
238149	Rooftop Heat Pump Units	A, B, C, E, F, K, Q
238200	Terminal Heating and Cooling Units	A, B, C, E, F, L, M, Q
238313	Electric Snow and Ice Melting System	A, B, C, E, F, I, L
238316	Radiant Hydronic Piping System	A, B, C, E, F, I, L
238325	Chilled Beams	A, B, C, F
238413	Humidifiers (Dispersion Type)	A, B, C, E, F
238414	Humidifiers (Immersion Type)	A, B, C, E, F
238415	Clean Steam Generator	A, B, C, F, Q
238416	Mechanical Dehumidification Units	A, B, C, E, F, Q
238417	Desiccant Wheel Units	A, B, C, E, F, H, K, Q
238419	Swimming Pool Air Handling Units	A, B, C, E, F, K, Q

238500 Electric Heating Units

B, C, E, F, M

CODED LEGEND

Α	Shop Drawings
R	Product Data

- Product DataPerformance Data, Capacities, Curves and Certificates
- D Coordination DrawingsE Wiring DiagramsF Installation InstructionsG Welder's Certificates
- H Certificates
 I Calculations
 J Test Reports
 K Special Warranties
 L Material Samples
 M Color Samples
- N Schedules
 O Equipment List
 P Material List
- Q Recommended Spare Parts List

TABLE 2: SPARE PARTS REQUIREMENTS FOR MECHANICAL EQUIPMENT

Section No	umber	Received/Date/Initial
230553	Identification for HVAC Piping and Equipment	
230914	Refrigerant Monitoring Systems	
230915	Vehicle Emission Monitoring Systems	
232116	Hydronic Specialties	
232123	Hydronic Pumps	
232133	Hydronic Packaged Pumping Systems	
232216	Steam and Condensate Piping Specialties	
232223	Steam Condensate Pumps	
232500	HVAC Water Treatment	
233300	Air Duct Accessories	
233413	Axial HVAC Fans	
233416	Centrifugal HVAC Fans	
233423	HVAC Power Ventilators	
233433	Air Curtains	
233600	Air Terminal Units	
233713	Diffusers, Registers, and Grilles	
233813	Commercial Kitchen Hoods	
234100	Particulate Air Filtration	
234200	Ultraviolet Light Emitters	
235400	Furnaces	
235500	Fuel-Fired Heaters	
235700	Heat Exchangers for HVAC	
236333	Evaporative Refrigerant Condensers	
236500	Cooling Towers	
236533	Liquid Coolers	
236534	Dry Coolers	
233815	Grease Scrubbers	
237200	Air-To-Air Energy Recovery Equipment	
237313	Modular Indoor Central-Station Air-Handling Units	
237323	Custom Central Station Air Handling Units	
237333	Indirect-Fired Heating & Ventilating Units	
237339	Direct-Fired Heating & Ventilating Units	
237413	Outdoor Packaged Heating and Cooling Units	
237433	Dedicated Outdoor Air Units	
237439	Indoor Packaged Heating and Cooling Units	
237443	Evaporative Condensing Rooftop Units	
238120	Evaporative Coolers	
238123	Computer Room Air Conditioners	
238126	Split System Air Conditioners	
238127	Variable Refrigerant Flow (VRF) Split AC Systems	
238146	Water-Source Unitary Heat Pumps	
238149	Rooftop Heat Pump Units	
238200		
238416	Terminal Heating and Cooling Units Mechanical Dehumidification Units	
238417	Desiccant Wheel Units	
238417	Swimming Pool Air Handling Units	
230419	Swimming Fool All Handing Utiles	

Owner's Signature

TABLE 3: SPECIAL WARRANTY REQUIREMENTS FOR MECHANICAL EQUIPMENT

Section Number Received/Date/Initial

235233.22 235233.25 235239.13 235243 235400 236200 236416 236423 236426 237323 237433 237433 237433 237443 237439 237443 238123 238127 238126 238127 238146 238149 238316 238416	Variable Frequency Drives Direct Digital Control for HVAC Facility Fuel Oil Piping Hydronic Packaged Pumping Systems HVAC Water Treatment Pulsed Power Water Treatment System Silica Based Water Treatment System Caboratory Exhaust Fans Air Curtains Draft Control Devices Electric Boilers Condensing Boilers Cast-Iron Boilers Finned-Copper Water-Tube Boilers Inclined Water-Tube Boilers Bent Tube Boilers Scotch Marine Boiler Firebox Boilers Furnaces Packaged Compressor and Condenser Units Centrifugal Water Chillers Reciprocating Water Chillers Rotary Screw Water Chillers Custom Central Station Air Handling Units Indoor Indirect-Fired Heating & Ventilating Units Outdoor Packaged Heating and Cooling Units Dedicated Outdoor Air Units Indoor Packaged Heating and Cooling Units Evaporative Condensing Rooftop Units Computer Room Air Conditioners Split Systems Air Conditioners Variable Refrigerant Flow (VRF) Split AC Systems Water-Source Unitary Heat Pumps Rooftop Heat Pump Units Radiant Hydronic Piping System Mechanical Dehumidification Units	
	Radiant Hydronic Piping System	
	Mechanical Dehumidification Units	
238417	Desiccant Wheel Units	
238419	Swimming Pool Air Handling Units	

TABLE 4: SPECIAL INSPECTION REQUIREMENTS FOR MECHANICAL EQUIPMENT

Section Nu	mber	Completed/Date/Initial
235233.22 235233.25	Seismic Controls for Mechanical Systems Vibration Isolation for HVAC Piping and Equipment Electric Boilers Condensing Boilers Cast-Iron Boilers Finned-Copper Water-Tube Boilers Inclined Water-Tube Boilers Bent Tube Boilers Scotch Marine Boiler Firebox Boilers	
_00_10	1 HOUGH BOHOLO	

TABLE 5: MECHANICAL SPECIFICATION OPERATION AND MAINTENANCE SUBMITTAL REQUIREMENTS

SPECIFICA	ATION NUMBER/TITLE	CODE DESIGNATION
230514 230516 230519 230529 230548 230550 230553 230593 230700 230800 230914 230915 230921 230921 230923 23113 232113 232113 232115 232116 232123 23213 232216 23223 232300 232313	Variable Frequency Drives Expansion Fittings and Loops for HVAC Piping Meters and Gauges for HVAC Piping Hangers and Supports for HVAC Piping and Equipment Seismic Controls for Mechanical Systems Vibration Isolation for HVAC Piping and Equipment Identification for HVAC Piping and Equipment Testing, Adjusting and Balancing for HVAC HVAC Insulation Commissioning of HVAC Systems Instrumentation and Control Devices for HVAC Refrigerant Monitoring Systems Vehicle Emission Monitoring Systems Pneumatic Control Systems Direct-Digital Control for HVAC Small Building Control Panel Facility Fuel Oil Piping Hydronic Piping Underground Hydronic and Steam Piping Mechanically Joined Hydronic Piping Systems Ground Loop Heat Pump Piping Hydronic Specialties Hydronic Packaged Pumping Equipment Steam and Condensate HVAC Piping Steam and Condensate Piping Specialties Steam Condensate Pumps Refrigerant Piping	CODE DESIGNATION B, C, D, E, G, H, I A, B B, G, I B A, B, C A, B, C B F A, B, C, D, E, G, H, I A, B, C, D, E, G, H A, B, C, D, E, G, H A, B, C, D, E, G, H A, B, C, I B, C, D, E, G, H, I A, B, C, I B, C, D, E, G, H, I A, B, C, I B, C, D, E, G, H, I A, B, C, I A, B, C, I B, C, D, G, H, I A, B, C, I
232313 232500 232520 232540 233113 233116 233117 233300 233413 233423 233427 233423 233427 233433 233600 233713 233723 233813 233815 234100 234200 235100 235113	VRF Refrigerant Piping HVAC Water Treatment Pulsed Power Water Treatment System Silica Based Water Treatment System Metal Ducts Non-Metal Ducts Fabric Ducts Air Duct Accessories Axial HVAC Fans Centrifugal HVAC Fans HVAC Power Ventilators Laboratory Exhaust Fans Air Curtains Air Terminal Units Diffusers, Registers and Grilles HVAC Gravity Ventilators Commercial Kitchen Hoods Grease Scrubbers Particulate Air Filtration Ultraviolet Light Emitters Breechings, Chimneys And Stacks Draft Control Devices	A, B, F, I B, C, D, E, G, H, I A, B, C, D, E, F, G, I A, B A, B A, B B, H B, C, G, I B, C, G, I B, C, G, I B, C, D, E, G, H, I C, H C, H A, B, C, D, E, G, H, I A, B A, B, C, D, E, G, H, I

005040	Floatria Dailara	B
235213	Electric Boilers	B, C, D, E, G, H, I
235216	Condensing Boilers	B, C, D, E, G, H, I
235223	Cast-Iron Boilers	B, C, D, E, G, H, I
	Finned Copper Water Tube Boilers	B, C, D, E, G, H, I
235233.22	Inclined Water-Tube Boilers	B, C, D, E, G, H, I
235233.25	Bent Tube Boilers	B, C, D, E, G, H, I
235239.13	Scotch Marine Boiler	B, C, D, E, G, H, I
235243	Firebox Boilers	B, C, D, E, G, H, I
235313	Boiler Feedwater Pumps	B, C, D, E, G, H, I
235316	Deaerators	B, C, D, E, G, H, I
235323	Boiler Accessories	B, C, D, E, G, H, I
235400	Furnaces	B, C, D, E, G, I
235500	Fuel-Fired Heaters	B, C, D, E, H, I
235700	Heat Exchangers for HVAC	B, C, G, H, I
236200	Packaged Compressor and Condensing Units	B, C, D, E, I
236313	Air-Cooled Refrigerant Condensers	B, C, D, E, G, H, I
236333	Evaporative Refrigerant Condensers	B, C, D, E, G, H, I
236416	Centrifugal Water Chillers	B, C, D, E, G, H, I
236419	Reciprocating Water Chillers	
	Scroll Water Chillers	B, C, D, E, G, H, I
236423		B, C, D, E, G, H, I
236426	Rotary Screw Water Chillers	B, C, D, E, G, H, I
236500	Cooling Towers	B, C, D, E, G, H, I
236533	Liquid Coolers	B, C, D, E, G, H, I
236534	Dry Coolers	B, C, D, E, G, H, I
237200	Air-To-Air Energy Recovery Equipment	B, C, D, E, H, I
237313	Modular Indoor Central Station Air Handling Units	B, C, D, H, G, I
237323	Custom Central Station Air Handling Units	B, C, D, H, G, I
237333	Indirect-Fired Heating & Ventilating Units	B, C, D, E, G, I
237339	Direct-Fired Heating & Ventilating Units	B, C, D, E, G, I
237413	Outdoor Packaged Heating and Cooling Units	B, C, D, E, G, H, I
237433	Dedicated Outdoor Air Units	B, C, D, E, G, H, I
237439	Indoor Packaged Heating and Cooling Units	B, C, D, E, G, H, I
237443	Evaporative Condensing Rooftop Units	B, C, D, E, G, H, I
238120	Evaporative Cooling Units	B, C, D, G, H, I
238123	Computer Room Air Conditioners	B, C, D, E, G, I
238127	Variable Refrigerant Flow (VRF) Split AC Systems	B, C, D, E, F, G, H, I
238146	Water-Source Unitary Heat Pumps	B, C, D, E, G, H, I
238149	Rooftop Heat Pump Units	B, C, D, E, G, H, I
238200	Terminal Heating and Cooling Units	B, C, D, H, I
238313	Electric Snow and Ice Melting System	A, B, G, I
238316	Radiant Hydronic Piping System	A, B, G, I
238325	Chilled Beams	B, C, E, G, I
238413	Humidifiers (Dispersion Type)	
	` ' '	B, C, D, E, G, H, I
238414	Humidifiers (Immersion Type)	B, C, D, E, G, H, I
238415	Clean Steam Generators	B, C, D, G, H, I
238416	Mechanical Dehumidification Units	B, C, D, E, H, I
238417	Desiccant Wheel Units	B, C, D, G, H, I
238419	Swimming Pool Air Handling Units	B, C, D, E, G, H, I
238500	Electric Heating Units	B, C, D, E, I

CODED LEGEND

A As-Built Drawings
B Product Data

- C Performance Data, Capacities, Curves and Certificates
- D Wiring Diagrams
- E Operating Instructions
- F Test Reports
- G Warranties
- H Recommended Spare Parts List
- I Service and Maintenance Instructions

SUBSTITUTION REQUEST FORM

To Project Engineer:	Request # (GC Determined):	
Project Name:		
Project No/Phase:	Date:	
Specification Title:		
Section Number: Page	e: Article/Paragraph:	
Proposed Substitution:		
Manufacturer:	Model No.:	
Address:	Phone:	
History: ☐ New product ☐ 1-4 years old ☐ 5-1	10 years old	
Differences between proposed substitution and specif	fied Work:	
Point-by-point comparative data attached – REQU Comparative data may include but not be limited to pervisual effect, sustainable design characteristics, warranched all information necessary for an evaluation.	erformance, certifications, weight, size, durability,	
Supporting Data Attached:	☐ Product Data ☐ Samples ☐ Reports ☐ Other:	
Reason for not providing specified item:		
Similar Installation: Project:	Architect:	
Address:	Owner:	
	Date Installed:	
Proposed substitution affects other parts of Work:	☐ No ☐ Yes; explain:	

Substitution Certification Statement:

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner that the:

- A. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
- B. Proposed substitution is consistent with the Contract Documents and will produce indicated results.
- C. Proposed substitution does not affect dimensions and functional clearances.
- D. Proposed substitution has received necessary approvals of authorities having jurisdiction.
- E. Same warranty will be furnished for proposed substitution as for specified Work.
- F. Same maintenance service and source of replacement parts, as applicable, is available.
- G. Proposed substitution will not adversely affect other trades or delay construction schedule.
- H. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitting Contractor	Date	Company
Manufacturer's Certification of Equal Quality:		
I represent th hereby certify and warrant to Architect, Engineer, Substitution meets or exceeds the Specified Item	and Owner that the fund	roposed Substitution item and ction and quality of the Proposed
Manufacturer's Representative	Date	Company
Engineer Review and Recommendation Section	on	
Recommend Acceptance	☐ No	
Additional Comments:	ched	
Acceptance Section:		
Contractor Acceptance Signature	Date	Company
Owner Acceptance Signature	Date	Company
Architect Acceptance Signature	Date	Company
Engineer Acceptance Signature	Date	Company

SECTION 230015

ELECTRICAL COORDINATION FOR MECHANICAL EQUIPMENT

PART 1 - General Requirement

1.1 SUMMARY

- A. This Section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory furnished motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.
- C. System shall be complete and operational with power and control wiring provided to meet the design intent shown on the drawings and specified within the specification sections.

1.2 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification Sections.

1.3 QUALITY ASSURANCE

- A. Electrical components and materials shall be UL labeled.
- B. All electrical equipment provided and the wiring and installation of electrical equipment shall be in accordance with the requirements of this Section and Division 26.

PART 2 - Products and Materials

1.4 GENERAL

- A. The Contractors shall provide all motors, starters, disconnects, wire, conduit, etc. as specified in the Construction Documents. If, however, the Division 23 Contractor furnishes a piece of equipment requiring a different motor, starter, disconnect, wire size, etc. than what is shown and/or intended on the Construction Documents, this Contractor shall coordinate the requirements with any other Contractor and shall be responsible for any additional cost incurred by any other Contractor that is associated with installing the different equipment and related accessories for proper working condition.
- B. Refer to Division 26, "COMMON WORK RESULTS FOR ELECTRICAL" for specification of motor connections.
- C. Refer to Division 26, "ENCLOSED CONTROLLERS" for specification of motor starters.
- D. Refer to Division 26, "ENCLOSED SWITCHES AND CIRCUIT BREAKERS" for specification of disconnect switches and enclosed circuit breakers.

PART 3 - EXECUTION

1.5 CONTRACTOR COORDINATION

- A. Unless otherwise indicated, all motors, equipment, controls, etc. shall be furnished, set in place and wired in accordance with Table 1. Any items not listed but shown on the drawings shall be considered part of the Contract Documents and brought to the attention of the Architect.
- B. The General Contractor is the central authority governing the total responsibility of all trade contractors. Therefore, deviations and clarifications of this schedule are permitted provided the General Contractor assumes responsibility to coordinate the trade contractors different than as indicated herein. If deviations or clarifications to this schedule are implemented, submit a record copy to the Engineer.

TABLE 1: ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

ITEM	FURN BY	SET BY	POWER WIRING	CONTROL WIRING
Equipment motors	DIV23m	DIV23m	DIV26	
Motor control centers	DIV26	DIV26	DIV26	DIV23t
Factory furnished motor starters	DIV23m	DIV23m	DIV26	DIV23t
contactors and disconnects				
Overload heaters	DIV23m	DIV26		
Loose motor starters, disconnect	DIV26	DIV26	DIV26	DIV23t
switches, thermal overloads				
and heaters.	D.I. (00	DII (00	DII (00	D1) (00)
Variable speed drives	DIV23m	DIV23m	DIV26	DIV23t
Manual operating multi-speed switches	DIV23m	DIV26	DIV26	DIV23t
Control relays	DIV23t	DIV23t	DIV26	DIV23t
Thermostats (line voltage)	DIV23t DIV23m	DIV23t DIV23m	 DIV26	DIV23t
Thermostats (line voltage) Time switches	DIV23III DIV23t	DIV23III DIV23t	DIV26	DIV23t
(for mechanical equipment)	DIVZ3l	DIVZSI	DIVZO	DIVZSL
Control power transformers	DIV23t	DIV23t	DIV26	DIV23t
Control power transformers	DIV23t	DIV23t	DIV26	DIV23t
furnished with equipment	DIVZJIII	DIVZJIII	DIVZO	DIVZJ
Temperature control panels	DIV23t	DIV23t	DIV26	DIV23t
(housing controllers)	DIVZSt	DIVZSt	DIVZO	DIVZJ
Building controllers, advanced	DIV23t	DIV23t	DIV23t	DIV23t
application controllers, and	B1720t	D17200	D17200	D11200
application specific controllers				
Motor and solenoid operated valves	DIV23t	DIV23m	DIV23t	DIV23t
Presssure independent control valves	DIV23t	DIV23m	DIV23t	DIV23t
Damper operators, PE & switches	DIV23t	DIV23t	DIV23t	DIV23t
Smoke dampers and combination	DIV23m	DIV23m	DIV26	DIV28
fire/smoke dampers				
Smoke dampers for smoke	DIV23t	DIV23m	DIV26	DIV23t/28
control system				
Duct Smoke detectors	DIV28	DIV23m	DIV28	DIV28
Refrigeration equipment and controls	DIV23m	DIV23m	DIV26	DIV23t
Pushbutton stations and connections	DIV23m	DIV23m	DIV26	DIV23t
Temporary heating connections	DIV23m	DIV23m	DIV26	DIV23m
Interlocks between cooling tower				DIV23m
or evaporative condenser and				
chemical treatment pump(s)				
Interlocks between basin heater for				DIV23m
cooling tower or evaporative				
condenser and sump				
temperature sensor				DI) (00
Interlocks between chiller control panel				DIV23m
and pump(s)				DIV23m
Interlocks between air handling units and exhaust fans				DIVZSIII
Interlocks between HVAC fans			DIV26	DIV23t
and damper operators	-		DIVZU	DIVZJI
Interlocks between kitchen exhaust				DIV23m
hood(s) and make-up air unit(s)				2.1120111

DIV23m = Mechanical Contractor DIV26 = Electrical Contractor DIV28 = Electronic Safety and Security DIV23t = Temperature Controls Sub-Contractor

END OF SECTION 230015

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - General Requirements

1.1 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with mechanical installations as follows:
 - Access panels and doors in walls, ceilings, and floors for access to mechanical materials and equipment.
 - 2. Mechanical equipment nameplate data.
 - 3. Concrete for bases and housekeeping pads.
 - 4. Non-shrink grout for equipment installations.
 - 5. Sleeves for mechanical penetrations.
 - 6. Drip Pans with detection.
 - 7. Miscellaneous metals for support of mechanical materials and equipment.
 - 8. Wood grounds, nailers, blocking, fasteners, and anchorage for support of mechanical materials and equipment.
 - 9. Joint sealers for sealing around mechanical materials and equipment.
 - 10. Sealing penetrations through noise critical spaces.
 - 11. Plenum insulation for enclosure of combustible items located within fire-rated plenums.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 07 Section "Penetration Firestopping" for material and methods for firestopping systems.
 - 2. Division 23 Section "Basic Piping Materials and Methods," for materials and methods for mechanical sleeve seals.
 - 3. Division 23 Section "Direct Digital Controls for HVAC" for integration with building automation system of leak detection system "Water Present" alarm.
 - 4. Division 26 Section "Common Work Results for Electrical" required electrical devices.
 - 5. Division 26 Sections "Enclosed Switches and Circuit Breakers" for field-installed disconnects.

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Division 01 and Division 23 Section General Mechanical Requirements.
 - 1. Product data for the following products:
 - a. Access panels and doors.
 - b. Joint sealers.

- c. Through and membrane-penetration firestopping systems.
- d. Plenum insulation.
- Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for mechanical materials and equipment.
- 3. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.
- Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut-off of utility services and details for dust and noise control.
 - a. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 01 Section "Summary of Work."
- Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.
 - a. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.3 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Fire-Resistance Ratings: Where a fire-resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.
 - 1. Provide UL Label on each fire-rated access door.
- C. Through and Membrane Penetration Firestopping Systems Installer Qualifications: A firm experienced in installing penetration firestopping systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

PART 2 - Products and Materials

1.4 ACCESS TO EQUIPMENT

- A. Manufacturers:
 - 1. Bar-Co., Inc.
 - 2. Elmdor Stoneman.
 - 3. JL Industries
 - 4. Jay R. Smith Mfg. Co.

- 5. Karp Associates, Inc.
- 6. Milcor
- 7. Nystrom Building Products
- 8. Wade
- 9. Zurn

B. Access Doors:

- 1. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- 2. Frames: 16-gauge steel, with a 1-inch-wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling.
 - For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inchwideexposed perimeter flange and adjustable metal masonry anchors.
 - b. For installation in gypsum wallboard or plaster: perforated flanges with wallboard bead.
 - c. For installation in full-bed plaster applications: galvanized, expanded metal lath and exposed casing bead, welded to perimeter of frame.
- 3. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
 - Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and selfclosing mechanism.
- 4. Locking Devices: Flush, screwdriver-operated cam locks.
- Locking Devices: Where indicated on the drawings or where access panels are installed in locations accessible to the public, provide 5-pin or 5-disc type cylinder locks, individually keyed; provide 2 keys.

1.5 MECHANICAL EQUIPMENT NAMEPLATE DATA

A. For each piece of power operated mechanical equipment, provide a permanent operational data nameplate indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliance's, and similar essential data. Locate nameplates in an accessible location.

1.6 CONCRETE EQUIPMENT BASES/HOUSEKEEPING PADS

- A. Provide concrete equipment bases and housekeeping pads for various pieces of floor mounted mechanical equipment. Concrete equipment bases/housekeeping pads shall generally conform to the shape of the piece of equipment it serves with a minimum 4" margin around the equipment and supports.
- B. Form concrete equipment bases and housekeeping pads using framing lumber or steel channel with form release agent. Chamfer top edges and corners. Trowel tops and sides of each base/pad to a smooth finish, equal to that of the floors.
- C. Concrete equipment bases and housekeeping pads shall be made of a minimum 28 day, 4000 psi concrete conforming to American Concrete Institute Standard Building Code for Reinforced Concrete (ACI 318-99) and the latest applicable recommendations of the ACI standard practice manual. Concrete shall be composed of cement conforming to ASTM C 150 Type I, aggregate conforming to ASTM C33, and potable water. All exposed exterior concrete shall contain 5 to 7 percent air entrainment.

- D. Unless otherwise specified or shown on the structural drawings, reinforce equipment bases and housekeeping pads with No. 4 reinforcing bars conforming to ASTM A 615 or 6x6 W2.9 x W2.9 welded wire mesh conforming to ASTM A185. Reinforcing bars shall be placed 24" on center with a minimum of two bars each direction.
- E. Provide galvanized anchor bolts for all equipment placed on concrete equipment bases and housekeeping pads or on concrete slabs. Anchor bolts size, number and placement shall be as recommended by the Manufacturer of the equipment.
- F. Concrete equipment bases and housekeeping pads shall have height as specified on the drawings or minimum height if not specified in accordance with the following table:

Equipment	Minimum Height
Furnaces, Exterior Equipment Less than or equal to 20 tons and Other Equipment Not Listed	3-1/2"

NOTES:

1. Height of equipment bases applies to equipment installed on slab-on-grade. For equipment installed on floors above grade and/or roof, reference the drawings.

1.7 GROUT

- A. Provide nonshrink, nonmetallic grout conforming to ASTM C 1107, Grade B, in premixed and factory-packaged containers.
- B. Grout shall have post-hardening, volume-adjusting, dry, non-staining, non-corrosive, non-gaseous, hydraulic-cement characteristics and shall be as recommended by manufacturer for interior and exterior applications.
- C. Grout shall have 5,000 psi, 28-day compressive strength design mix.

1.8 PENETRATIONS

A. Sleeves:

- 1. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A-53 grade A or 12 gauge (0.1084 inches) welded galvanized steel formed to a true circle concentric to the pipe.
- 2. Sheet-Metal Sleeves: 10 gauge (0.1382 inches), galvanized steel, round tube closed with welded longitudinal joint.
- B. Frames for rectangular openings attached to forms and of a maximum dimension established by the Architect. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, provide 18 gauge (0.052 inches) welded galvanized steel. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, provide 10 gauge (0.1382 inches) welded galvanized steel. Notify the General Contractor or Architect before installing any box openings not shown on the Architectural or Structural Drawings.

1.9 DRIP PANS

A. Drip pans for pipes in protected areas shall be 20 gauge galvanized steel with 2" lapped and soldered joints. Drip pan shall have a depth of 2" and a width of 6" in addition to the diameter of the associated pipe. Provide 3/4" galvanized pipe with male NPT outlet at low point of drip pan. Connect 3/4" type "L" copper indirect drain line to drip pan outlet. Route and discharge to receptor with air gap outside of the protected area.

- B. Drip pan supports shall be ¼" X 2" galvanized bar stock welded to the drip pan without holes. Provide ¼" galvanized threaded rods through bar stock on each side of the drip pan and attached with 2 nuts per rod. Attach rods to structure with MSS SP-58 compliant components.
- C. Leak Detection System: Rope style leak sensor and controller capable of connecting to a building automation system with audible and visual alarms for leak detection in all drip pans unless otherwise noted on drawings.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chatsworth Products, Inc.
 - b. RLE Technologies
 - c. Upsite Technologies
 - d. W.E. Anderson, a division of Dwyer Instruments
- D. Flood Detector: Flood detector switch utilizing hydrophilic pad and stainless steel sensor array to detect moisture. Switch shall be provided with integral feet to prevent pad from contacting the pan. Provide with solid state electronics and double throw relay to allow switch to shut down unit and provide an auxiliary alarm output.
 - Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diversitech or approved equivalent

1.10 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold-Formed Steel Tubing: ASTM A 500.
- C. Hot-Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Fasteners: Zinc-coated, type, grade, and class as required.

1.11 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light-framing-size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPA rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP-2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C-D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less that 15/32 inches.

1.12 JOINT SEALERS

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.
- C. Elastomeric Joint Sealers: Provide the following types:
 - One-part, nonacid-curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacture. Provide one of the following:
 - a. "Dow Corning 790," Dow Corning Corp.

- b. "Silglaze II SCS 2801," General Electric Co.
- c. "Silpruf SCS 2000," General Electric Co.
- d. "864," Pecora Corp.
- e. "Rhodia 5C," Rhone-Poulenc, Inc.
- f. "Spectrem 1," Tremco, Inc.
- g. "Spectrem 2," Tremco, Inc.
- h. "Dow Corning 795," Dow Corning Corp.
- i. "Rhodia 7B," Rhone-Poulenc, Inc.
- j. "Rhodia 7S," Rhone-Poulenc, Inc.
- k. "Omniseal," Sonneborn Building Products Div.
- 2. One-part, mildew-resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non-traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in-service exposure to conditions of high humidity and temperature extremes. Provide one of the following:
 - a. "Dow Corning 786," Dow Corning Corp.
 - b. "Sanitary 1700," General Electric Co.
 - c. "898 Silicone Sanitary Sealant," Pecora Corp.
- D. Acrylic-Emulsion Sealants: One-part, nonsag, mildew-resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent. Provide one of the following:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Chem-Calk 600," Bostik Construction Products Div.
 - b. "AC-20," Pecora Corp.
 - c. "Tremflex 834," Tremco, Inc.
 - d. "CP 506", Hilti, Inc.
 - e. "CP 572", spray application, Hilti, Inc.

1.13 ACOUSTICAL SEALANTS

- A. General: Penetrations by ducts, pipes and conduit through surfaces that are around and between noise critical spaces shall be sleeved, packed and sealed airtight with foam rod, non-hardening sealant and/or packing material as described herein.
- B. Foam Rod: Foam backer rod shall be closed cell polyethylene suitable for use as a backing for non-hardening sealant.
- C. Non-Hardening Sealant: Sealant for penetrations shall be non-hardening polysulphide type. Permanently flexible, approved firestop putty may be used in lieu of the sealant on foam rod in noise critical walls that are also fire rated.
 - Manufacturers:
 - a. USG Acoustical sealant
 - b. Pre-approved equal.

D. Packing Material: Mineral fiber; non-combustible; resistant to water, mildew and vermin. Expanding resilient foams manufactured for this purpose are an acceptable alternative only if the material density is at least 15 pcf (40 kg/m3).

1.14 PLENUM INSULATION

- A. General: Combustible materials including, but not limited to, plastic pipe and plastic-coated cables that do not meet the minimum combustibility requirements of the applicable building codes may be installed in fire-rated plenums when enclosed within high-temperature insulation blanket where approved by the authority having jurisdiction.
- B. Material: FyreWrap 0.5 Plenum Insulation, ETS Schaefer Plenumshield Blanket, Thermal Ceramics PlenumWrap+, or equivalent utilizing light weight, high temperature blanket enhanced for biosolubility. The encapsulating material shall be aluminum foil with fiberglass reinforcing scrim covering.
- C. Certification: Plenum insulation shall have an encapsulated flame spread rating less than 25 and a smoke developed rating of less than 50. The product shall be UL 1887 (Modified) listed, certified by ASTM E-136 for Non-combustibility and ASTM E-84/UL 723 for Surface Burning Characteristics.
- D. Physical Properties: Plenum insulation shall be single 1" minimum layer with a density of 2 to 6 pounds per cubic foot.

PART 3 - EXECUTION

1.15 INSTALLATION, GENERAL

A. Install products in accordance with manufacturer's instructions.

1.16 INSTALLATION OF ACCESS DOORS

- A. Provide access doors for all concealed equipment and duct and piping accessories that require service where indicated or as required, except where above lay-in ceilings. Refer to Section "Identification for HVAC Piping and Equipment" for labeling of access doors.
- B. Access doors shall be adequately sized for the devices served with a minimum size of 18 inches x 18 inches, furnished by the respective Contractor or Subcontractor and installed by the General Contractor.
- C. Access doors must be of the proper construction for type of construction where installed.
- D. The exact location of all access doors shall be verified with the Architect prior to installation.
- E. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- F. Adjust hardware and panels after installation for proper operation.

1.17 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

1.18 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

- B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

1.19 PREPARATION FOR JOINT SEALERS

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

1.20 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
 - 2. Comply with recommendations of ASTM C 790 for use of acrylic-emulsion joint sealants.
- B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; 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.

1.21 PENETRATIONS:

A. New Construction:

- Coordinate with Divisions 03 and 04 for installation of sleeves and sleeve seals integrally in cast-in-place, precast, and masonry walls and horizontal slabs where indicated on the Drawings or as required to support piping or ductwork penetrations.
- B. Construction in Existing Facilities:
 - 1. Saw cut or core drill existing walls and slabs to install sleeves and sleeve seals in existing facilities. Do not cut or drill any walls or slabs without first coordinating with, and receiving approval from, the Architect, Owner, or both. Seal sleeves and sleeve seals into concrete walls or slabs with a waterproof non-shrink grout acceptable to the Architect.
- C. Provide sleeves and/or box frames for openings in all concrete and masonry construction and fire or smoke partitions, for all mechanical work that passes through such construction; Coordinate with other trades and Divisions to dimension and lay out all such openings.
- D. The General Contractor will provide only those openings specifically indicated on the Architectural or Structural Drawings as being provided under the General Contractor's work.
- E. The cutting of new or existing construction shall not be permitted except by written approval of the Architect.
- F. Floor sleeves shall be fitted with means for attachment to forms and shall be of length to extend at least two inches above the floor level.
- G. All sleeves shall be of ample size to allow for movement of conduit, duct or pipe and insulation through the sleeves without damage to the insulation.
- H. Cut sleeves to length for mounting flush with both surfaces of walls.
- I. Extend sleeves installed in floors 2 inches above finished floor level.

- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
- K. Seal space outside of sleeves with approved joint compound for penetrations of gypsum board assemblies.
- L. All openings sleeved through underground exterior walls shall be sealed with mechanical sleeve seals as specified in Division 23 Section "Basic Piping Materials and Methods".

1.22 DRIP PANS

- A. Provide drip pans in locations indicated on drawings.
- B. Provide drip pans for piping or equipment installed over electrical panels in variance with the drawings. Obtain approval from the Architect prior to installation.
- C. Provide drip pans for piping directly above a two hour rated ceiling of an elevator machine room.
- D. Provide drip pans, only with written approval obtained prior to installation, installed beneath piping above electrical rooms, telecom rooms, data rooms, servers or any other protected area not clearly indicated by drawings.
- E. Provide drip pan supports every 4'-0".
- F. Install leak detection rope in a zig-zag pattern covering entire length and width of the drip pan. Secure rope to pan per manufacturers recommendations.
- G. Mount leak detection controller on wall adjacent to exit of the room above which the drip pan is located unless otherwise indicated on drawings indicated on drawings.
- H. Coordinate disconnect and power supply for leak detection system and 120V dedicated receptacle adjacent to controller with Division 26. Power wiring and receptacles are specified in Division 26 Section "Common Work Results for Electrical". Disconnects are specified in Division 26 Section "Enclosed Switches and Circuit Breakers"
- I. Place flood detector in the lowest location in the drip pan. Interlock detector with the HVAC equipment per manufacturer's recommendations.
- J. Wire flood detector to remote alarm, Diversitech Universal Alarm or equivalent. Coordinate location of the remote alarm with building owner prior to installation.
- K. Coordinate interlock of "Water Present" alarm with building automation system. Refer to Division 23 Section "Direct Digital Controls for HVAC" for integration with building automation system and low voltage power wiring.

1.23 ACOUSTICAL PENETRATIONS

- A. General: There shall be no direct contact of Sheet Metal or piping with shaft walls, floor slabs and/or partitions. All openings around pipes and ducts in the structure surrounding the mechanical equipment and surrounding noise-critical spaces shall be sealed, packed with caulking for the full depth of the penetration, as described herein. This includes all slab penetrations and penetrations of noise critical walls.
- B. Duct Penetrations: Where each duct passes through a wall, floor or ceiling of a noise critical space, there shall be a clear annular space of 1 inch between the duct and structure. After all of the ductwork is installed, the Contractor shall check the clearance, pack the voids full depth with packing material and caulk both ends with non-hardening sealant backed by foam rod or permanently flexible firestop material. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.
- C. HVAC Piping

1. Where a pipe passes through a wall, ceiling or floor slab of a noise critical space, a steel sleeve shall be cast or grouted into the structure. The internal diameter of the sleeve shall be 2 inches larger than the external diameter of the pipe passing through it. After all of the piping is installed in that area, the Contractor shall check the clearance and correct it, if necessary, to within 1/2 inch. Pack the void full depth with packing material sealed at both ends, 1 inch deep, with non-hardening sealant backed by foam rod.

1.24 PLENUM INSULATION

- A. General: Plenum insulation shall be installed as a single layer encapsulation applied directly on the surface of combustible items within fire-rated plenums where permitted by the local authority having jurisdiction
- B. Overlap: Provide a minimum 1" perimeter and longitudinal overlap at all seams and joints. Seal all cut edges with aluminum foil tape. There shall be no exposed fiber.
- C. Secure Attachment: Securely attach insulation using stainless steel tie wire or banding at locations and intervals as recommended by the manufacturer. The entire installation shall comply with the manufacturer's written installation instructions.
- D. Approval: Plenum insulation shall not be installed where not allowed by local authority having jurisdiction. Do not install combustible material within fire-rated plenums where the use of plenum insulation is not approved.

END OF SECTION 230500

SECTION 230510

BASIC PIPING MATERIALS AND METHODS

PART 1 - General Requirements

1.1 SUMMARY

- A. This Section specifies piping materials and installation methods common to more than one Section of Division 23 and includes the following:
 - 1. Joining materials.
 - 2. Piping specialties.
 - 3. Roof curbs for pipe penetrations.
 - Basic piping installation instructions.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - Division 23 Section "Common Work Results for HVAC," for materials and methods for sleeve materials.
 - 2. Division 26 Sections "Common Work Results for Electrical" and "Enclosed Controllers" for power-supply wiring including field-installed disconnects and required electrical devices.

1.2 SUBMITTALS

- A. Refer to Division 01 and Division 23 Section "General Mechanical Requirements" for administrative and procedural requirements for submittals.
- B. Product Data: Submit product data on the following items:
 - 1. Escutcheons.
 - 2. Dielectric Flanges and Flange Kits.
 - 3. Dielectric Unions.
 - 4. Dielectric Waterway Fittings.
 - Mechanical Sleeve Seals.
 - 6. Pipe Roof Curbs.
 - 7. Pipe Freeze Protection System.
 - 8. Wall Pipes.
- C. Quality Control Submittals:
 - 1. Submit welders' certificates specified in Quality Assurance below.
- D. Piping Schedule: Submit a piping schedule that states the material being proposed for each piping system in the project including manufacturer, pipe sizes, type, grade, schedule, and ASTM standard and connection method(s).
- E. Submit a schedule of dissimilar metal joints and dielectric flanges, flange kits, unions, or waterway fittings. Include proposed product, joint type materials, and connection method to isolate dissimilar metals. Refer to the individual Division 23 piping system specification sections for piping materials and fittings relative to that particular system and additional requirements.
- F. Submit certification that fittings and specialties are manufactured in plants located in the United States or certified that they comply with applicable ANSI and ASTM standards.

1.3 QUALITY ASSURANCE

- A. Welder's Qualifications: All welders shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.
- B. Welding procedures and testing shall comply with ANSI Standard B31.9 Standard Code for Building Services Piping, and The American Welding Society, Welding Handbook.
- C. Soldering and Brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.
- D. Pipe freeze protection system shall be listed and classified by Underwriter's Laboratories, Inc. as suitable for purpose intended.
- E. Pipe specialties and fittings shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide piping materials and specialties from one of the following:
 - 1. Escutcheons:
 - a. AWI Manufacturing.
 - b. Keeney Manufacturing Company.
 - c. Wal-Rich Corp.
 - d. Jones Stephens Corp.
 - 2. Dielectric Flanges and Flange Kits:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Matco-Norca
 - d. Pipeline Seal & Insulator, Inc..
 - e. Tampa Rubber & Gasket Co. Inc.
 - f. Watts Water Technologies
 - 3. Dielectric Unions:
 - a. Hart Industries.
 - b. Matco-Norca.
 - c. Victaulic Company of America.
 - d. Watts Regulator Co.
 - 4. Dielectric Waterway Fittings:
 - a. Grinnell Mechanical Products.
 - b. Matco-Norca.
 - Victaulic Company of America (Sweat and threaded connections only).
 - 5. Mechanical Sleeve Seals:
 - Thunderline/Link Seal
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - 6. Pipe Roof Curbs
 - a. Custom Curb, Inc.
 - b. Pate Company.

- c. Thycurb.
- 7. Wall Pipes
 - a. Josam Mfg. Co.
 - b. Smith (Jay R) Mfg. Co.
 - c. Tyler Pipe/Wade Div.; Subs. of Tyler Corp.
 - d. Watts Industries. Inc.
 - e. Zurn Industries, Inc.; Hydromechanics Div.

2.2 PIPE AND FITTINGS

- A. Refer to the individual piping system specification sections in Division 23 for specifications on piping and fittings relative to that particular system.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 Piping Sections for special joining materials not listed below.
- B. Welding Materials: AWS D10.12; Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
- C. Brazing Materials: AWS A5.8; Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.
- D. Soldering Materials: ASTM B32; Refer to individual piping system specifications for solder appropriate for each respective system.
- E. Gaskets for Flanged Joints: ASME B16.21; Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select material, thickness, and type to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.4 PIPING SPECIALTIES

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.
- B. Dielectric Unions: Factory-fabricated with cast bronze body meeting ASTM B584 and galvanized or black steel body with plastic dielectric gasket, class 125 for low pressure service and class 250 for high pressure service, and appropriate end connections for the pipe materials in which installed (screwed or soldered) to effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- A. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining, and appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged) to effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion..
- B. Dielectric Flanges and Flange Kits:
 - Full-faced gasket with same outside diameter and bolt hole arrangement as the flange. Conform to ANSI B16.5. Pressure rating of 200 psi for low pressure service and 400 psi for high pressure service at a continuous operating temperature of 180F.
 - 2. Steel washers, thermoplastic washers and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves.
 - 3. Flanges: Cast bronze meeting ASTM B584, class 125 solder type or cast iron meeting ASTM A536, class 125 threaded type for low pressure service, bronze class 250 solder type or cast iron class 250 threaded type for high pressure service.

C. Sleeves:

- 1. Sleeve: Refer to Division 23 Section "Common Work Results for HVAC" for sleeve materials.
- 2. Wall Pipes: cast iron soil pipe, ASTM A74, with retaining ring.
- D. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
- E. Pipe Roof Curbs: Provide factory-fabricated, pipe roof curbs with the following features:
 - 1. Factory installed treated wood nailer.
 - 2. Welded, 18 gauge galvanized steel shell, base plate and flashing.
 - 3. 1-1/2" thick, 3 pound rigid insulation.
 - 4. Fully mitered 3-inch raised cant.
 - 5. Cover of weather-resistant, weather-proof material.
 - 6. Pipe collar of weather-resistant material with stainless steel pipe clamps.

2.5 WALL PIPES

- A. Cast-iron sleeve with integral clamping flange with clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

PART 3 - **EXECUTION**

3.1 INSTALLATION, GENERAL

A. Install products in accordance with manufacturer's instructions.

3.2 PREPARATION

- A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.3 INSTALLATIONS

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.
- B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.
- C. Install piping free of sags and bends and with ample space between piping to permit proper insulation applications.
- D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.
- E. Install horizontal piping as high as possible allowing for specified slope and coordination with other components. Install vertical piping tight to columns or walls. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- G. Support piping from structure. Do not support piping from ceilings, equipment, ductwork, conduit and other non-structural elements.

- H. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
- I. Verify final equipment locations for roughing in.

3.4 PIPING PROTECTION

- A. Protect piping during construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

3.5 PENETRATIONS

- A. Mechanical penetrations occur when piping or ductwork penetrate concrete slabs, concrete or masonry walls, or fire / smoke rated floor and wall assemblies.
- B. Above Grade Concrete or Masonry Penetrations
 - Provide sleeves for pipes passing through above grade concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide sleeves as follows:
 - a. Provide schedule 40 galvanized steel pipe for sleeves smaller than 6 inches in diameter.
 - b. Provide galvanized sheet metal for sleeves 6 inches in diameter and larger, thickness shall be 10 gauge (0.1382 inches).
 - c. Provide welded galvanized sheet metal for rectangular sleeves with the following minimum metal thickness:
 - 1) For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 18 gauge (0.052 inches).
 - 2) For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 10 gauge (0.1382 inches).
 - d. Schedule 40 PVC pipe sleeves are acceptable for use in areas without return air plenums.
 - 2. Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeve for a minimum of 1" annular clear space between inside of sleeve and outside of insulation.
 - 3. Seal elevated floor, exterior wall and roof penetrations watertight and weathertight with nonshrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2" of sealant.
- C. Underground, Exterior-Wall Penetrations: Install cast-iron wall pipes for sleeves. Size sleeves to allow for 1-inch (or larger, if required by the mechanical sleeve manufacturer) annular clear space between pipe and sleeve. Provide mechanical sleeve seal.
 - 1. Use type and number of sealing elements recommended by manufacturer for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
 - Inspect installed sleeve and sleeve-seal installations for damage and faulty work. Verify watertight integrity of sleeves and seals installed below grade to seal against hydrostatic pressure.
- D. Elevated Floor Penetrations of Waterproof Membrane:
 - 1. Provide cast-iron wall pipes for sleeves, extend top of wall pipe minimum 1" above finish floor. Size wall pipe for minimum ½" annular space between pipe and wall pipe.
 - 2. Extend pipe insulation for insulated pipe through wall pipe. The vapor barrier shall be maintained. Size wall pipe for a minimum of 1" annular clear space between inside of sleeve and outside of insulation.

- 3. Pack with mineral wool and seal both ends with minimum of 1/2" of waterproof sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Secure waterproof membrane flashing between clamping flange and clamping ring. Comply with requirements for flashing specified in Division 07 Section "Sheet Metal Flashing and Trim."
- 5. Extend bottom of wall pipe below floor slab as required and secure underdeck clamp to hold wall pipe rigidly in place.
- E. Interior Foundation Penetrations: Provide sleeves for horizontal pipe passing through or under foundation. Sleeves shall be cast iron soil pipe two nominal pipe sizes larger than the pipe served.
- F. Concrete Slab on Grade Penetrations:
 - Provide schedule 40 PVC pipe sleeves for vertical pressure pipe passing through concrete slab on grade. Sleeves shall be one nominal pipe size larger than the pipe served and two pipe sizes larger than pipe served for ductile iron pipes with restraining rods. Seal watertight with silicone caulk.
 - Provide 1/2" thick cellular foam insulation around perimeter of non-pressure pipe passing thru concrete slab on grade. Insulation shall extend to 2" above and below the concrete slab.
- G. Interior Penetrations of Non-Fire-Rated Walls: Seal annular space between sleeve and pipe or duct, using joint sealant appropriate for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of 1/2" of sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.
 - 1. Extend pipe insulation for insulated pipe through sleeve. The vapor barrier shall be maintained. Size sleeve for a minimum of 1" annular clear space between inside of sleeve and outside of insulation.
- H. Exterior Wall Penetrations: Seal annular space between sleeve and pipe or duct, using joint sealant appropriate for size, depth, and location of joint. Pack with mineral wool and seal both ends with minimum of 1/2" of waterproof sealant. Refer to Division 07 Section "Joint Sealants" for materials and installation.
 - 1. Extend pipe insulation for insulated pipe through sleeve. The vapor barrier shall be maintained. Size sleeve for a minimum of 1" annular clear space between inside of sleeve and outside of insulation.
- I. Fire / Smoke Rated Floor and Wall Assemblies: Seal around penetrations of fire rated assemblies to maintain fire resistance rating of fire-rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Install sealants in compliance with the manufacturer's UL listing. Refer to Division 07 Section "Penetration Firestopping" for special sealers and materials.
- J. Acoustical Barrier Penetrations: Where a pipe passes through a wall, ceiling or floor slab of a noise critical space, a steel sleeve shall be cast or grouted into the structure. Refer to Section "Common Work Results for HVAC" for noise critical spaces. The internal diameter of the sleeve shall be minimum of 2 inches larger than the external diameter of the pipe. After the piping is installed, the Contractor shall check the clearance and correct it to within 1/2-inch. Contractor shall pack the void full depth with glass/mineral fiber insulation and seal at both ends, 1-inch deep, with sealant backed by foam rod.
 - 1. Penetration of sound isolating ceilings by sprinkler pipes and heads shall be sleeved and sealed and shall have no rigid connections between them.

3.6 FITTINGS AND SPECIALTIES

- A. Use fittings for all changes in direction and all branch connections.
- B. Remake leaking joints using new materials.
- C. Install components with pressure rating equal to or greater than system operating pressure.

- D. Install dielectric unions for piping 2" and smaller or dielectric flanges for piping 2-1/2" and larger to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum) for the following conditions:
 - 1. Copper or brass connected to carbon steel, stainless steel, cast or ductile iron.
- E. Install dielectric unions for piping 2" and smaller or dielectric flanges for piping 2-1/2" and larger to connect piping materials of dissimilar metals in wet piping systems (water, steam) for the following conditions:
 - 1. Copper or brass connected to carbon steel, stainless steel, cast or ductile iron.
 - 2. Install waterway fittings where installation is concealed. Do not install dielectric unions in concealed spaces.
- F. Install dielectric waterway fittings for piping 2" and smaller for copper or brass pipe connections to carbon steel equipment connections.
- G. Install dielectric flanges for piping 2-1/2" and larger for copper or brass pipe connections to cast iron, carbon steel, or stainless steel equipment connections, valves, or fittings.
- H. Dielectric Flange Installation:
 - 1. Provide brass nipples between the equipment connection and dielectric flange for screwed connections. Provide an iron flange for the equipment side and a bronze flange for the copper or brass piping side of the joint.
 - 2. Provide a bronze flange for the copper or brass piping connection to a cast iron, ductile iron or steel flange.
 - 3. Provide full face gasket with pressure rating equal to system served.
 - 4. At each bolt provide steel washers, thermoplastic washers, and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves.

3.7 JOINTS

A. Steel Pipe Joints:

- Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1.
 Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and
 restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for
 which the pipe is intended on the male threads at each joint and tighten joint to leave not
 more than 3 threads exposed.
- 2. Pipe Larger Than 2":
 - a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
 - b. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.9 Code for Building Services Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

B. Non-ferrous Pipe Joints:

- Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.9 - Standard Code for Building Services Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.
- 2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
- Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.
- C. Joints for other piping materials are specified within the respective piping system Sections.

3.8 PIPE FIELD QUALITY CONTROL

A. Testing: Refer to individual piping system specification sections.

SECTION 230593

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies the requirements and procedures for total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- B. This section includes:
- C. Test, adjust, and balance the following mechanical systems:
 - 1. Supply air systems, all pressure ranges; including variable volume and double duct systems:
 - 2. Return air systems;
 - 3. Exhaust air systems;
 - 4. Verify temperature control system operation.
- D. Test systems for proper sound and vibration levels.
- E. This Section does not include:
 - 1. Specifications for materials for patching mechanical systems;
 - Specifications for materials and installation of adjusting and balancing devices. If devices
 must be added to achieve proper adjusting and balancing, refer to the respective system
 sections for materials and installation requirements.
 - Requirements and procedures for piping and ductwork systems leakage tests.

1.2 DEFINITIONS

- A. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - 1. Balance of air and water distribution;
 - 2. Adjustment of total system to provide design quantities;
 - 3. Electrical measurement;
 - 4. Verification of performance of all equipment and automatic controls;
 - Sound and vibration measurement.
- B. Test: To determine quantitative performance of equipment.
- C. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
- D. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
- E. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.

- F. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
- G. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- H. Main: Duct or pipe containing the system's major or entire fluid flow.
- Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
- J. Branch main: Duct or pipe serving two or more terminals.
- K. Branch: Duct or pipe serving a single terminal.

1.3 SUBMITTALS

- A. Agency Data:
 - 1. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.
- B. Engineer and Technicians Data:
 - Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.
- C. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
- D. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section "General Mechanical Requirements".
- E. Sample Forms: Submit sample forms, if other than those standard forms prepared by the NEBB[, AABC][, or TABB] are proposed.
- F. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:
 - Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
 - 3. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title

descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:

- a. General Information and Summary
- b. Air Systems
- c. Temperature Control Systems
- d. Special Systems
- e. Sound and Vibration Systems
- 4. Report Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
 - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the NEBB[,][AABC,][OR TABB], for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
- G. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

1.4 QUALITY ASSURANCE

A. Test and Balance Engineer's Qualifications: A certified Test and Balance Engineer on staff and having at least 5-years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project.

B. Agency Qualifications:

- 1. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- 2. The independent testing, adjusting, and balancing agency shall be certified by National Environmental Balancing Bureau (NEBB)[or][Associated Air Balance Council (AABC)][or] [Testing Adjusting and Balancing Bureau (TABB)] in those testing and balancing disciplines required for this project. Agency shall have at least one Professional Engineer certified by NEBB[or AABC][or TABB] as a Test and Balance Engineer. The project shall be staffed at all times by qualified personnel.

C. Codes and Standards:

- 1. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- 2. AABC: "National Standards For Total System Balance".
- TABB: SMACNA's "HVAC Systems Testing, Adjusting, and Balancing".

- 4. ASHRAE: ASHRAE Handbook, HVAC Applications Volume, Chapter "Testing, Adjusting, and Balancing", most current edition.
- 5. ASHRAE: ASHRAE Handbook, HVAC Applications Volume, Chapter "Sound and Vibration Control", most current edition.
- NEBB: "Procedural Standards for the Measurement and Assessment of Sound and Vibration."

D. Balancing Tolerances:

- 1. Air Systems: Balance individual terminal devices and branch lines to \pm 10 percent and main ducts and air handling equipment to \pm 5 percent of specified airflow.
- 2. For applications where differential pressure needs to be maintained, balance air systems to specified airflow as follows:
 - a. Positive Zones: Balance supply air to 0 to +10 percent and exhaust and return air to 0 to -10 percent.
 - b. Negative Zones: Balance supply air to 0 to -10 percent and exhaust and return air to 0 to +10 percent.
- E. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

1.5 PROJECT CONDITIONS

A. Systems Operation: Systems shall be fully operational prior to beginning procedures.

1.6 COORDINATION OF WORK

- A. Coordinate mechanical work including ductwork, piping and controls to provide complete, properly tested, adjusted and balanced systems. Division 23 Contractor shall submit progress reports to communicate status of work so that the testing, adjusting and balancing work is completed in a timely manner. Division 23 Contractor shall ensure that duct systems are sealed, piping systems have been tested for leaks and equipment is operational and capable of producing the scheduled capacity requirements.
- B. Coordinate with the Division 26 Contractor to verify that electrical work for mechanical equipment is complete, properly tested and operational prior to beginning procedures.
- C. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- D. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- E. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 SEQUENCING AND SCHEDULING

- A. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.
- B. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART 2 - PRODUCTS AND MATERIALS

(Not Used)

PART 3 - EXECUTION

3.1 PROCEDURES FOR ALL SYSTEMS

- Measure and record the ambient conditions at the time of testing and balancing. Include the following:
 - a. Dry bulb temperature.
 - b. Relative humidity.
 - c. Cloud cover.
 - d. Wind speed.
 - e. Time.

3.2 PRE-TESTING OF HVAC SYSTEMS

A. Perform preconstruction testing of existing air systems. Submit test report to engineer for approval. Construction or demolition of the pre-tested systems shall not proceed until the engineer has reviewed and approved the preconstruction test report.

3.3 PROCEDURES FOR PRE-TESTING OF EXISTING AIR SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
- B. Contractor Responsibilities shall include the following but shall not be limited to:
 - Testing, Adjusting, and Balance Contractor:
 - Measure and record the operating speed, airflow, and total and external static pressure
 of each fan system. Provide individual pressure drop readings across all coils, filter
 banks, dampers and other internal fan system components
 - Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - c. Check the condition of filters.
 - d. Check the condition of coils.
 - e. Check the operation of the drain pan and condensate-drain trap.
 - f. Check bearings and other lubricated parts for proper lubrication.
 - g. For variable air volume systems: Open automatic air dampers to full design position to simulate a design day. Measure and record the operating speed and airflow of each fan system for full load conditions.
 - h. Report on the results of the measurements taken and any deficiencies.
 - 2. Mechanical Contractor:
 - a. Check the refrigerant charge.
 - b. Report on the operating condition of the equipment and any deficiencies.

3.4 PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING

A. Before operating the system, perform these steps:

- 1. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
- 2. Obtain copies of approved shop drawings of air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
- 3. Compare design to installed equipment and field installations.
- 4. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
- Check filters for cleanliness.
- 6. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
- 7. Verify volume dampers are installed at locations needed for balancing the air systems.
- 8. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
- 9. Determine best locations in main and branch ductwork for most accurate duct traverses.
- 10. Place outlet dampers in the full open position.
- 11. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
- 12. Lubricate all motors and bearings.
- 13. Check fan belt tension.
- 14. Check fan rotation.

3.5 MEASUREMENTS

- A. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
- B. Provide instruments meeting the specifications of the referenced standards.
- C. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
- D. Apply instrument as recommended by the manufacturer.
- E. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
- F. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
- G. Take all reading with the eye at the level of the indicated value to prevent parallax.
- H. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
- I. Take measurements in the system where best suited to the task.

3.6 PERFORMING TESTING, ADJUSTING, AND BALANCING

A. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.

- B. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
- C. Patch insulation, ductwork, and housings, using materials identical to those removed.
- D. Seal ducts and piping, and test for and repair leaks.
- E. Seal insulation to re-establish integrity of the vapor barrier.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
 - 1. Energize fan motors, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a. Replace fan and motor pulleys as required to achieve design conditions.
- G. Record the necessary information for optimizing pump operation as defined on the controls drawings. Give this information to the controls contractor for building automation system programming.
- H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

3.7 TESTING FOR SOUND AND VIBRATION

A. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

3.8 RECORD AND REPORT DATA

- A. Record data regarding design conditions from contract documents and installed conditions from shop drawings including equipment identification number, model number, location, area served, manufacturer, model number, serial number, motor nameplate horsepower and rpm, fan rpm, capacity and electrical voltage, amps and phases
- B. Record data obtained during testing, adjusting, and balancing including sound and vibration measurements in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
- C. Prepare and submit report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- D. Prepare and submit report of recommendations for correcting any sound or vibration levels that are outside of manufacturer's tolerances, ASHRAE standards and/or values specified in the contract documents.

END OF SECTION 230593

SECTION 230700

HVAC INSULATION

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Extent of Mechanical insulation required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Types of Mechanical insulation specified in this Section include the following:
 - 1. Piping Systems Insulation:
 - a. Fiberglass
 - b. Cellular Glass
 - c. Calcium Silicate
 - d. Flexible Elastomeric
 - e. Polyisocyanurate (closed cell)
 - 2. Ductwork System Insulation:
 - a. Fiberglass
 - b. Cellular Glass
 - c. Flexible Elastomeric
 - Equipment Insulation:
 - a. Fiberglass
 - b. Calcium Silicate
 - c. Cellular Glass
 - d. Flexible Elastomeric
- C. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 23 Section "Hangers & Supports for HVAC Piping & Equipment," for insulation shields and pipe saddles for protecting insulation vapor barrier and materials and methods for piping installations.
 - Division 23 Section "Underground Hydronic and Steam Piping," for insulation of piping installed below grade.

1.2 DEFINITIONS

- A. Cold Pipe: Piping that carries fluid with a minimum operating temperature less than 60 degrees F.
- B. Hot Pipe: Piping that carries fluid with a minimum operating temperature greater than 105 degrees F.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

- B. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by UL 723 or ASTM E 84 (NFPA 255) method.
 - 1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.
 - Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame spread index of 75 and smoke developed index of 150.
 - 3. Exception: Polyisocyanurate insulation that is not installed in a return air plenum may have a flame spread index of 25 and smoke developed index of 450.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

PART 2 - PRODUCTS AND MATERIALS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
 - 1. Aeroflex USA, Inc.
 - 2. Armacell LLC.
 - 3. CertainTeed Corp.
 - 4. Johns Manville
 - 5. Knauf Insulation
 - 6. K-Flex USA
 - 7. Owens Corning
 - 8. Pittsburgh Corning Corp.
 - 9. ITW Insulation Systems, Inc.
 - a. Trymer Supercel for return air plenums.
 - b. Trymer 2000 in non-return air plenums.
 - 10. Dyplast Products.

2.2 PIPING INSULATION MATERIALS

- A. Fiberglass Piping Insulation: ASTM C547, Type I or II, Grade A.
- B. Cellular Glass Piping Insulation: ASTM C552, Type II, Class 2.
- C. Calcium Silicate Piping Insulation: ASTM C533, Type I.
- D. Flexible Elastomeric Piping Insulation: ASTM C534, Type I.
- E. Polyisocyanurate Piping Insulation: ASTM C591. Provide vapor retardant film and tape of thickness as recommended by the manufacturer for the installation.
- F. Jackets for Piping Insulation: ASTM C1136, Type I.

- 1. PVC: One-piece, pre-molded PVC cover conforming to ASTM D1784, Johns Manville Zeston 2000 PVC or approved equivalent. Factory supplied, pre-cut insulation blanket inserts for use with PVC fitting covers are acceptable.
- G. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
 - 1. Vapor Barrier Coating: Comply with MIL-PRF-19565C, Type II.
 - a. Water-Based Mastic
 - Permeance in accordance with ASTM C755 for insulation application and service conditions and tested in accordance ASTM E96.

a) Pipe and vessels (33 deg. F to Ambient): 0.05 perms or less.
b) Pipe and vessels (-40 deg. F to 32 deg. F): 0.02 perms or less.
c) Ducts (40 degrees F to Ambient): 0.02 perms or less.

- 2) Foster 30-80, Childers CP-38 or equal.
- Solvent-Based Mastic: Permeance shall be 0.05 perms or less at 35 mils dry per ASTM F 1249.
- 2. Lagging Adhesive: Comply with MIL-A-3316C, Class 1, Grade A. Provide Foster 30-36, Childers CP-50AHV2 or equal.
- 3. Weather Barrier Breather Mastic: Permeance shall be 1.0 perms or less at 62 mils dry per ASTM E96, Procedure B. Provide Foster 46-50, Childers CP-10/11 or equal.
- H. Insulation Diameters: Comply with ASTM C585 for inner and outer diameters of rigid thermal insulation.
- I. Pipe, Valve and Fitting Covers: Comply with ASTM C450 for fabrication of fitting covers for pipe, valves and fittings.
- J. High Density Insulation:
 - 1. Calcium Silicate conforming to ASTM C533 and C795.
 - 2. Flexible elastomeric piping insulation conforming to ASTM C534, Type 1.

2.3 DUCTWORK INSULATION MATERIALS

- A. Rigid Fiberglass Ductwork Insulation: UL/ULC Classified, meeting ASTM C612, Types IA or IB, with density of 1.5 pounds per cubic foot.
- B. Flexible Fiberglass Ductwork Insulation: UL/ULC Classified, meeting ASTM C553, Type II, with density of 0.75 pounds per cubic foot.
- C. Cellular Glass Ductwork Insulation: ASTM C552, Type I.
- D. Flexible Elastomeric Ductwork Insulation: ASTM C534-01a, Type II.
- E. Jackets for Ductwork Insulation: ASTM C1136, Type I or Type II for ductwork. Protective jackets for ductwork shall be ASTM C921 Type I made of sheet aluminum in accordance with ASTM B 209, 3003 alloy, H-14 temper, minimum 0.032 inch thick with a moisture barrier lining except where the protective jacket is applied over a Type I vapor barrier jacket and with stainless steel draw bands.
- F. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, pins with insulation retaining washers, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

- G. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
 - 1. Vapor Barrier Coating: Comply with MIL-PRF-19565C, Type II.
 - a. Water-Based Mastic: Permeance shall be 0.013 perms or less at 43 mils dry per ASTM E 96. Provide Fosters 30-80, Childers CP-38 or equal.
 - Solvent-Based Mastic: Permeance shall be 0.05 perms or less at 35 mils dry per ASTM F 1249.
 - 2. Fiberglass Adhesive: Comply with ASTM C916, Type 2 or MIL-A-3316C, Class 2, Grade A. Provide Foster 85-60, Childers CP-127 or equal water based adhesive.
- H. Jackets for Duct Insulation Exposed to Weather (All Insulation Except Flexible Elastomeric): Jackets installed over exterior duct insulation shall be approved by the jacket manufacturer for use with the specific insulation material that it covers. Jackets utilized to cover exterior duct insulation shall include one of the following options:
 - Encase fiberglass insulation with rigid aluminum shell with weather-proof construction. Shell shall be minimum 0.032 inch stucco embossed aluminum with three aluminum attachment bands per section and with aluminum fitting covers.
 - 2. Provide Polyguard Products, Inc. Alumaguard 60 mils thick cladding, or approved equivalent, consisting of a UV-resistant aluminum outer layer, multi-ply cross-laminated polyethylene film, and rubberized asphalt formulated for use on faced insulated duct and piping applications. Alumaguard shall only be applied when ambient temperature is above 50°F. For installation in low temperatures down to 10°F, Polyguard Products, Inc. Alumaguard Low Temp (LT) or approved equal rubberized bitumen with 35 mils thick cladding can be used.
 - 3. Provide VentureClad Plus 1579CW 15.5 mils thick cladding, or approved equivalent, consisting of 13 ply fabric reinforced UV resistant outer layer and cold weather acrylic adhesive that may be applied at temperatures as low as -10°F.
- I. Jackets for Flexible Elastomeric Duct Insulation Exposed to Weather: Jackets utilized to cover exterior ductwork insulation shall consist of one of the following options:
 - 1. Encase flexible elastomeric insulation with aluminum jacket with weather-proof construction. Jacket shall be minimum 0.032 inch stucco embossed aluminum with three aluminum attachment bands per section and with aluminum fitting covers.
 - Provide ArmaTuff flexible elastomeric insulation or approved equivalent, with 12 mils thick UV and damage resistant cladding laminated at factory. Cover all seams with ArmaTuff seal tape.

2.4 EQUIPMENT INSULATION MATERIALS

- A. Rigid Fiberglass Equipment Insulation: ASTM C612, Class 2.
- B. Flexible Fiberglass Equipment Insulation: ASTM C553, Types IA and IB
- C. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block.
- D. Cellular Glass Equipment Insulation: ASTM C552, Type I.
- E. Flexible Elastomeric Equipment Insulation: ASTM C534, TYPE II.
- F. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- G. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

- 1. Vapor Barrier Coating: Comply with MIL-PRF-19565C, Type II.. Permeance shall be 0.013 perms or less at 43 mils dry per ASTM E 96 or 0.08 perms at 37 mils dry per ASTM F 1249. Provide Foster 30-80, Childers CP-38 or equal.
- 2. Lagging Adhesive: Comply with MIL-A-3316C, Class 1, Grade A. Provide Foster 30-36. Childers CP-50AHV2 or equal.
- 3. Fiberglass Adhesive: Comply with ASTM C916, Type II.
- H. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

3.2 PIPING SYSTEM INSULATION

- A. General: Reference Insulation Schedules at the end of this specification for minimum insulation conductivity and thickness requirements.
- B. Insulation Omitted: Omit insulation on the following:
 - 1. Hot piping within radiation enclosures or unit cabinets;
 - 2. Cold piping within unit cabinets provided piping is located over drain pan;
 - 3. Heating piping between coil and shutoff valves provided piping is located within heated space and not more than three feet from coil;
 - 4. Condensate piping between steam trap and union; and
 - 5. Flexible connections and expansion joints in pipes with fluids above ambient temperatures.
- C. Exterior Piping: Insulate all exterior HVAC piping with cellular glass or flexible elastomeric of thickness noted.
- D. Sub-Freezing Piping (0 to 39 degrees F (-18 to 4 degrees C)):
 - 1. Application Requirements: Insulate the following piping systems:
 - Refrigerant liquid lines between the expansion valve and the evaporator coil.
 - b. Refrigerant suction lines between evaporator coil and compressor.
 - c. Brine refrigerant piping.
 - 2. Insulate each piping system specified above with one of the following types of insulation:
 - a. Fiberglass
 - b. Cellular Glass
 - c. Flexible Elastomeric: Insulation shall be seamless except where piping joints need to be made. Seams at piping joints shall be sealed and taped.
 - d. Polyisocyanurate
- E. Cold Piping (40 degrees F (4.4 degrees C) to ambient):
 - 1. Application Requirements: Insulate the following piping systems:

- a. HVAC chilled water supply and return piping.
- b. HVAC make-up water piping.
- c. Air conditioner condensate drain piping.
- d. Condenser water supply and return piping when used for free cooling.
- e. Heat pump supply and return water piping.
- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass
 - b. Cellular Glass
 - c. Flexible Elastomeric
 - d. Polyisocyanurate
- F. Warm Temperature Piping (100 degrees to 140 degrees F (38 to 94 degrees C)):
 - 1. Application Requirements: Insulate the following piping systems:
 - a. HVAC hot water supply and return piping.
 - b. Refrigerant hot gas lines between the compressor and condensing unit.
 - c. Refrigerant liquid lines between the condensing unit and expansion valve.
 - 2. Insulate each piping system specified above with one of the following types of insulation.
 - a. Fiberglass
 - b. Cellular Glass
 - c. Flexible Elastomeric
 - d. Polyisocyanurate

3.3 DUCTWORK SYSTEM INSULATION

- A. Insulation Omitted: Do not insulate fibrous glass ductwork, or lined ductwork. Refer to Section "Metal Ductwork" for requirements for duct liner material.
- B. Application Requirements:
 - Insulate the following duct systems:
 - Supply Air.
 - 1) Insulate neck and bells of supply diffusers.
 - b. Return Air:
 - Omit insulation on return ductwork located in return air ceiling plenums except all return air ductwork within 10 feet of exterior roof or wall penetrations.
 - c. Exhaust and Relief Air:
 - 1) Within 10 feet of exterior discharge outlet.
 - Downstream of heat recovery device (wheel, plate, heat pipe, etc.) to exterior discharge outlet.
 - d. HVAC plenums and unit housings not pre-insulated at factory or lined.
 - e. Range and kitchen hood non-grease exhaust ductwork.
 - f. Dishwasher exhaust ducts within 10 feet of discharge to the outdoors.

- Insulate each ductwork system specified above with one of the following types and thickness of insulation:
 - a. Rigid Fiberglass: 2" thick, minimum R-8.0. Use 2" thick, minimum R-8 in machine, fan and equipment rooms.
 - b. Flexible Fiberglass: 3" thick, minimum R-8.0 installed R-value at maximum 25% compression, application limited to concealed locations.
 - c. Cellular Glass: 2-1/2" thick, minimum R-8.0.
 - d. Flexible Elastomeric: 2" thick, minimum R-8.0.

C. Exterior Ductwork:

- 1. Application Requirements: Insulate the following exterior ductwork:
 - a. Supply.
 - b. Return.
 - c. Outside air downstream of conditioning unit.
 - d. Plenums and unit housings not pre-insulated at factory or lined.
- Insulate each ductwork system specified above with one of the following types and thickness of insulation:
 - a. Cellular Glass: 2-1/2" thick, minimum R-8.0.
 - b. Flexible Elastomeric: 2" thick, minimum R-8.0.
 - c. Rigid Fiberglass: 2" thick, minimum R-8.0.
 - d. Calcium Silicate: 3" thick, minimum R-8.0.
- D. Range and hood grease exhaust ductwork: Refer to Section "Air Duct Accessories" for requirements of fire-rated wrap insulation for grease exhaust duct.

3.4 EQUIPMENT INSULATION

- A. Cold Equipment (Below Ambient Temperature):
 - 1. Application Requirements: Insulate the following cold equipment unless pre-insulated at factory:
 - a. Refrigeration equipment, including chillers, tanks and pumps.
 - b. Drip pans under chilled equipment.
 - c. Chilled water storage tanks.
 - d. Chilled water expansion tanks, air separators and piping accessories.
 - e. Chilled water pumps.
 - Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 2" thick for cold surfaces above 35 degrees F (2 degrees C) and 3" thick for surfaces 35 degrees F (2 degrees C) and lower.
 - b. Cellular Glass: 3" thick for surfaces above 35 degrees F (2 degrees C) and 4-1/2" thick for surfaces 35 degrees F (2 degrees C) and lower.
 - c. Flexible Elastomeric: 1" thick.
- B. Hot Equipment (Above Ambient Temperature):

- Application Requirements: Insulate the following hot equipment unless pre-insulated at factory:
 - a. Boilers.
 - b. Condensate receivers.
 - c. Hot water expansion tanks.
 - d. Hot water pumps.
 - e. Condensate pumps.
- Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.
 - b. Calcium Silicate: 3" thick except 4-1/2" thick for low-pressure boilers and steam-jacketed heat exchangers.
 - c. Flexible Elastomeric: 1" thick. Do not use for equipment operating above 180 degrees F (82 degrees C) or 300F (149C) for high-temperature formula.

C. Breeching and Stacks:

- 1. Application Requirements: Insulate the following breechings and stacks:
 - a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.
 - b. Stack from bottom to top except for factory insulated stacks.
- Insulate each breeching and stack specified above with one of the following types and thicknesses of insulation:
 - a. Fiberglass: 2" thick.
 - b. Calcium Silicate: 2" thick.

3.5 INSTALLATION OF PIPING INSULATION

- A. Maintain continuous thermal and vapor-retarder integrity throughout entire installation unless otherwise indicated.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating.
- E. Cold Pipe Insulation:
 - 1. Provide high density insulation material under supports or pre-insulated supports.
 - Protect insulation with shields to prevent puncture or other damage. Refer to Section "Hangers & Supports for HVAC Piping & Equipment" for pre-insulated supports and insulation shields.
 - High density insulation material shall extend a minimum 2 inches past the pipe shield on each side.

4. Butt pipe insulation tightly at insulation joints. Apply wet coat of vapor barrier lap cement on joint and seal with 3 inch wide vapor barrier tape or band and coat all taped seams with vapor barrier coating to prevent moisture ingress.

F. Hot Pipe Insulation:

- 1. Butt pipe insulation tightly at insulation joints and wrap insulation around supports. Apply 3 inch wide vapor barrier tape or band over joint.
- G. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - Insulate pipe elbows using fiberglass inserts with pre-molded PVC parts, preformed fitting
 insulation, or mitered fittings made from same material and density as adjacent pipe
 insulation. Each piece shall be butted tightly against adjoining piece and bonded with
 adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to
 a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - Insulate tee fittings with fiberglass inserts with pre-molded PVC parts, preformed fitting
 insulation, or sectional pipe insulation of same material and thickness as used for adjacent
 pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in
 place with tie wire. Bond pieces with adhesive.
 - 3. Insulate valves using fiberglass inserts with pre-molded PVC parts, preformed fitting insulation, or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 4. Insulate strainers using fiberglass inserts with pre-molded PVC parts, preformed fitting insulation, or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 5. Insulate flanges and unions using fiberglass inserts with pre-molded PVC parts or a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 6. Cover segmented insulated surfaces with a layer of finishing cement and finish with a coating or mastic. Install vapor-barrier coating for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the coating or mastic to a smooth and well-shaped contour.
 - For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- H. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- I. Install removable insulation covers at locations indicated. Installation shall conform to the following:

- 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
- When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
- 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
- 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
- 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
- J. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

3.6 INSTALLATION OF DUCTWORK INSULATION

- A. Install insulation materials with smooth and even surfaces.
- B. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- C. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage,
- D. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- E. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed. At interface of lined and wrapped ductwork, overlap lined ductwork by 2 feet (minimum) with wrapped insulation.
- F. Cold Ductwork in Mechanical Rooms or Other Non-Conditioned Spaces: To prevent condensation from forming on the duct supports, provide one or more of the following:
 - 1. Install thermal break such as rigid board insulation between the support and duct.
 - 2. Wrap support that is in contact with the duct with external duct wrap insulation to prevent condensation. Wrap shall extend a minimum of 12" from point of contact of the support with the duct. Tape joints to provide a thermal and vapor barrier. Coat all taped joints, punctures and seams with 4" wide coating of vapor barrier mastic.
 - 3. If a support device similar to unistrut is used, foam fill or stuff tube.
- G. Exterior Ductwork: Install ductwork with sufficient slope to ensure that water cannot pond anywhere on the duct. Drainage must be achieved by sloping ductwork not by varying the insulation thickness. Locate longitudinal seams of outer shell (aluminum, flexible elastomeric, or cladding as applicable) at bottom of duct. Install cladding in strict conformance with cladding manufacturer's instructions.
- H. Protect outdoor insulation from weather by installing outdoor protective weather barrier mastic and reinforcing mesh as recommended by manufacturer or protective jacket as specified. Install protective jacket in accordance with manufacturer's recommendations.

- I. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.
- J. Where rectangular ducts are 24" (600mm) in width or greater, duct wrap shall be additionally secured to the bottom of the duct with mechanical fasteners, spaced on 18" (425mm) centers (maximum) to prevent sagging of insulation. Fasteners shall include 2-inch square self-sticking galvanized carbon-steel base plates with minimum 0.106-inch diameter zinc-coated, low carbon steel, fully annealed shank spindle, length to suit depth of insulation. Insulation shall be secured to spindles with self-locking washers incorporating a spring steel insert to ensure permanent cap retention.

3.7 INSTALLATION OF EQUIPMENT INSULATION

- A. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- B. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- C. Do not apply insulation to equipment, breechings, or stacks while hot.
- D. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately. Tape all joints using a suitable, matching acrylic adhesive tape; minimum 3" wide.
- E. Coat insulated surfaces of calcium silicate with layer of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- F. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable. Tape all joints using a suitable, matching acrylic adhesive tape; minimum 3" wide.
- G. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- H. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- I. Equipment Exposed to Weather: Protect outdoor insulation from weather by installation of Self-Adhesive Water and Weather Seal material (such as VentureClad) or jacketing, as recommended by the manufacturer.

3.8 PROTECTION AND REPLACEMENT

- A. Provide all required protection for insulation (installed and uninstalled) throughout the duration of construction to avoid exposure to plaster, dust, dirt, paint, moisture, deterioration, and physical damage.
- 3. Replace damaged insulation which cannot be repaired satisfactorily, including insulation with vapor barrier damage and insulation that has been exposed to moisture during shipping, storage, or installation. Drying the insulation is not acceptable. Dry surfaces prior to installation of new insulation that replaces the damaged or wet insulation.

3.9 CALIFORNIA BUILDING EFFICIENCY STANDARDS (TITLE 24 – PART 6) REQUIREMENTS, PIPE INSULATION

	Minimum Pipe Insulation Thickness						
	Insulation Conductivity		Nominal Pipe or Tube Size (in.)				
Fluid Operating	Conductivity,	Mean Rating	<1	1 to	1-1/2	4 to	≥8
Temp. Range (°F) And Usage	Btu·in./(hr·ft²·°F)	Temp., °F.		<1-1/2	to <4	<8	
				Insulation Thickness, in.			
>350°F	0.32-0.34	250	4.5	5.0	5.0	5.0	5.0
251°F-350°F	0.29-0.32	200	3.0	4.0	4.5	4.5	4.5
201°F-250°F	0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141°F-200°F	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105°F-140°F	0.22-0.28	100	1.0	1.5	1.5	1.5	1.5
40°F–60°F	0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
<40°F	0.20-0.26	50	1.0	1.5	1.5	1.5	1.5

Notes:

- a. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows: $T = r\{(1 + t/r)^{\Lambda}(K/k) 1\}$ where
 - 1) T = minimum insulation thickness (in.),
 - 2) r = actual outside radius of pipe (in.),
 - 3) t = insulation thickness listed in this table for applicable fluid temperature and pipe size.
 - 4) K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu·in./hr·ft²·°F); and
 - 5) k = the lower value of the conductivity range listed in this table for the applicable fluid temperature.
- b. Insulation thicknesses are based on energy efficiency considerations only. Add insulation where safety issues, surface temperature, water vapor permeability, or surface condensation are a concern; or where noted on the drawings.
- c. For piping that shall be installed below grade, reference Division 23 section "Underground Hydronic and Steam Piping."
- d. The table is based on steel pipe. Non-metallic pipes schedule 80 thickness or less shall use the table values. For other non-metallic pipes having thermal resistance greater than that of steel pipe, reduced thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat transfer per foot than a steel pipe of the same size with the insulation thickness shown on the table.

END OF SECTION 230700

SECTION 232300

REFRIGERANT PIPING

PART 1 - General Requirements

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air conditioning applications. This Section includes:
 - 1. Pipes, tubing, fittings, and specialties.
 - 2. Special duty valves.
 - 3. Refrigerants.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 02 Section "Earthwork," for trenching and backfilling materials and methods for underground piping installations.
 - 2. Division 07 Section "Penetration Firestopping," for materials and methods for fire barrier penetrations.
 - 3. Division 07 Section "Joint Sealers," for materials and methods for sealing pipe penetrations through basement and foundation walls.
 - 4. Division 23 Section "Identification for HVAC Piping & Equipment," for labeling and identification of refrigerant piping.
 - 5. Division 23 Section "Common Work Results for HVAC" for materials and methods for wall and floor penetrations and equipment pads.
 - 6. Division 23 Section "Basic Piping Material and Methods," for materials and methods for mechanical sleeve seals.
 - 7. Division 23 Section "Hangers & Supports for HVAC Piping & Equipment," for insulation shields, saddles and materials and methods for hanging and supporting refrigerant piping.
 - 8. Division 23 Section "HVAC Insulation," for materials and methods for insulating refrigerant piping.

1.2 SUBMITTALS

- A. Product data for the following products:
 - 1. Each type valve specified.
 - 2. Each type refrigerant piping specialty specified.
- B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.
- C. Brazer's Certificates signed by Contractor certifying that brazers comply with requirements specified under "Quality Assurance" below.
- D. Test reports specified in Part 3 below.
- E. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operation and Maintenance Data specified in Division 01 and Division 23 Section "General Mechanical Requirements."

1.3 QUALITY ASSURANCE

- A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".
- B. Regulatory Requirements: Comply with provisions of the following codes:
 - 1. ASME/ANSI B16.22: Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

- 2. ASME/ANSI B16.50: Wrought Copper and Copper Alloy Brazed-Joint Pressure Fittings
- 3. ASME/ANSI B31.5: ASME Code for Pressure Piping Refrigerant Piping.
- 4. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
- 5. Mechanical Code.
- C. Pipe, pipe fittings and pipe specialties shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Refrigerant Valves and Specialties:
 - a. Alco Controls Div, Emerson Electric.
 - b. Danfoss Electronics, Inc.
 - c. EATON Corporation, Control Div.
 - d. Henry Valve Company.
 - e. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
 - f. Sporlan Valve Company.

2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3, Article "PIPE APPLICATION" for identification of systems where the below specified pipe and fitting materials are used.
- B. Copper Tubing:
 - 1. ASTM B280, Type ACR, seamless, hard-drawn straight lengths and soft-annealed coils. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.
 - 2. ASTM B88, Type L, seamless, hard-drawn straight lengths and soft-annealed coils.
 - 3. ASTM B88, Type K, seamless, hard-drawn straight lengths and soft-annealed coils.
- C. Refrigerant Line Kits:
 - 1. Type ACR seamless copper roll of refrigerant tubing with pipe diameters as recommended by the manufacturer and of length as required for the installation.
 - 2. Factory or field installed flexible unicellular insulation:
 - a. Minimum thickness as required per Division 23 section "HVAC Insulation".
 - 3. Quick-connect flare tubing compression fittings or solder connections as required to match the connections of the condensing unit and evaporator coil.

2.3 FITTINGS

- A. Wrought-Copper Fittings for Solder-joint: ANSI B16.22, streamlined pattern.
- B. Mechanical Flared Fittings: ASME B16.26, Cast Copper Alloy Fittings for Flared Copper Tube.
- C. Wrought-Copper Fittings for Brazed-joint: ANSI B16.50, streamlined pattern.

2.4 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.
- B. Brazing Filler Metals:
 - 1. AWS A5.8, Classification BAg-5.
 - a. Silver (Ag) 44.0 46.0%
 - b. Zinc (Z) 23.0 27.0%
 - c. Copper (Cu) 29.0 31.0%.

- 2. AWS A5.8, Classification BCuP 5.
 - a. Phosphorus (P) 4.8 5.2%
 - b. Silver (Ag) 14.5 15.5%
 - c. Copper (Cu) remainder.

2.5 VALVES

- A. General: Complete valve assembly shall be UL-listed and designed to conform to AHRI 760. Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- B. Globe: 450 psig maximum operating pressure, 275 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.
- C. Check Valves Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.
- D. Check Valves 7/8 inch and Larger: 450 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass bolted bonnet; floating piston with mechanically retained Teflon seat disc. Valve shall be straight through or angle pattern, with solder-end connections.
- E. Solenoid Valves: 250 deg. F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2 inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.
- F. Evaporator Pressure Regulating Valves: pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gage tappings, 24 volts DC, 50/60 Hz, standard coil; and wrought copper fittings for solder end connections.
- G. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.
- H. Hot Gas Bypass Valve: adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings for solder end connections.

2.6 REFRIGERANT PIPING SPECIALTIES

- A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to AHRI 760.
- B. Strainers: 500 psig maximum working pressure; forged brass body with Monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
 - 1. Standard capacity desiccant sieves to provide micronic filtration.
 - 2. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.
- E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225 deg. F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.

- F. Suction Line Filters: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter core kit, including gaskets, as follows:
- G. Flanged Unions: 400 psig maximum working pressure, 330 deg. F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.
- H. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

2.7 REFRIGERANT

A. Refrigerant No. 410A, in accordance with ASHRAE Standard 34.

PART 3 - EXECUTION

3.1 PIPE APPLICATIONS

- A. Above Grade:
 - 1. Type L or Type ACR tubing.
- B. Below Grade and Within Slabs:
 - 1. Use Type K tubing for 2 inch and smaller without joints. Mechanical fittings (crimp or flare) are not permitted.
 - 2. Install tubing in insulated PVC or HDPE protective conduit. Vent conduit to the outdoors.
- C. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "CLEANING" below.
- D. At contractor's option, use refrigerant line kits for refrigerant systems of 5 tons and smaller capacity.

3.2 PIPING INSTALLATIONS

- A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 "The Safety Code for Mechanical Refrigeration" and the equipment manufacturer's installation requirements.
- B. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- C. Install piping for minimum number of joints using as few elbows and other fittings as possible.
- D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- F. Insulate piping per Division 23 Section "HVAC Insulation."
 - Do not install insulation until system testing has been completed and all leaks have been eliminated.
- G. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.
- H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- I. Slope refrigerant piping as follows:
 - Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.

- Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
- Install traps and double risers where indicated, and where required to entrain oil in vertical runs.
- 4. Liquid lines may be install level.
- J. Use fittings for all changes in direction and all branch connections.
- K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- L. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- M. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, unless indicated to be exposed to view.
- N. Install horizontal piping as high as possible allowing for specified slope and coordination with other components. Install vertical piping tight to columns or walls. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- P. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal. Refer to Division 23 Section "Basic Piping Materials and Methods" for additional information.
- Q. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 07 Section "Penetration Firestopping" for special sealers and materials.
- R. Underground Exterior Wall Penetrations: Seal pipe penetrations through underground exterior walls with sleeves and mechanical sleeve seals. Refer to Division 23 Section "Basic Piping Materials and Methods" for additional information.
- S. Elevated Floor Penetrations of Waterproof Membrane, Interior Penetrations of No-Fire Rated Walls and Concrete Slab on Grade Penetrations: Provide sleeves and seal pipes that pass through waterproof floors, non-fire rated walls, partitions and ceilings or concrete slab on grade. Refer to Division 23 Section "Common Work Results for HVAC" for special sealers and materials.
- T. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- U. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

3.3 HANGERS AND SUPPORTS

- A. General: Hanger, supports, and anchors are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Conform to the table below for maximum spacing of supports:
 - Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Provide plastic galvanic isolators for copper tubing where indicated.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe rollers complete supports for multiple horizontal runs, 20 feet or longer supported by a trapeze.
 - 4. Spring hangers to support vertical runs.

- 5. Provide insulation saddles and protection shields as specified in Section "Hangers & Supports for HVAC Piping & Equipment". Provide insulation inserts as specified in Section "HVAC Insulation".
- C. Install hangers with the following minimum rod sizes and maximum spacing:

MAX. SPAN-FT	MIN. ROD SIZE - INCHES
5	3/8
6	3/8
7	3/8
8	3/8
8	3/8
9	1/2
10	1/2
12	1/2
14	5/8
	5 6 7 8 8 9 10 12

- D. Support vertical runs at each floor.
- E. Install a support within one foot of each change of direction.
- F. Vibration Isolation:
 - 1. Resiliently support piping within 50 feet of connected rotating equipment that has scheduled capacity greater than 50 tons of cooling.
 - a. Suspend pipe using Type SPNM or Type SPNH isolators. Provide vibration isolation anchors and guides for pipe. The first isolator both upstream and downstream of equipment on springs shall have a static deflection equal to 1.5 times that of the equipment isolators, up to a maximum of 2 inches. The static deflection of the remaining pipe isolators shall be 1 inch.
 - b. Reference section "Vibration Isolation for HVAC Piping and Equipment" for isolator definition.

3.4 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - 1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
 - 2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
- B. Copper-to-copper joints shall be made using BCuP-5 brazing filler metal without flux.
- C. Dissimilar metals such as copper and brass shall be joined using an appropriate flux with either BCuP-5 or BAg-5 brazing filler metal. Apply flux sparingly to the clean tube only and in a manner to avoid leaving any excess inside the completed joint.
- D. Continuously purge the pipe and fittings during brazing, with an inert gas (i.e., dry nitrogen or carbon dioxide) to prevent formation of scale. Maintain purge until the joint is cool to the touch.
- E. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.5 VALVE AND PIPING SPECIALTIES INSTALLATIONS

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.
- B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- C. Install a full sized, 3-valve bypass around each drier.
- D. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.

- 1. Electrical wiring for solenoid valves is specified in Division 26. Coordinate electrical requirements and connections.
- E. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.
 - Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet
 - 2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
 - 3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
 - 4. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.
- F. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.
- G. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.
- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
 - 1. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.
- I. Install flexible connectors at the inlet and discharge connection of compressors.

3.6 EQUIPMENT CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow servicing and maintenance.

3.7 FIELD QUALITY CONTROL

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI. Provide test report summarizing the test procedures and results of the tests.
- B. Repair leaking joints using new materials, and retest for leaks.
- C. Field Test: Every refrigerant-containing part of every system that is erected on the premises, except safety devices, pressure gauges, control mechanisms, compressors, evaporators, and systems that are factory-tested, shall be tested and proved tight after complete installation and before operation. The high side and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high side and low side of the system, respectively.
- D. Testing Procedure: Tests shall be performed with dry nitrogen. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-reducing device and a gage on the outlet side. The pressure-relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system's components.

3.8 CLEANING

- A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:
 - 1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.
 - 2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 3. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - 4. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.9 ADJUSTING AND CLEANING

A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

- B. Clean and inspect refrigerant piping systems in accordance with requirements of Division 23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.10 STARTUP

- A. Charge system using the following procedure:
 - 1. Install core in filter dryer after leak test but before evacuation.
 - 2. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
 - 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 - 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 - 5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
 - Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
- B. Train Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.
- C. Review data in Operating and Maintenance Manuals. Refer to Division 01 section "Closeout Procedures."
- D. Schedule training with Owner through the Architect, with at least 7 days advance notice.

END OF SECTION 232300

SECTION 233113

METAL DUCTS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. This Section includes:

- 1. Rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gauge.
- 2. Duct liner.
- 3. Factory-fabricated grease exhaust ductwork.
- 4. Wire rope hanging system.

B. Related Sections:

- 1. Division 7 Section "Penetrations Firestopping," for materials and methods for fire barrier penetrations.
- 2. Division 7 Section "Joint Sealers," for materials and methods for sealing duct penetrations through basement and foundation walls.
- 3. Division 23 Section "Identification for HVAC Piping & Equipment," for labeling and identification of metal ducts.
- 4. Division 23 Section "Common Work Results for HVAC," for materials and methods for wall penetrations and equipment pads.
- 5. Division 23 Section "Particulate Air Filtration" for filter requirements.

1.2 DEFINITIONS

- A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
 - Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
 - Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

1.4 SUBMITTALS

- A. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
 - Duct Liner.

- 2. Sealing Materials.
- 3. Fire-Stopping Materials.
- B. Shop drawings from duct fabrication shop, drawn to a scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as the Contract Drawings, detailing:
 - 1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 - Duct layout, indicating pressure classifications, duct gauge and sizes in plan view. For exhaust ducts systems, indicate the classification of the materials handled as defined in this Section.
 - 3. Fittings.
 - 4. Reinforcing details and spacing.
 - 5. Seam and joint construction details.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Terminal heating and cooling unit, coil, humidifier and duct silencer installations.
 - 8. Locations of fire and fire/smoke dampers and associated duct access doors.
 - 9. Locations of cleanout and access doors in grease exhaust ducts.
 - 10. Location of manual balancing dampers.
 - 11. Duct smoke detector locations. Refer to electrical drawings for general locations and coordinate locations with the electrical contractor.
 - 12. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
- C. Coordination drawings for ductwork installation in accordance with Division 23 Section "General Mechanical Requirements." In addition to the requirements specified in "General Mechanical Requirements" show the following:
 - 1. Coordination with ceiling suspension members.
 - 2. Spatial coordination with other systems installed in the same space with the duct systems.
 - 3. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
 - 4. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.
- D. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 23 Section "General Mechanical Requirements" and Division 1.
- E. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "Quality Assurance" below.

1.5 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."
- B. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.
- C. NFPA Compliance: Comply with the following NFPA Standards:

- 1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.
- 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- 3. NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment," Chapter 3, "Duct System," for kitchen hood duct systems, except as indicated otherwise.
- D. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Provide ductwork systems in conformance with "HVAC Duct Construction Standards Metal and Flexible," latest edition.
- E. Underwriter's Laboratories (UL): Comply with the UL standards listed within this section. Provide mastic and tapes that are listed and labeled in accordance with UL 181A and marked according to type.

1.6 PROTECTION AND REPLACEMENT

- A. Protect ductwork during shipping and storage from dirt, debris and moisture damage. Provide plastic covers over ends of ductwork during shipping, storage and installation.
- B. Replace duct liner that is damaged and cannot be repaired satisfactorily, including insulation with vapor barrier damage and insulation that has been exposed to moisture during shipping, storage, or installation. Drying the insulation is not acceptable. Dry surfaces prior to installing new duct liner.

PART 2 - PRODUCTS AND MATERIALS

2.1 SHEET METAL MATERIALS

- A. Sheet Metal, General: Provide sheet metal in thickness indicated (minimum 26 gauge), packaged and marked as specified in ASTM A 700.
- B. Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Coating Designation G 90. Provide mill phosphatized or galvanealed finish for surfaces of ducts exposed to view that is to be field painted. Provide bright galvanized finish for ductwork that is exposed to view and not field painted.
- C. PVC-Coated Galvanized Steel: UL-181 Class 1 Listing. Lock-forming quality galvanized sheet steel with ASTM A 653, Coating Designation G 90. Provide with factory-applied, 4-mil, PVC coating on the exposed surfaces of ducts and fittings (exterior of ducts and fittings for underground applications, and the interior of ducts and fittings for fume-handing applications) and 2-mil PVC coating on the reverse side of the ducts and fittings.
- D. Carbon Steel Sheets: ASTM A 366, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- E. Stainless Steel: ASTM A 480, Type 316, sheet form, with No. 4 finish on exposed surface for ducts exposed to view; Type 304, sheet form, with No. 1 finish for concealed ducts.
- F. Aluminum Sheets: ASTM B 209, Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish where ducts are exposed to view, and mill finish for concealed ducts.
- G. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.
- H. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DUCT LINER

A. General:

- Comply with NFPA Standard 90A and North American Insulation Manufacturers Association (NAIMA) Standard AHC-101.
- Liner shall have a flame spread rating of not more than 25 without evidence of continued progressive combustion and a smoke developed rating of no higher than 50, when tested in accordance with ASTM E84.
- 3. Duct sizes on mechanical plans indicate clear inside airflow dimensions. Sheet metal sizes for ductwork with duct liner shall be increased accordingly to account for liner thickness.
- B. Fiberglass: ASTM C 1071, Type I or II, glass fibers firmly bonded together with a thermosetting resin with surface exposed to airstream coated to prevent erosion of glass fibers. Liner surface shall serve as a barrier against infiltration of dust and dirt, shall meet ASTM C 1338 for fungi resistance and shall be cleanable using duct cleaning methods and equipment outlined by NAIMA Duct Cleaning Guide. Duct liner shall be rated for air velocity of 6,000 fpm.
 - 1. Rectangular fiberglass duct liner shall be Certainteed ToughGard T, JohnsManville Linacoustic RC, Knauf Atmosphere, Owens Corning QuietR or approved equal.
 - a. Thickness and Density:
 - 1) 2 inch, 1-1/2 pounds.
 - Round fiberglass duct liner shall be Certainteed ToughGard UltraRound, JohnsManville Spiracoustic Plus, Owens Corning QuietZone Spiral, or approved equal.
 - a. Thickness and Density:
 - 1) 2 inch, 4 pound.
 - 3. Thermal Performance: Meet minimum "K-Factor" equal to 0.28 (Btu·in/h·sq ft·F) or better, at a mean temperature of 75°F and rated in installed condition in accordance with ASTM C518 and/or ASTM C177.
 - 4. Liner Adhesive: Comply with NFPA Standard 90A /UL 181 classified with flame spread/smoke development less than 25/50 and ASTM C 916. Adhesive shall be a minimum 50% solid content, water-based, non-oxidizing and have a service temperature of –20 to 200 F. Water-based adhesive shall be one of the following:
 - a. Armacell LLC Armsflex 520 BLV low VOC.
 - b. Design Polymerics DP 2502.
 - c. Duro Dyne WIT.
 - d. Foster 85-60.
 - e. Childers CP-127.
 - f. Johns Manville SuperSeal HV.
 - g. Hardcast 951.
 - h. United McGill Uni-Tack.
 - 5. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct.
 - a. Fastener Pin Length: As required for thickness of insulation, and without projecting more than 1/8 inch into the airstream.

- b. Adhesive For Attachment of Mechanical Fasteners: Comply with the "Fire Hazard Classification" of duct liner system.
- C. Flexible Elastomeric Duct Liner: Insulation material shall be a flexible, closed cell, elastomeric insulation in sheet form that complies with ASTM C534. Material shall have a maximum thermal conductivity of 0.27 Btu-in/h-sf-F and a minimum water vapor transmission of 0.08 perm-inches. Liner shall be 1 inch thick or greater to meet local code requirements.
 - Manufacturers:
 - a. Aeroflex USA, Inc Aerocel Sheet.
 - b. Armacell LLC Armaflex SA.
 - c. K-Flex USA Liner Gray.
- D. Flexible elastomeric acoustical and conformable duct liner: Flexible elastomeric thermal, acoustical and conformable insulation. Compliance with ASTM C 534 Grade 1, Type II or ASTM C 1534, NFPA 90A or NFPA 90B, Thickness: 1/2 inch and 1 inch, Thermal Conductivity: 0.25 BTU-in/hr sq ft F at 75 F mean temp, ASTM C 518, Noise Reduction Coefficient: 0.6, ASTM C 423, Sound Transmission Class (STC) 25, ASTM E 90, EPA registered anti-microbial additive to inhibit mold and mildew, ASTM G21.
 - Manufacturers:
 - a. Aeroflex USA, Inc PLUS Acoustical Duct Liner.
 - b. Armacell LLC AP Coilflex.
 - c. Approved equal.
- E. Polyester Duct Liner: Duct liner shall be an engineered nonwoven, thermally bonded polyester with a smooth and durable FSK facing. Liner shall have a noise reduction coefficient of at least 0.65 per ASTM C423 and have thermal values greater or equal to an R-5 at 1 inch, R-6 at 1-1/2 inch and R-8 at 2 inch, respectively. Polyester liner must be able to withstand a constant internal temperature up to 250 F, must be compliant with Greenguard Environmental Institute, and contain zero VOCs per ASTM D5116. Liner must comply with NFPA 90A, NFPA 90 B and UL 181. Liner must meet ASTM C518 for thermal conductance properties and ASTM G-21 for fungal resistance properties. Liner must consist of at least 25 percent recycled content.
 - 1. Manufacturers:
 - a. Ductmate Industries "PolyArmor."
 - b. Approved equal.

2.3 SEALING MATERIALS

- A. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics. Duct tape shall not be used as a sealant on any ducts. Sealants used on metal duct systems shall comply with VOC limits that meet LEED IEQ 4.1
- B. Joint and Seam Tape: 2 inches wide, glass-fiber-reinforced fabric.
- C. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.
- D. Solvent-Based Joint and Seam Sealant: One-part, non-sag, solvent-release-curing, polymerized butyl sealant complying with FS TT-S-001657, Type I; formulated with a minimum of 70 percent solids.
 - 1. Manufacturers:

- a. Childers CP-140.
- b. Duro Dyne SGD.
- c. Fosters 32-14.
- d. Approved equal.
- E. Water-Based Joint and Seam Sealant, Non-Fibrated: UL 181 Listed and UL 723 classified with flame spread/smoke development of less than 25/50. Sealant shall be rated to ±15 inches w.g. Sealant shall have a service temperature of –25 to 200 F and be freeze/thaw stable through 5 cycles.
 - 1. Manufacturers:
 - Childers CP-146.
 - b. Design Polymerics DP 1010.
 - c. Ductmate Proseal/Fiberseal.
 - d. Duro Dyne Duroseal.
 - e. Fosters 32-19
 - f. United Duct Sealer (Water Based).
 - g. Hardcast 601.
- F. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- G. Flanged Gasket Tapes: Butyl gasket shall be UL 181 classified with flame spread/smoke development of 10/10. Gasket size shall be minimum 5/8" x 3/16" and have nominal 100% solid content. It shall be non-oxidizing, non-skinning and have a service temperature of –25 to 180 F.
 - Manufacturers:
 - a. Design Polymerics DP 1040.
 - b. Ductmate 440.
 - c. Hardcast 1902.

2.4 FIRE-STOPPING

- A. Fire-Resistant Sealant: Two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Resistant Sealant: One-part elastomeric sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. "3M Fire Stop Foam"; 3M Corp.
 - 2. "SPECSEAL Pensil 200 Silicone Foam"; Specify Technology, Inc.
 - 3. 3M Fire Stop Sealant"; 3M Corp.
 - 4. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.

- 5. "Fyre Putty"; Standard Oil Engineered Materials Co.
- 6. "FS-ONE", Hilti, Inc.

2.5 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concrete or for slabs less than 4 inches thick.
- B. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
 - 1. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
 - 2. Straps and Rod Sizes: Conform with SMACNA HVAC Duct Construction Standards, 2005 Edition, for sheet steel width and gauge and steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
 - Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
 - 2. For stainless steel ducts, provide stainless steel support materials.
 - 3. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

2.6 RECTANGULAR DUCT FABRICATION

- A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Tables 2-1 through 2-28, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
 - 1. Fabricate rectangular ductwork of minimum 26 gauge sheet metal.
 - Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 - 3. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gauge or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figure 2-9, unless they are lined or are externally insulated.
- C. Exterior Ductwork: Ductwork installed exterior to the building without weather-proof jacket or cladding shall be minimum #18 gauge with longitudinal and transverse joints welded or sealed airtight as specified under Paragraph "Seam and Joint Sealing".
- D. Field Painted Ductwork: Provide mill phosphatized finish on exposed surfaces of rectangular ductwork and duct fittings to be field painted.

2.7 RECTANGULAR DUCT FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 2005 Edition, Figures 4-1 through 4-8. Unless otherwise noted on drawings, provide prefabricated 45 degree, high efficiency, rectangular/round branch duct takeoff fittings with manual balancing damper, 3/8 inch

- square shaft, U-bolt, nylon bushings, locking quadrant, and 2 inch insulation build-out for branch duct connections and take-offs to individual diffusers, registers and grilles. 45 degree, high efficiency, rectangular/round branch duct takeoff fittings shall be Flexmaster STO with model BO3 damper or equal.
- B. Provide radius elbows, turns, and offsets with a minimum centerline radius of 1-1/2 times the duct width. Where space does not permit full radius elbows, provide short radius elbows with a minimum of two continuous splitter vanes. Vanes shall be the entire length of the bend. The use of square throat, radius heel elbows is prohibited. Remove and replace all installed elbows of this type with an approved elbow at no additional cost to the owner.
- C. Provide mitered elbows where space does not permit radius elbows, where shown on the drawings, or at the option of the contractor with the engineer's approval. The contractor shall obtain approval to substitute mitered elbows in lieu of radius elbows prior to fitting fabrication. Mitered elbows less than 45 degrees shall not require turning vanes. Mitered elbows 45-degrees and greater shall have single thickness turning vanes of same material and gauge as ductwork, rigidly fastened with guide strips in ductwork. Vanes for mitered elbows shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in grease ductwork. Refer to Section "Ductwork Accessories" for turning vane construction and mounting.
- D. Provide full radius elbows for ductwork installed in noise critical spaces. Refer to Section "Basic Mechanical Materials and Methods" for noise critical spaces. Where space does not permit the installation of radius elbows, provide mitered elbows with sound attenuating, acoustical turning vanes. Refer to Section "Ductwork Accessories" for acoustical turning vanes.

2.8 SHOP APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.
- B. Apply a coat of adhesive to liner facing in direction of airflow not receiving metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.
- E. Longitudinal joints in rectangular ducts shall not occur except at corners of ducts, unless the size of the duct and standard liner product dimensions make longitudinal joints necessary.
 - 1. Apply an adhesive coating on longitudinal seams in ducts exceeding 2,500 FPM air velocity.
- F. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- G. Secure transversely oriented liner edges facing the airstream with metal nosings that are either channel or "Z" profile or are integrally formed from the duct wall at the following locations:
 - 1. Fan discharge.
 - 2. Intervals of lined duct preceding unlined duct.
 - Upstream edges of transverse joints in ducts where duct velocity is greater than 2,500 FPM.
- H. Terminate liner with duct buildouts installed in ducts to attach dampers, turning vane assemblies, and other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to the duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire damper sleeve through fire separation.

2.9 ROUND AND FLAT OVAL DUCT FABRICATION

- A. General: "Basic Round Diameter" as used in this article is the diameter of the size of round duct that has a circumference equal to the perimeter of a given sized of flat oval duct. Except where interrupted by fittings, provide round and flat oval ducts in lengths not less than 12 feet.
 - 1. Fabricate round and flat oval ductwork of minimum 26 gauge sheet metal.
- B. Round Ducts: Fabricate round supply ducts using seam types identified in SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figure 3-2, RL-1, RL-4, or RL-5 except where diameters exceed 72 inches. Seam Types RL-2 or RL-3 may be used for ducts smaller than 72 inches in diameter if spot-welded on 1-inch intervals. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams. Comply with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Table 3-5 through 3-13 for galvanized steel gauges. For round duct with static pressure classification of 2 inches water gauge or lower, round supply ducts may be fabricated using snaplock seam types identified in SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figure 3-2, RL-6A, RL-6B, RL-7 or RL-8.
- C. Flat Oval Ducts: Fabricate flat oval supply ducts with standard spiral lockseams (without intermediate ribs) or with butt-welded longitudinal seams in gauges listed in SMACNA "HVAC Duct Construction Standards," 2005 Edition, Table 3-15.
- D. Field Painted Ductwork: All round and flat oval ductwork and duct fittings to be field painted shall have galvanized metal primer applied in the shop after fabrication and prior to shipping.

2.10 ROUND AND FLAT OVAL SUPPLY AND EXHAUST FITTINGS FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to conform to SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figures 3-5, 3-6 and 3-7 and with metal thickness specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from the body onto branch tap entrance.
- C. Elbows: Unless elbow construction type is indicated, provide elbows meeting the following requirements:
 - 1. Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate the bend radius of die-formed, gored, and pleated elbows 1.5 times the elbow diameter.
 - a. Elbows in Round Duct: Provide full radius elbows.
 - b. Elbows in Flat Oval Duct: Provide full radius elbows. Where space limits the installation of full radius elbows, short radius elbows with a minimum of two continuous splitter vanes shall be installed. Vane length shall be the entire length of the bend or 36 inches whichever is greater.
 - c. The use of square throat, radius heel elbows is prohibited. Remove and replace all installed elbows of this type with an approved elbow at no additional cost to the owner.
 - d. Provide full radius elbows for ductwork installed in noise critical spaces or where shown on the drawings. Refer to Section "Basic Mechanical Materials and Methods" for noise critical spaces.
 - Mitered Elbows: Fabricate mitered elbows with welded construction in gauges specified below.
 - a. Mitered Elbows Radius and Number of Pieces: Unless otherwise indicated, construct elbow to comply with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Table 3-1.
 - b. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from minus 2 inches to plus 2 inches:

- 1) 3 to 26 inches: 24 gauge.
- 2) 27 to 36 inches: 22 gauge.
- 3) 37 to 50 inches: 20 gauge.
- 4) 52 to 60 inches: 18 gauge.
- 5) 62 to 84 inches: 16 gauge.
- c. Round Mitered Elbows: Solid welded and with metal thickness listed below for pressure classes from 2 inches to 10 inches:
 - 1) 3 to 14 inches: 24 gauge.
 - 2) 15 to 26 inches: 22 gauge.
 - 3) 27 to 50 inches: 20 gauge.
 - 4) 52 to 60 inches: 18 gauge.
 - 5) 62 to 84 inches: 16 gauge.
- d. Flat Oval Mitered Elbows: Solid welded and with the same metal thickness as longitudinal seam flat oval duct.
- e. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material handling classes A and B; and only where space restrictions do not permit the use of 1.5 bend radius elbows. Fabricate with a single-thickness turning vane.
- 3. Round Elbows 8 Inches and Smaller: Die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 3-1/2- and 4-1/2-inch) elbows with gored construction.
- 4. Round Elbows 9 Through 14 Inches: Gored or pleated elbows for 30, 45, 60, and 90 degrees, except where space restrictions require a mitered elbow. Fabricate nonstandard bend angle configurations or 1/2-inch-diameter (e.g. 9-1/2- and 10-1/2-inch) elbows with gored construction.
- 5. Round Elbows Larger Than 14 Inches and All Flat Oval Elbows: Gored elbows, except where space restrictions require a mitered elbow.
- 6. Die-Formed Elbows for Sizes Through 8 Inches and All Pressures: 20 gauge with 2-piece welded construction.
- 7. Round Gored Elbows Gauges: Same as for non-elbow fittings specified above.
- 8. Flat Oval Elbows Gauges: Same as longitudinal seam flat oval duct.
- 9. Pleated Elbows Sizes Through 14 Inches and Pressures Through 10 Inches: 26 gauge.
- D. Double-Wall (Insulated) Fittings: Fabricate double-wall insulated fittings with an outer shell, insulation, and an inner liner as specified below. Dimensions indicated on internally insulated ducts are nominal inside dimensions.
 - 1. Outer Shell: Base outer shell gauge on actual outer shell dimensions. Provide outer shell lengths 2 inches longer than inner shell and insulation. Gauges for outer shell shall be same as for uninsulated fittings specified above.
 - Insulation: Unless otherwise indicated, provide 1-inch-thick fiber-glass insulation with thermal conductivity performance of 0.27 Btu/sq.ft./°F/inch-thickness at 75°F mean temperature. Provide insulation ends where internally insulated duct connects to single-wall duct or non-insulated components. The insulation end shall terminate the insulation and reduce the outer shell diameter to the nominal single-wall size.

- 3. Solid Inner Liner: Construct round and flat oval inner liners with solid sheet metal of the gauges listed below. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
- 4. Perforated Inner Liner: Construct round and flat oval inner liners with perforated sheet metal of the gauges listed below. Provide 3/32-inch-diameter perforations, with an overall open area of 23 percent. For flat oval ducts, the diameter indicated in the table below is the "basic round diameter."
 - a. 3 to 34 inches: 24 gauge.
 - b. 35 to 58 inches: 22 gauge.
 - c. 60 to 88 inches: 20 gauge.
- 5. Maintain concentricity of liner to outer shell by mechanical means. Retain insulation from dislocation by mechanical means.
- E. PVC-Coated Elbows and Fittings: Fabricate elbows and fittings as follows:
 - 1. Round Elbows 4 to 8 Inches: 2-piece, die stamped, with longitudinal seams spot welded, bonded, and painted with a PVC aerosol spray.
 - 2. Round Elbows 9 to 26 Inches: Standing seam construction.
 - 3. Round Elbows 28 to 60 Inches: Standard gore construction, riveted and bonded.
 - 4. Other Fittings: Riveted and bonded joints.
 - 5. Couplings: Slip-joint construction with a minimum of a 2-inch insertion length.

2.11 FACTORY-MANUFACTURED DUCTWORK

A. Manufacturers:

- 1. Hercules Industries.
- 2. Lewis & Lambert.
- 3. Lindab Safe.
- 4. Linx Industries, Inc.
- 5. Semco.
- 6. Approved equal.
- B. General: At the Contractor's option, factory-manufactured ductwork can be provided instead of fabricated ductwork for round and oval ductwork. The round duct system shall consist of fittings that are factory fitted with a sealing gasket and spiral duct which, when installed according to the manufacturer's instructions, will seal the duct joints without the use of duct sealer.

C. Duct Construction

1. Unless otherwise noted, all duct and fittings shall be constructed from galvanized steel in accordance with SMACNA's Duct Construction Standards for +10" water gauge pressure with thickness as shown in the following tables:

Single Wall Round Duct:

Diameter	Galvanized	Galvanized
(Inches)	Spiral Duct	Fittings
3-14	28	24
15-24	26	24
26-42	24	22

42-60 22 20

Double Wall Round Duct:

Diameter	Galvanized		Galvanized	
(Inches)	Spiral Duct		Fittings	
	Inner	Outer	Inner	Outer
3-14	28	28	24	24
16-24	26	26	24	24
26-42	24	24	22	22
44-60	22	22	20	20

Oval Duct:

Major Axis		Galvanized
(Inches)	Spiral Duct (ga)	Fittings (ga)
3-24	24	20
25-38	22	20
37-48	22	18
49-60	20	18
61-70	20	16
71 and large	18	16

- 2. Duct shall be calibrated to manufacturer's published dimensional tolerance standard.
- 3. All duct 14" diameter and larger shall be corrugated for added strength and rigidity.
- 4. Spiral seam slippage shall be prevented by means of a flat seam and a mechanically formed indentation evenly spaced along the spiral seam.
- 5. Ducts shall be constructed using spiral lock seam sheet metal construction.
- 6. Ductwork to be installed in exposed locations shall have the surface prepared in the factory for field painting.

D. Fittings:

- 1. All fitting ends for round duct and transitions and divided flow fittings smaller than 50" diameter that convert oval duct to round duct shall come factory equipped with a double lipped, U-profile, EPDM rubber gasket. Gasket shall be manufactured to gauge and flexibility so as to insure that system will meet all of the performance criteria set forth in the manufacturer's literature. Gasket shall be classified by Underwriter's Laboratories to conform to ASTM E84-91a and NFPA 90A flame spread and smoke developed ratings of 25/50.
- 2. All fittings shall be calibrated to manufacturer's published dimensional tolerance standard and associated spiral duct.
- 3. All fitting ends from 5" to 60" diameter shall have rolled over edges for added strength and rigidity.
- 4. All elbows from 5" to 12" diameter shall be 2 piece die stamped and continuously stitch welded. All elbows 14" diameter and larger shall be standing seam gorelock construction and internally sealed.
- 5. The radius of all 90° and 45° elbows shall be 1.5 times the elbow diameter, unless otherwise noted on the contract documents to be 1.0. The radius of all 15°, 30° and 60° elbows shall be 1.0 times the elbow diameter.

- 6. All fittings that are of either spot welded or button punched construction shall be internally sealed. When contract documents require divided flow fittings, only full body fittings will be accepted. The use of duct taps is unacceptable except for retrofit installations.
- 7. Double wall duct and fittings shall consist of a perforated or solid inner liner, a 1 inch, 1.50 lb/ft3 (unless otherwise specified) layer of fiberglass insulation and a solid outer pressure shell. Perforated inner liner shall have a retaining fabric wrapped between the perforated inner and the fiberglass insulation. This fabric shall provide fiberglass tear retention while maintaining the desired acoustical properties. For 1 inch thick insulation, the outer pressure shell diameter shall be 2 inches larger than the inner liner.
- 8. All double wall fittings for round duct shall be furnished with the Lindab Safe gasket on the outer shell. The inner shell on all double wall fittings shall extend a minimum of 1 inch past the outer shell.
- Double wall to single wall transitions shall be provided where insulated duct connects to noninsulated, single wall duct. Transitions shall also act as insulation ends reducing the double wall outer shell diameter to the inner shell diameter.
- All double wall duct and fittings shall be furnished with both an inner liner and an outer pressure shell coupling. The inner liners shall not be fastened tighter to allow for expansion and contraction.
- 11. All volume dampers shall be Lindab Safe type DRU, DSU or DTU or approved equal. Damper shall be fitting sized to slip into spiral duct. Damper shall have the following features:
 - a. Locking quadrant with blade position indicator.
 - b. 2" sheet metal insulation stand-off.
 - c. Integral shaft/blade assembly.
 - d. Shaft mounted, load bearing bushings.
 - e. Gasketed shaft penetrations to minimize leakage.

2.12 SNAP-LOCK DUCT SYSTEM

- A. General: At Contractor's option, snap-lock round ductwork can be provided instead of fabricated ductwork for round ductwork up to 14" in diameter in air systems with pressures between negative 1" and positive 2" w.c..
- B. Duct Construction:
 - 1. Material:
 - Galvanized steel conforming to ASTM A653 and A924 with G-60 galvanized coating conforming to ASTM A653 and ASTM A90.
 - Duct shall be minimum 26 gauge. Duct shall be self-locking and incorporate a factory applied
 gasket in the longitudinal seam and the female end of the traverse joint to provide a system
 that meets SMACNA Seal Class A.
 - 3. Fittings: Minimum 26 gauge. All high-efficiency take-offs, conicals, and collars shall have a factory applied gasket along all rivets, co-latches, and flanges. Dampered fittings shall have low leakage hardware with closed-end bearings.
- C. Gaskets: Butyl and EPDM rubber that meets flame spread index of 25 and smoke spread index of 50 according to ASTM E84.
- D. Manufacturers:
 - 1. Ductmate GreenSeam.
 - 2. Approved equal.

2.13 WIRE ROPE HANGING SYSTEMS

- A. Manufacturers:
 - 1. Ductmate.
 - 2. Duro Dyne.
 - 3. Gripple.
 - 4. Approved equal.
- B. General: At Contractors option, provide wire rope mechanical system hangers with easy lightweight mechanical adjustment system for hanging ductwork.
- C. Wire rope shall be 7 x 7 or 7 x 19 aircraft quality zinc coated cable by Ductmate or galvanized steel wire rope by Duro Dyne or Gripple of size appropriate for working load being supported, including a 5:1 safety factor. Provide Ductmate WR10 through 40, Duro Dyne WC2 through WC6 or Gripple No. 1 through No. 5 wire rope for duct hanging application.
- D. Secure wire rope to duct using Ductmate Clutcher, Duro Dyne Cable Lock or Gripple Hang Fast easily adjustable attachment. Locking devices shall be constructed of cast zinc housings with stainless steel springs. For seismic applications, hangers shall be seismic tested, conforming to GR 63, level 4 seismic, with UL and SMACNA seismic approvals. Reference Division 23 Section 230548 "Seismic Controls for Mechanical Systems" for additional requirements.
- E. Upper hanger attachment shall be compatible with wire rope hanger system and shall be by same manufacturer as wire rope duct attachment. Provide Ductmate EZ-Lock Wire rope beam clamp mechanical hanger with locking nut for easy adjustment or Duro Dyne or Gripple ceiling, beam or purlin clip as applicable for the structure to which it is attached.
- F. Wire rope, duct attachment, and upper end attachment to structure shall each have minimum 5 to 1 safety factor based upon the weight being supported.
- G. Where approved by local code authority, the loop system may be swaged directly on to a seismic approved bracket or appropriate end fixing.

PART 3 - EXECUTION

3.1 DUCT MATERIAL APPLICATION

- A. All ducts shall be galvanized steel except as follows:
 - Grease Hood Exhaust Ducts: Comply with NFPA 96.
 - a. Concealed: Carbon-steel sheet, minimum 16 gauge.
 - b. Exposed: Type 304, stainless steel, minimum 18 gauge, with finish to match kitchen equipment and range hood.
 - c. Weld and flange seams and joints.
 - d. At Contractor's option, a UL listed concentric ductwork package may be used in lieu of the welded carbon steel duct for connecting hood to exhaust fan. Provide manufacturers UL listing number and verification certificate as a part of the shop drawing submittal. Install duct package in strict conformance with manufacturer's instructions and recommendations.

2. Dishwasher Hood Exhaust Ducts:

a. Type 304, stainless steel, minimum 18 gauge, with finish to match kitchen equipment and range hood. Provide continuously welded seams on top or sides of duct and flanged joints with watertight EPDM gaskets.

- b. Aluminum, with longitudinal seams and laps arranged on top of duct. Seal joints with silicone sealant to provide watertight joint.
- 3. Natatorium or Swimming Pool Ductwork:
 - a. Aboveground: Minimum 22 gauge aluminum sheet material.
 - b. Underground: Polyvinyl Chloride up to 24" in diameter or fiber reinforced plastic (FRP). Refer to Section "NonMetal Ducts".
- 4. Dryer Vent Ducts: Rigid, smooth wall, aluminum duct, minimum 26 gauge.
- 5. Acid-Resistant (Fume-Handling) Ducts: Provide factory-fabricated ducts and fittings only; no shop or field fabrication will be allowed.
 - a. Type 304, stainless-steel sheet with No. 4 finish for exposed surfaces and No. 1 for concealed surfaces.
 - b. PVC-coated galvanized steel with thicker coating on duct interior.
- 6. Exterior Ductwork: Ductwork installed exterior to the building shall be minimum #18 gauge with longitudinal and transverse joints welded or sealed airtight as specified under Paragraph "Seam and Joint Sealing".

3.2 DUCT LINER INSTALLATION

- A. Fiberglass Duct Liner:
 - 1. Attach fiberglass duct liner using fasteners that do not damage the liner when applied as recommended by the manufacturer, that do not cause leakage in the duct, and will indefinitely sustain a 50-pound tensile dead load test perpendicular to the duct wall.
- B. Flexible Elastomeric Duct Liner:
 - 1. Attach flexible elastomeric duct liner to clean, oil-free sheet metal surfaces with adhesive as recommended by the liner manufacturer.
 - 2. Seal all seams with adhesive and install compression joints in accordance with manufacturer's instructions.
- C. Polyester Duct Liner:
 - Install polyester duct liner per SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible," unless otherwise specified.
 - 2. Attach polyester duct liner using a non flammable, low VOC water based adhesive.
 - Apply a non flammable, low VOC water based lagging adhesive to the exposed leading edge
 of the insulation.
 - 4. Install fasteners per SMACNA HVAC Duct Liner installation instructions.
- D. Application: Provide duct liner on the following interior air ducts and where specified on the drawings.
 - 1. Supply Ductwork:
 - a. All ductwork.
 - Exposed rectangular ductwork.
 - c. Exposed round ductwork.
 - d. First 15 feet of ductwork downstream of equipment outlets.
 - Return Ductwork.
 - a. All ductwork.

- b. Exposed rectangular ductwork.
- c. Exposed round ductwork.
- d. First 15 feet of ductwork upstream of equipment outlets.

3.3 DUCT INSTALLATION, GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Duct System Pressure Class: Construct and install each duct system except factory-manufactured ductwork for the specific duct pressure classification indicated. For factory-manufactured ductwork, refer to Paragraph "Factory-Manufactured Ductwork".
 - 1. Supply Air Ducts: 3 inches water gauge.
 - 2. Primary Supply Air Ducts (upstream of terminal boxes): 4 inches water gauge.
 - 3. Secondary Supply Air Ducts (downstream of terminal boxes): 2 inches water gauge
 - 4. Return and Outdoor Air Ducts: 2 inches water gauge, negative pressure.
 - 5. Exhaust Air Ducts: 2 inches water gauge, negative pressure.
- C. Install ducts with the fewest possible joints.
- D. Seal duct joints with the appropriate sealing material.
- E. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
- G. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.
- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- Cover ducts openings during construction with duct caps or three-mil plastic to protect inside of (installed and delivered) ductwork from exposure to dust, dirt, paint and moisture. Do not use duct tape on ducts that will be exposed or painted.
- J. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
- K. Install insulated ducts with 1-inch clearance outside of insulation.
- L. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
- M. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- N. Exposed Ductwork: Exposed ductwork shall be free of defects, dents or blemished surfaces to provide a smooth, finished appearance. Any damaged material shall be replaced with new material. Ductwork that is to be field painted shall have surfaces wiped clean of lubricant, dirt, or fil prior to priming and painting. Apply primer and paint of type as recommended by paint manufacturer for duct material and finish.
- O. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- P. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation

with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

Q. Acoustical Barrier Penetrations: Where a duct passes through a wall, ceiling or floor slab of a noise critical space, provide a clear annular space of 1-inch between the duct and the structure. Refer to Section "Common Work Results for HVAC" for noise critical spaces. The Contractor shall check the clearance and, if clearance is acceptable, shall install the duct and pack the voids full depth with mineral fiber batt insulation. Contractor shall caulk both ends with a non-aging, non-hardening sealant backed by a polyethylene foam rod or permanently flexible firestop material. Where there is insufficient clearance space, Contractor shall place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.

3.4 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints as follows:
 - All transverse joints, longitudinal seams, and duct wall penetrations shall be sealed to meet SMACNA Seal Class A.
 - 2. Seal class shall apply to all supply, return, outdoor air, and exhaust ductwork, regardless if the duct is positively or negatively pressurized.
- B. Seal externally insulated ducts prior to insulation installation.
- C. Ductwork installed exterior to the building shall have longitudinal and transverse joints welded or sealed airtight with weatherproof heavy liquid sealant applied according to manufacturer's instructions.

D. AEROSOLIZED DUCT SEALING

1. Application must be performed by a manufacturer approved service provider and the procedure shall be done as per manufacturer's recommendations.

2. Duct Preparation:

- a. Inspect air distribution system for major leakage and repair major leakage greater than ½ inch externally using mastic and tapes per SMACNA standards.
- b. Inspect air distribution system for significant accumulation of dust, dirt and debris and remove all debris and significant dust and dirt by duct cleaning method.
- c. Temporarily remove or protect from aerosol particles building instrumentation and control devices, humidifier dispersion tubes, and fire and smoke sensors. Temporarily isolate air moving equipment and block off air inlets and outlets.

3. Duct Sealing:

- a. Seal air distribution system from the inside using automated aerosolized sealant injection.
- b. Repair all injection and test holes in existing ductwork sealed tight as per SMACNA standards.

3.5 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in Chapter 5 of the SMACNA "HVAC Duct Construction Standards", 2005 Edition.
- B. The use of wire rope hanging systems is an acceptable alternate hanging methods when installed in strict accordance with manufacturer's instructions. Wire rope hanger spacing shall not exceed 8 feet. Supported load shall not exceed manufacturer's recommended load rating.
- C. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
- D. Support vertical ducts at a maximum interval of 16 feet and at each floor.

- E. Upper attachments to structures shall have an allowable load not exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated. Hangers and supports shall be fastened to building joists or beams. Do not attach hangers and supports to the above floor slab or roof with sheet metal screws.
- F. Install concrete insert prior to placing concrete.
- G. Install powder actuated concrete fasteners after concrete is placed and completely cured.

3.6 PENETRATIONS

- A. Fire Barrier Penetrations: Where ducts pass though fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity.
- B. Exterior Wall Penetrations: Seal duct penetrations through exterior wall constructions with sleeves, packing, and sealant. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for additional information.
- C. Underground Exterior Wall Penetrations: Seal duct penetrations through underground exterior walls with sleeves, packing, and sealant. Refer to Division 23 Section "Basic Piping Materials and Methods" for additional information.
- D. Elevated Floor Penetrations of Waterproof Membrane, Interior Penetrations of No-Fire Rated Walls and Concrete Slab on Grade Penetrations: Seal ducts that pass through waterproof floors, non-fire rated walls, partitions and ceilings or concrete slab on grade. Refer to Division 23 Section "Basic Mechanical Materials and Methods" for special sealers and materials.

3.7 CONNECTIONS

- A. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section "Air Duct Accessories."
- B. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figures 4-5 and 4-6.
- C. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figures 7-6 and 7-7. Where a 90-degree elbow is required at the connection to air devices, provide a rigid duct elbow or, at Contractor's option, a flexible elbow assembly as specified in Division 23 Section "Air Duct Accessories."
- D. Fan Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2005 Edition, Figure 7-8.

3.8 FIELD QUALITY CONTROL

- A. Remove temporary protection devices over ductwork prior to starting equipment and turning the system over to the owner.
- B. If permanent HVAC equipment is used during the construction period, provide temporary filters at all openings in the ductwork and at inside equipment to protect the system from dust, dirt, paint, and moisture. Replace and maintain filters when needed, but not less than every month. On the day of substantial completion, clean the duct system and provide a new set of filters in the HVAC unit.
 - 1. Refer to Division 23 Section 234100 Particulate Air Filtration for filter requirements.

3.9 ADJUSTING AND CLEANING

- A. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section "TESTING, ADJUSTING, AND BALANCING FOR HVAC" for requirements and procedures for adjusting and balancing air systems.
- B. Vacuum duct systems prior to final acceptance to remove dust and debris.

3.10 CLEANING NEW SYSTEMS

- A. Contractor shall clean the HVAC systems in accordance with NADCA.
- B. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- C. Use service openings, as required, for physical and mechanical entry and for inspection.
 - 1. Create other openings to comply with duct standards.
 - 2. Disconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- D. Vent vacuuming system to the outside. Provide filtration and/or containment systems to keep debris removed from HVAC systems from contaminating other spaces. Locate exhaust down wind and away from air intakes and other points of entry into building.
- E. Clean the following metal duct systems by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply and outdoor air ducts, dampers, actuators, and turning vanes.
- F. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment while the system is under negative pressure; do not permit duct liner to get wet.
 - Clean coils and coil drain pans according to ACR 2002. Keep drain pan operational. Rinse
 coils with clean water to remove latent residues and cleaning materials; comb and straighten
 fins.
- G. Disposal: Debris collected from the HVAC system shall be disposed of in accordance with applicable federal, state and local requirements.
- H. Cleanliness Verification:
 - 1. Visually inspect metal ducts for contaminants.
 - 2. Where contaminants are discovered, re-clean and re-inspect ducts.

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this Section.
- B. Types of ductwork accessories required for project include the following:
 - 1. Dampers.
 - a. Low pressure manual dampers.
 - b. Counterbalanced backdraft dampers.
 - 2. Cable operated damper systems.
 - 3. Electronic zone pulse damper systems.
 - 4. Fire and smoke dampers.
 - 5. Ceiling radiation dampers.
 - 6. Smoke Detectors
 - 7. Turning vanes.
 - 8. Duct hardware.
 - Duct access doors.
 - 10. Flexible ductwork.
 - 11. Flexible elbow assembly.
 - 12. Metal duct connectors.
 - 13. Flexible duct connectors.
 - 14. Duct wrap for rated shaft enclosure protection.
- C. Refer to other Division 23 Sections for testing, adjusting, and balancing of ductwork accessories; not work of this Section.

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Codes and Standards:
 - 1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible", 2005 Edition.
 - Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - 3. UL Compliance:
 - a. Construct, test, and label fire dampers in accordance with current edition of UL Standard 555 "Fire Dampers". Construct, test, and label smoke dampers in accordance with current edition of UL Standard 555S "Smoke Dampers".
 - Construct flexible ductwork in compliance with UL Standard 181 "Factory-Made Air Ducts and Connections".
 - c. Duct tape shall be labeled in accordance with UL Standard 181B and marked 181B-FX. Non-metallic duct clamps shall be labeled in accordance with UL Standard 181B and marked 181B-C.

- Duct clamps shall be labeled in accordance with UL Standard 181B and marked 181B C
- e. Grease exhaust duct wrap shall meet the fire protection requirements defined by UL Standard 1479 "Fire Tests of Through-Penetration Firestops.".
- f. Fire rated duct wrap shall meet the fire protection requirements defined by UL Standard 1479 "Fire Tests of Through-Penetration Firestops.".

4. NFPA Compliance:

- a. Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories. Comply with NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- b. Comply with NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Operations" for fire-rated grease exhaust ducts.
- ASTM Compliance: Products shall have flame-spread index of 25 or less, and smokedeveloped index of 50 or less, as tested by ASTM E 84 "Surface Burning Characteristics" (NFPA 255) method.
 - a. Duct silencers shall be tested for performance in accordance with ASTM E477 "Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers."
 - b. Grease exhaust duct wrap shall be tested for performance in accordance with ASTM E 2336 "Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems" and ASTM E814 "Standard Test Methods of Fire Resistance of Through-Penetration Fire Stops".
 - c. Fire rated duct wrap shall be tested in accordance with ASTM E814 "Standard Test Methods of Fire Resistance of Through-Penetration Fire Stops".

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory including dimensions, capacities and materials of construction; and installation instructions. Submit performance data for duct silencers including insertion loss performance in octave bands from 63 Hz to 8,000 Hz and pressure drop at specified airflow.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 1.

1.4 SPARE PARTS

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

PART 2 - PRODUCTS AND MATERIALS

2.1 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards". Damper material shall be galvanized steel for standard air systems, aluminum for wet or natatorium environments and stainless steel for corrosive environments. Bearings shall be corrosion resistant, molded synthetic and axles shall positively lock into the damper blade. Extended shafts shall be metal material. Blade seals shall be neoprene for round dampers. Blade seals shall be silicone for rectangular dampers. Dampers shall be Greenheck Model MBD Series, or approved

- equal, with locking quadrant. Provide with standoff bracket and shaft extension as required for insulation requirements.
- B. Control Dampers: Refer to Division 23 section Instrumentation and Control Devices for HVAC for control dampers; not work of this section.
- C. Counterbalanced Backdraft Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to open at indicated static pressure. Construct frames and blades of minimum 16-ga aluminum. Provide minimum 1/2" diameter, corrosion-resistant bearings and 1/2" diameter, galvanized or stainless steel axles. Blade edge seals shall be mechanically locked into blade edge. Blade seals shall be neoprene for round dampers. Blade seals shall be silicone or vinyl for rectangular dampers.
- D. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
 - 1. Air Balance, Inc.
 - 2. Arrow United Industries.
 - Cesco
 - 4. Greenheck
 - 5. Louvers & Dampers, Inc.
 - 6. Nailor Industries, Inc.
 - 7. Pottorff
 - 8. Ruskin Mfg. Co.
 - TAMCO
 - 10. Vent Products

2.2 CABLE OPERATED DAMPER SYSTEMS

- A. General: Where access to dampers through a hard ceiling is required, provide a concealed, cable operated volume damper with remote operator.
 - 1. Damper shall be adjustable through the diffuser face or frame with standard 1/4" nutdriver or flat screwdriver.
 - 2. Cable assembly shall attach to damper as one piece with no linkage adjustment.
 - 3. Positive, direct, two-way damper control shall be provided with no sleeves, springs or screw adjustments to come loose after installation.
 - 4. Provide cable length as required to span the distance from the damper to the remote operator location.
 - 5. Support cable assembly to avoid bends and kinks in cable.
- B. Where approved by Architect, a ceiling cup with cover plate can be used for access to cable operator.
- C. Manufacturer: Subject to compliance with requirements, provide cable operated damper systems of one of the following:
 - 1. Metropolitan Air Technology, Inc. (Reference model number is RT-250).
 - 2. Young Regulator Co..

2.3 ELECTRONIC ZONE PULSE DAMPER SYSTEM

- A. General: Where access to dampers is hard to reach or inaccessible, provide an electronic zone pulse damper with a remote operator.
- B. Remote Controlled Balancing Damper: Damper shall be Ruskin ZPD25 or equivalent for round branch or diffuser neck installation. Frame and blade shall be 20 gauge (minimum) galvanized steel on 3/8" axle and molded synthetic bearings. Damper shall be rated for maximum 2" water column static pressure and maximum 2000 FPM velocity. Actuator shall be gear drive, fail in place motor.

- C. Remote Damper Control: Provide Ruskin ZRC020 or equivalent remote controller complete with wall box mounting kit, power control cable and RJ11 connectors. Power shall be supplied by 9 volt battery. Switch shall be DPDT-CO (Open Off Closed).
- D. Balancing: Controller shall be permanently connected for intermittent balancing by owner-user. Controller shall be used to adjust position of damper during building air balance or commissioning and disconnected from control cable when set point is established.

2.4 FIRE AND SMOKE DAMPERS

- A. General: Provide fire, smoke, and fire/smoke dampers at locations indicated on the drawings. Damper ratings shall be as required to maintain the fire and/or smoke ratings noted on the architectural drawings. Provide duct access door for inspection and service to each fire, smoke, and fire/smoke damper and fusible link as required. Provide sleeves of length as required to meet the installed location.
- B. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of minimum 22-ga galvanized steel or as required to maintain applicable UL classification. Construct casings of 20 gauge stainless steel where installed in corrosive or moisture laden airstreams or where noted on the drawings. Fire dampers shall be dynamic-rated for closure under pressure. Provide fusible link rated at 160 to 165 degrees F (71 to 74 degrees C) unless otherwise indicated. Provide damper with positive lock in closed position, and with the following additional features:
 - 1. Damper Blade Assembly: Single-blade type.
 - 2. Damper Blade Assembly: Multi-blade type.
 - 3. Damper Blade Assembly: Curtain type with blades out of the airstream.
 - 4. Blade Material: Steel, match casing.
 - 5. Blade Material: Stainless steel, match casing.
 - 6. Open-closed indication switch.
- C. Fire/Smoke Dampers: Provide fire/smoke dampers, of types and sizes indicated, and with actuator as specified herein.
 - 1. Dampers: Dampers shall be UL555 (current edition) classified fire damper of rating required for location installed, UL555S (current edition) classified smoke damper for leakage class II and rated for dual directional airflow. Fire/smoke dampers shall be rated for closure in ducts up to minimum velocity of 2,000 fpm and static pressure of 4" w.g. Construct casings of 16-ga galvanized steel. Construct casings of 16 gauge stainless steel where installed in corrosive or moisture laden airstreams or where noted on the drawings. Construct blades of minimum 22 gauge thickness with airfoil or longitudinal grooved shape for airflow velocities up to 2,000 fpm and airfoil shape for airflow velocities greater than 2,000 fpm. Bearings shall be self-lubricating, turning in extruded hole in the frame. Jamb seals shall be flexible, stainless steel. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in to the blade edge. Linkage shall be concealed in the frame. Provide resettable temperature device rated at 160 to 165 degrees F (71 to 74 degrees C) unless otherwise indicated. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector, or terminal block for connection to the building fire alarm system and the following additional features:
 - a. Damper Blade Assembly: Single-blade type.
 - b. Damper Blade Assembly: Multi-blade type.
 - c. Blade Material: Galvanized steel, match casing.
 - d. Blade Material: Stainless steel, match casing.
 - e. Open-closed indication switch.
 - f. Temperature Limited Override.
 - g. Test Switch.
 - h. Smoke Detector.

- 2. Motor-Driven Actuators: Actuators shall be factory installed. All actuators shall open in 15 seconds or less and close in 15 seconds or less after alarm or smoke detection has occurred. Actuators shall be rated for a minimum of 20,000 cycles of operation. Provide motor-driven fire/smoke dampers in types and sizes indicated, with 120 Volt, two-position, fail close, electric motor designed to close and/or open damper between 7 and 15 seconds, motor mounting bracket, and with the following construction features:
 - a. Unit Assembly: Motor mounted outside air stream.
 - b. Unit Assembly: Motor mounted inside air stream.
 - c. Motor shall be designed for power return open/spring closed operation.
 - d. Provide automatic reset of damper upon cessation of detector (test or actual smoke detection), and normalization of duct air temperature.
 - e. Provide with integral end switch.
- 3. Pneumatic Actuators: Appropriate pneumatic actuator shall be installed by the damper manufacturer at the time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications. Electric-pneumatic switch to be provided by damper manufacturer; coordinate. Provide air bleed orifice to limit closing time of damper to greater than five seconds, but not more than 15 seconds.
 - a. Unit Assembly: Actuator mounted outside air stream.
 - b. Unit Assembly: Actuator mounted inside air stream.
 - c. Actuator shall be designed for power return open/spring closed operation.
 - d. Provide automatic reset of damper upon cessation of detector (test or actual smoke detection), and normalization of duct air temperature.
- D. Smoke Dampers: Provide Smoke dampers, of types and sizes indicated, and with actuator as specified herein.
 - Dampers: Dampers shall be UL555S (current edition) classified smoke damper for leakage class II and rated for dual directional airflow. Smoke dampers shall be rated for a minimum velocity of 2,000 fpm and pressure of 4" w.g. Construct casings of 16-ga galvanized steel. Construct casings of 16 gauge stainless steel where installed in corrosive or moisture laden airstreams or where noted on the drawings. Construct blades of minimum 22 gauge thickness with airfoil or longitudinal grooved shape for airflow velocities up to 2,000 fpm and airfoil shape for airflow velocities greater than 2,000 fpm. Bearings shall be self-lubricating, turning in extruded hole in the frame. Jamb seals shall be flexible, stainless steel. Blade edge seals shall be silicone rubber mechanically locked in to the blade edge. Linkage shall be concealed in the frame. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector, or terminal block for connection to the building fire alarm system] and the following additional features:
 - a. Damper Blade Assembly: Single-blade type.
 - b. Damper Blade Assembly: Multi-blade type.
 - c. Blade Material: Galvanized steel, match casing.
 - d. Blade Material: Stainless steel, match casing.
 - e. Open closed indication switches.
 - f. Test switch.
 - g. Smoke Detector.
 - 2. Motor-Driven Actuators: Actuators shall be factory installed. All actuators shall open in 15 seconds or less and close in 15 seconds or less after alarm or smoke detection has occurred. Actuators shall be rated for a minimum of 20,000 cycles of operation. Provide motor-driven smoke dampers in types and sizes indicated, with 120 Volt, two-position, fail close, 24 volt, two position, fail close, 24 volt, modulating, electric motor designed to close and/or open

damper between 7 and 15 seconds, motor mounting bracket, and with the following construction features:

- a. Unit Assembly: Motor mounted outside air stream.
- b. Unit Assembly: Motor mounted inside air stream.
- c. Motor shall be designed for power return open/spring closed operation.
- d. Provide automatic reset of damper upon cessation of detector (test or actual smoke detection), and normalization of duct air temperature.
- e. Provide with integral end switch.
- 3. Pneumatic Actuators: Appropriate fail close pneumatic actuator shall be installed by the damper manufacturer at the time of damper fabrication. Damper and actuator shall be supplied as a single entity which meets all applicable UL555S qualifications. Electric-pneumatic switch to be provided by damper manufacturer; coordinate. Provide air bleed orifice to limit closing time of damper to greater than five seconds, but not more than 15 seconds.
 - a. Unit Assembly: Actuator mounted outside air stream.
 - b. Unit Assembly: Actuator mounted inside air stream.
 - c. Actuator shall be designed for power return open/spring closed operation.
 - d. Provide automatic reset of damper upon cessation of detector (test or actual smoke detection), and normalization of duct air temperature.
- E. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
 - 1. Air Balance, Inc.
 - 2. Cesco Products.
 - 3. Greenheck
 - 4. Louvers & Dampers, Inc.
 - 5. Nailor Industries, Inc.
 - 6. Pottorff
 - 7. Prefco Products, Inc.
 - 8. Ruskin Mfg. Co.

2.5 CEILING RADIATION DAMPERS

- A. General: Conform to UL 555C or tested in accordance with UL 263.
- B. Construction:
 - 1. Casing: Galvanized steel in gauges as required to maintain applicable UL classification.
 - 2. Damper Blades: Galvanized steel with UL classified thermal insulation as required to meet UL criteria and fire and smoke ratings noted on the architectural drawings.
 - 3. Fusible link: Integral to device, rated at 165 degrees F.
- C. Accessories:
 - 1. Volume Controller: Manually adjustable volume controller integral to the assembly used to regulate airflow through the damper for testing and balancing.
- D. Manufacturer: Subject to compliance with requirements, provide ceiling radiation dampers of one of the following:
 - 1. Air Balance, Inc.
 - 2. Cesco Products.
 - 3. Greenheck
 - 4. Louvers & Dampers, Inc.

- 5. Nailor Industries, Inc.
- 6. Pottorff.
- 7. Prefco Products, Inc.
- Ruskin Mfg. Co.

2.6 SMOKE DETECTORS

- A. Manufacturers:
 - 1. Notifier.
 - 2. SimplexGrinnell.
 - 3. Siemens-Cerberus Division.
 - 4. Kidde/Edwards.
 - 5. Gamewell-FCI.
 - 6. Fike.
 - 7. Silent Knight.
- B. Duct Smoke Detectors: Photoelectric type complying with UL 268A with a standard, relay or isolator detector mounting base. Provide manufacturer's standard housing to protect the measuring chamber from damage and insects. Provide drilling templates and gaskets to facilitate locating and mounting the housing.
 - 1. Provide for variations in duct air velocity between 100 and 4,000 feet per minute.
 - Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet.
 - 3. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
 - Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor control circuit.
 - 5. Contacts: Include low voltage supervisory and alarm contacts.
 - 6. Provide remote alarm LEDs and remote test stations as shown on the plans.
 - 7. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.

2.7 TURNING VANES

- A. Manufactured Turning Vanes: Provide turning vanes and runners fabricated from galvanized sheet metal, lock-forming quality, ASTM A 653, minimum Coating Designation G 60, of the same gauge thickness or greater as the ductwork in which they are installed. Vanes shall be rigidly fastened with guide strips to minimize noise and vibration. Vanes in ductwork over 30" deep shall be installed in multiple sections with vanes not over 30" long and shall be rigidly fastened. Turning vanes shall be constructed per SMACNA Duct Construction Standards Metal and Flexible 2005 Edition, Figure 4-3 and set into side strips suitable for mounting in ductwork.
- B. Acoustical Turning Vanes: Provide acoustical turning vanes constructed of airfoil shaped aluminum extrusion with perforated faces and fiberglass fill in systems serving noise critical spaces. Refer to Section "Common Work Results for HVAC".
- C. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
 - 1. Aero Dyne Co.
 - 2. Anemostat Products Div.; Dynamics Corp. of America.
 - 3. Ductmate Industries.
 - 4. Duro Dyne Corp.
 - 5. Elgen Manufacturing Co., Inc.

- 6. Hart & Cooley Mfg. Co.
- 7. Register & Grille Mfg. Co., Inc.
- 8. Sheet Metal Connectors, Inc.

2.8 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 - 1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 - 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
 - 1. Ductmate Industries.
 - 2. Elgen Manufacturing Co., Inc.
 - 3. Ventfabrics, Inc.
 - 4. Young Regulator Co.

2.9 DUCT ACCESS DOORS

- A. General: Provide, where indicated on the drawings or where specified in Part 3 of this section, duct access doors of size allowable by duct dimensions with, unless otherwise noted on the drawings, minimum size of 10" by 10" and maximum size of 24" by 24". Provide removable section of duct where duct size is too small for a 10" by 10" access door. Construct access doors in accordance with SMACNA "HVAC Duct Construction Standards Metal and Flexible" and as specified herein. Label access doors for fire and smoke dampers as specified in Paragraph "Installation of Ductwork Accessories.
- B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one size hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
- C. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
 - 1. Air Balance Inc.
 - 2. Ductmate Industries.
 - 3. Duro Dyne Corp.
 - 4. Register & Grille Mfg. Co., Inc.
 - Ruskin Mfg. Co.
 - 6. Ventifabrics, Inc.
 - 7. Vent Products.
 - 8. Zurn Industries, Inc.; Air Systems Div.

2.10 FLEXIBLE DUCT.

- A. Construction: Provide flexible ductwork conforming to UL 181-Class I, NFPA 90A and NFPA 90B and as follows. Duct types of manufacturers are indicated for reference in regards to required quality of construction and materials. Flexible duct shall have fire retardant polyethylene or reinforced metalized protective vapor barrier as follows:
 - 1. Low pressure (duct pressure class up to and including 2" w.g.) and medium pressure (duct pressure class greater than 2" up to and including 6" w.g.)
 - a. Fire retardant polyethylene vapor barrier

- 1) ATCO 80 Series
- 2) Flexmaster Type 5B
- 3) JPL Type PR Series
- 4) Thermaflex Type G-KM
- b. Reinforced metalized vapor barrier
 - 1) ATCO 30 Series
 - 2) Flexmaster Type 5M
 - 3) JPL Type MHP Series
 - 4) Thermaflex Type M-KE
- 2. High pressure (duct pressure class over 6" w.g.)
 - a. Fire retardant polyethylene vapor barrier
 - 1) Flexmaster Type 3B
 - b. Reinforced metalized vapor barrier
 - 1) Flexmaster Type 3M
 - 2) Thermaflex Type M-KC
- Flexible ductwork shall have CPE liner with steel wire helix mechanically locked or permanently bonded to the liner.
- 4. Provide acoustical, fiberglass insulated duct with minimum R-value of R-8.0.
- B. Manufacturer: Subject to compliance with requirements, provide flexible ductwork of one of the following:
 - 1. ATCO Rubber Products.
 - 2. Flexmaster.
 - 3. JPL (J.P. Lamborn Co)
 - 4. Thermaflex.

2.11 FLEXIBLE ELBOW ASSEMBLY

- A. General: At Contractors option, in lieu of rigid sheet metal elbows at connections to air inlets and outlets in concealed spaces, provide flexible elbow assembly to air devices requiring a 90 degree elbow connection.
- B. Flexible elbow assembly shall be constructed of durable composite material and UL listed for use in return air plenums with a turning radius of not less than 3 inches.
- C. Flexible elbow assembly shall be FlexFlow Elbow as manufactured by Flexible Technologies, Inc., FlexRight Elbow as manufactured by Build Right Products or approved equal.

2.12 METAL DUCT CONNECTORS

- A. Description: Factory-fabricated, slide-on transverse flange connectors, corners, cleats, gaskets, and components. Material, gauge, and shape shall match the connecting ductwork.
- B. Manufacturers: Subject to compliance with requirements, provide duct connectors by one of the following or approved equal:
 - 1. Ductmate Industries.
 - 2. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

2.13 FLEXIBLE DUCT CONNECTORS

A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment.

- B. Fabric Material: Flame-retardant or noncombustible fabrics compliant with NFPA 701.
 - Metal-Edged Connectors: Factory fabricated with a fabric strip minimum 3-1/2 inches wide attached to two strips of minimum 24 gauge galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
 - 2. Indoor System, Flexible Connector Fabric: Glass fabric coated with neoprene.
 - a. Minimum Weight: 26 oz./sq. yd.
 - b. Minimum Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - c. Service Temperature: Minus 40 to plus 200 deg F.
 - 3. Outdoor System, Flexible Connector Fabric: Glass fabric coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - a. Minimum Weight: 24 oz./sq. yd.
 - b. Minimum Tensile Strength: 225 lbf/inch in the warp and 300 lbf/inch in the filling.
 - Service Temperature: Minus 40 to plus 250 deg F.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Flexible connectors shall have flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
- E. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
 - 1. Ductmate Industries.
 - 2. Duro Dyne Corp.
 - 3. Elgen Manufacturing Co., Inc.
 - Ventfabrics, Inc.

2.14 ACOUSTICAL PLENUMS

- A. Construction: Acoustical plenums shall be 4" thick sandwich construction, manufactured from minimum 18 gauge galvanized steel outer leaf and 22 gauge galvanized perforated steel inner leaf with an open area of 30%, with the perforations equally distributed over the full area of the inner leaf. Plenums shall be internally stiffened using minimum 16 gauge steel channel stiffeners. Internal fill shall be minimum 4 pcf density glass or mineral fiber packed under 10% compression. Fill material shall be noncombustible, inert, mildew resistant, and vermin proof, and shall comply with NFPA 90A.
- B. Plenums shall be joined together with minimum 18 gauge galvanized steel "H" members
- C. Floor panels shall be a minimum of 16 gauge galvanized steel supported with minimum 18 gauge channels.
- D. Doors shall be double wall construction of same thickness as the plenum constructed of minimum 18 gauge galvanized solid steel panels, size as noted on the drawings. Doors shall be provided with minimum of two hinges and two latches with an inside release handle. Doors shall be supplied with a continuous air/acoustic seal around the sill, jamb and head.
- E. Construction shall be self supporting without the need for additional bracing or structure. Plenums shall be structurally designed to avoid excessive deflection or bowing and shall be sealed to prevent air leakage when subjected to 2000 Pa. differential pressure between inside and outside of plenum.
- F. All openings for ductwork, piping, connectors, flanges, etc. shall be framed airtight with a minimum of 18 gauge galvanized steel.
- G. Manufacturer: Subject to compliance with requirements, provide acoustical plenums of one of the following:
 - 1. Commercial Acoustics, Div. of Metal Form Manufacturing
 - 2. Industrial Acoustics (IAC)

- 3. Lewis & Lambert
- 4. Vibron
- 5. Vibro-Acoustics
- 6. United Sheet Metal

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- C. Provide balancing dampers at branch takeoffs from main ducts. Unless otherwise noted on drawings, provide prefabricated 45 degree, high efficiency, rectangular/round branch duct takeoff fittings with manual balancing damper and locking quadrant for branch duct connections and takeoffs to individual diffusers, registers and grilles.
- D. Coordinate all smoke and fire/smoke damper installation, wiring, and checkout to ensure that the dampers function properly and that they respond to the proper fire alarm system signal.
- E. Install ceiling radiation dampers per manufacturer's instructions. Support damper assembly from structure.
- F. Duct Smoke Detectors: Comply with NFPA 72, and NFPA 90A where adopted by the local AHJ. Install sampling tubes so they extend the full width of the duct. Tubes more than 36 inches long shall be supported at both ends.
 - 1. Do not install smoke detector in duct smoke detector housing during construction. Install detector only during system testing and prior to system turnover.
 - 2. Air handling units with smoke detection that serve fan-powered terminal units:
 - a. Provide duct detection and shutdown fan-powered terminal units that are less than 2,000 cfm when the respective air handling unit shuts down.
 - b. Provide individual duct detection and shutdown for each fan-powered terminal unit exceeding 2,000 cfm.
 - 3. Provide duct detection and shutdown for air distribution systems exceeding 2,000 cfm.
- G. Provide turning vanes, of same gauge as ductwork, rigidly fastened with guide strips in ductwork having an offset of 45 degrees or more. Vanes shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in grease ductwork.
- H. Provide duct access doors to maintain and/or clean components internal to ductwork including, but not limited to, coils, airflow stations, motorized and backdraft dampers, humidifiers, etc, and equipment at the following locations: Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
 - 1. At each change in direction and at maximum 50-foot (15-m) spacing.
 - 2. Upstream from turning vanes.
 - 3. Upstream or downstream from duct silencers.

Provide duct access door(s) as scheduled below, at each fire and smoke damper within 12 inches
of the device to allow for testing and maintenance. Label each door (with minimum 1" lettering)
indicating which damper type is served. Door should be capable of being fully opened or provide
removable door.

DUCT ACCESS DOOR SCHEDULE

Duct Width/Depth	Door Size	Quantity
10" TO 12"	10 X 10	1
14" TO 18"	12 X 12	1
20" TO 36"	14 X 14	1
38" TO 54"	18 X 18	1
56" TO 72"	18 X 18	2 (1 EACH END)
74" TO 96"	20 X 20	2 (1 EACH END)

- J. Install flexible duct in accordance with manufacturer's instructions. At a minimum, install two wraps of duct tape around the inner core connection and a metallic or non-metallic clamp over the tape and two wraps of duct tape or a clamp over the outer jacket.
 - Flexible duct runs shall not exceed 5 feet in length. Utilize the minimum length of duct to make the connections.
 - 2. Flexible ductwork shall be installed straight as possible avoiding tight turns with a maximum of one 90 degree bend in any length. Install flexible duct fully extended minimizing compression.
 - 3. Provide continuous length with no intermediate joints.
 - 4. Support flexible duct from structure and not from ceiling tile, light fixtures or air terminals. Support for maximum sag of 1/2-inch per foot.
 - 5. Avoid incidental contact with metal fixtures, water lines, pipes, or conduit.
 - 6. Support straps/saddles shall be minimum 1-1/4" wide. Use of wire hanging systems shall utilize strap and connect wire to strap.
 - a. Factory installed suspension systems are acceptable
 - 7. Ductwork shall not be crimped against joist or truss members, pipes, conduits, etc.
 - 8. The bend radius at the center line shall be equal to or greater than one duct diameter.
 - a. Support bends approximately one duct diameter on both sides of bends.
 - 9. Connections to ductwork and air devices shall have at least 1" overlap.
- K. Provide rigid duct elbow or flexible elbow assembly where a 90 degree elbow is required at connection to air devices.
- L. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.4 ADJUSTING AND CLEANING

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
- B. Label access doors in accordance with Division-23 section "Identification for HVAC Piping and Equipment".
- C. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting, and Balancing for HVAC".
- D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 233300

SECTION 233416

CENTRIFUGAL HVAC FANS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. This Section includes the following types of centrifugal fans:
 - 1. Centrifugal fans for indoor installations
 - 2. Inline centrifugal fans
 - 3. Utility set fans

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
 - 1. Product data for selected models, including specialties, accessories, and the following:
 - a. Certified fan performance curves with system operating conditions indicated.
 - b. Certified fan sound power ratings.
 - c. Motor ratings and electrical characteristics plus motor and fan accessories. For fans with factory-furnished starters or variable frequency drives, include short circuit current ratings.
 - d. Materials gages and finishes, including color charts.
 - e. Dampers, including housings, linkages, and operators.
 - 2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
 - 3. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
 - 4. Product certificates, signed by manufacturers of centrifugal fans, certifying that their products comply with specified requirements.
 - 5. Maintenance data for air-handling units, for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23 Section "General Mechanical Requirements."

1.3 QUALITY ASSURANCE

- A. AMCA Compliance: Provide products that meet performance requirements and are licensed to use the AMCA Seal.
- B. UL Compliance: Fans and components shall be UL listed and labeled.
- C. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

- E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
- F. UL 705 Standard for Power Ventilators, Underwriter's Laboratory, most current edition.

1.4 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad.
- B. Coordinate the size and location of structural steel support members.

1.5 SPARE PARTS

A. Furnish one additional complete set of belts for each belt-driven fan.

PART 2 - PRODUCTS AND MATERIALS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Centrifugal Fans:
 - a. Acme Engrg. & Mfg. Corp.
 - b. Barry Blower
 - c. Bayley Fan Group.
 - d. Chicago Blower Corp.
 - e. Cook (Loren) Co.
 - f. Greenheck Fan Corp.
 - g. Hartzell Fan, Inc.
 - h. RuppAir Management Systems
 - i. Trane Co.
 - j. Twin City Fan Company
 - 2. Inline Centrifugal Fans:
 - a. Acme Engrg. & Mfg. Corp.
 - b. Barry Blower
 - c. Carnes Company, Inc.
 - d. Cook (Loren) Co.
 - e. Greenheck Fan Corp.
 - f. PennBarry.
 - g. RuppAir Management Systems.
 - h. Twin City Fan Company
 - 3. Utility Sets:
 - a. Accurex.
 - b. Acme Engrg. & Mfg. Corp.

- c. Barry Blower
- d. Bayley Fan Group.
- e. Carnes Company, Inc.
- f. Chicago Blower Corp.
- g. Cook (Loren) Co.
- h. Greenheck Fan Corp.
- i. Hartzell Fan, Inc.
- j. RuppAir Management Systems
- k. Trane Co.
- I. Twin City Fan Company

2.2 SOURCE QUALITY CONTROL

- A. Testing Requirements: The following factory tests are required:
 - Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
 - Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

2.3 FANS, GENERAL

- A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.
- B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.
 - 1. Fan Shaft: Turned, ground, and polished steel, designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.
- C. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
 - 1. Service Factor: 1.4.
- D. Belts: Oil-resistant, nonsparking, and nonstatic.
 - 1. Fans used for smoke control applications shall have 1.5 times the number of belts required for the design duty with a minimum of two belts.
- E. Motors: Refer to Section "Common Motor Requirements for HVAC Equipment" for requirements.
- F. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
 - Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.
- G. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA L(50)) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.

- H. Hazardous Duty: Provide fans with spark resistant construction and explosion proof motor where specified in the schedule.
- I. Factory Finish: The following finishes are required:
 - Sheet Metal Parts: Prime coating prior to final assembly.
 - Exterior Surfaces: Baked-enamel finish coat after assembly.

2.4 CENTRIFUGAL FANS

- A. General Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and support structure.
- B. Housings: Fabricated from formed and reinforced galvanized steel panels to form curved scroll housings with continuously welded or deep-locked seams and access doors or panels to allow access to internal parts and components.
 - Inlet Cones: Spun metal.
 - 2. Duct Connections: Flanged.
 - 3. Panel Bracing: Steel angle-or channel-iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
- C. Fan Wheels: Single-width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.
 - Blade Materials: Steel.
 - 2. Blade Type: Backward-curved, flat-plate type.
 - 3. Blade Type: Backward-curved, airfoil type.
 - 4. Blade Type: Forward-curved, airfoil type.
- D. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
- E. Accessories: Provide the following accessories where indicated:
 - 1. Scroll Bypass Dampers: Aluminum, opposed, airfoil blades with extruded vinyl seals on blades, low-friction bearings, and positive control linkage for manual or automatic operation.
 - 2. Scroll Housing Access Doors: Latch-type handles; flush-mounted for uninsulated housings and raised-mounted for insulated housings.
 - 3. Inlet Vanes: Radial vanes with linkage for manual or automatic operation.
 - a. Double-Width Fans Inlet Vanes: Connected for single operator.
 - 4. Inlet Screens: Heavy wire mesh screens, mounted inside of shaft bearings.
 - 5. Discharge Dampers: Heavy-gage steel, opposed blade design, with linkage for manual or automatic operation.
 - 6. Drain Connections: Threaded, 3/4-inch NPS, capped nipple installed at lowest point of housing.
 - 7. Shaft Cooler: Metal disc between bearings and fan wheel, designed to dissipate heat from shaft.
 - 8. Spark-Resistant Construction: AMCA construction option A, B, or C as indicated.
 - 9. Shaft Seals: Air-tight seals installed around shaft on drive side of single-width fans.

2.5 INLINE CENTRIFUGAL FANS

- A. General Description: Inline, belt-driven, centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, drive assembly, motor and disconnect switch, mounting brackets, and accessories
- B. Housing: Split, spun-aluminum housing, with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor encased in housing out of air stream, factory-wired to disconnect located on outside of fan housing.
- D. Belt-Drive Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- E. Wheel: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories: Provide the following accessories as indicated:
 - 1. Volume Control Damper: Manual operated with guadrant lock, located in fan outlet.
 - 2. Companion Flanges: For inlet and outlet duct connections.
 - 3. Fan Guards: Expanded metal in removable frame.
 - 4. Speed Control: Variable speed switch with on-off control and speed control for 100 to 50 percent of fan air delivery.
 - Motor sound attenuator.

2.6 UTILITY SET FANS

- A. General Description: Belt-driven, centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.
- B. Housings: Fabricated of heavy-gage steel with side sheets fastened to scroll sheets by means of welding or deep lock seam.
 - 1. Inlet: Round duct collar.
 - 2. Discharge: Slip-joint duct connection.
 - 3. Housings Discharge Arrangement: Adjustable to 8 standard positions.
- C. Fan Wheels: Single-width, single-inlet, welded to cast-iron or cast-steel hub and spun steel inlet cone, with hub keyed to the shaft.
 - 1. Blade Materials: Steel
 - 2. Blade Type: Backward-curved, die-formed.
 - Blade Type: Forward-curved, die-formed.
- D. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings.
- E. Accessories: Provide the following accessories where indicated:
 - 1. Backdraft Dampers: Gravity-actuated with counterweight and interlocking aluminum blades and felt edges in steel frame installed on fan discharge.
 - 2. Access Doors: Gasketed doors with latch-type handles.
 - 3. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
 - 4. Spark-Resistant Construction: AMCA construction option A, B, or C as indicated.

- 5. Inlet Screens: Removable, heavy wire mesh.
- 6. Drain Connections: 3/4-inch, threaded coupling drain connection installed at lowest point of housing.
- 7. Weather Hoods: Weather-resistant with stamped vents over motor and drive compartment.

2.7 MOTORS

- A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.
- B. Motor Sizes: Minimum sizes and characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.
- C. Temperature Rating: 90 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class B Insulation).
- D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.
- E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B.
 - 1. Bases: Adjustable.
 - 2. Bearings: The following features are required:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Grease lubricated.
 - Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 3. Enclosure Type: The following features are required:
 - a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
 - b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - 4. Overload protection: Built-in, automatic reset, thermal overload protection.
 - 5. Noise rating: Quiet.
 - Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
 - 7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.
- F. Starters, Electrical Devices, and Wiring: Starters, electrical devices and connections are specified in Division 26.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 23 Section "Vibration Isolation for HVAC Piping and Equipment."
 - 1. Support floor-mounted units on concrete equipment bases using neoprene pads. Secure units to anchor bolts installed in concrete equipment base.
 - 2. Support floor-mounted units on concrete equipment bases using housed spring isolators. Secure units to anchor bolts installed in concrete equipment base.
 - 3. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.
- B. Arrange installation to provide access space around fans for service and maintenance.

3.2 EQUIPMENT BASES

A. Construct concrete equipment pads in accordance with Division 23 Section "Common Work Results for HVAC".

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

3.4 STARTUP

- A. Final checks before start-up: Perform the following operations and checks before start-up:
 - 1. Remove shipping, blocking, and bracing.
 - 2. Verify fan assembly is secure on mountings and supporting devices and that connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 - 3. Perform cleaning and adjusting specified in this Section.
 - Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 6. Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.
 - 7. Disable automatic temperature control operators.

B. Starting procedures for fans:

- Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a. Replace fan and motor pulleys as required to achieve design conditions.
 - b. Measure and record motor electrical values for voltage and amperage.
 - c. Shut unit down and reconnect automatic temperature control operators.

d. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for air-handling-system testing, adjusting, and balancing.

3.5 DEMONSTRATION

- A. Demonstration Services: Train Owner's maintenance personnel on the following:
 - 1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
 - 2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Closeout Procedures" and Division 23 Section "General Mechanical Requirements."
- B. Schedule training with at least 7 days' advance notice.

END OF SECTION 233416

SECTION 233713

DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this Section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
 - Louvers.
- C. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this Section.
- D. Refer to other Division 23 sections for balancing of air outlets and inlets; not work of this Section.

1.2 RELATED REQUIREMENTS

A. 230548 – Seismic Controls for Mechanical Systems, for seismic controls.

1.3 QUALITY ASSURANCE

- A. Codes and Standards:
 - AHRI Compliance: Test and rate air outlets and inlets in accordance with AHRI 650
 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
 - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings at specified airflows. Indicate selections on data.
 - 4. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
 - 5. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

- B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.
- C. Color Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for diffusers, registers, and grilles with factory-applied color finishes.
- D. Samples for Verification: Provide samples of diffusers, registers, and grilles, in manufacturer's standard sizes, showing the full range of colors. Prepare Samples from the same material to be used for the Work.

1.5 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

PART 2 - PRODUCTS AND MATERIALS

2.1 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and provided with accessories as required for a complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Linear Slot Diffusers: Slot diffusers shall be standard one-piece lengths up to 6-feet and shall be furnished in multiple sections greater than 6-feet. Multiple sections shall be joined together end-to-end with alignment pins to form a continuous slot appearance. All alignment components shall be provided by the manufacturer. Plenums shall be manufactured by the slot diffuser manufacturer. Plenums shall be internally insulated, by the manufacturer, with minimum ½" thick, closed-cell insulation. Insulation shall not be made of fibrous material.
- E. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as scheduled on the drawings.
- F. Manufacturers: Subject to compliance with requirements, provide diffusers of one of the following:
 - 1. Carnes Co.
 - 2. Price Industries, Inc.
 - 3. Krueger Mfg. Co.
 - 4. Metalaire; Metal Industries, Inc.
 - 5. Nailor Industries, Inc.
 - 6. Titus HVAC
 - 7. Tuttle & Bailey; Div. of Air Systems Components, Inc.

2.2 REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and provided with accessories as required for a complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with

- accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.
- D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as scheduled on the drawings.
- E. Manufacturers: Subject to compliance with requirements, provide registers and grilles of one of the following:
 - 1. Carnes Co.
 - 2. Price Industries, Inc.
 - 3. Krueger Mfg. Co.
 - 4. Metalaire; Metal Industries, Inc.
 - 5. Nailor Industries, Inc.
 - 6. Titus HVAC
 - 7. Tuttle & Bailey; Div. of Air Systems Components, Inc.

2.3 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard louvers as scheduled or indicated on the drawings; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and provided with accessories as required for a complete installation.
- B. Performance: Provide louvers that have minimum free area, and maximum pressure drop of each type as listed in manufacturer's current data, complying with louver schedule.
 - Structural Performance: Louvers shall withstand the effects of gravity loads and wind and/or seismic loads as defined in the applicable building code for the installed location without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
- D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.
- E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Louver Supports: Louver design shall limit span between visible mullions to 10' and shall incorporate structural supports required to withstand a wind load of 20 lbs. per sq. ft.
- G. Intermediate Blade Supports: Where needed blade supports shall be provided by louver manufacturer on the rear of blade only.
- H. Louver Blank-Off Panels: Blank off any unused portions of louver with lined galvanized sheet metal panels and seal airtight. Back of panels shall be insulated with 1" thick, 3 lb. density duct liner.
- I. Manufacturers: Subject to compliance with requirements, provide louvers of one of the following:
 - 1. American Warming & Ventilating Inc.
 - 2. Arrow United Industries, Inc.
 - 3. Carnes Co.; Div. of Wehr Corp.
 - 4. Cesco
 - 5. Greenheck
 - 6. Industrial Louvers, Inc.
 - 7. Louvers & Dampers, Inc.
 - Nailor Industries, Inc.

- 9. Pottorff
- 10. Ruskin Mfg. Co.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed for compliance with installation tolerances and conditions that would affect the performance of the equipment. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions, design drawings, referenced standards, and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, to interface installation of air outlets and inlets with other work.
- C. Where a 90-degree elbow is required at the connection to air devices, provide a rigid duct elbow or, at Contractor's option, a flexible elbow assembly as specified in Division 23 section "Metal Ducts".
- D. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before beginning air balance.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove dirt and smudges. Replace any air device that has damaged finishes.

END OF SECTION 233713

SECTION 237413

OUTDOOR PACKAGED HEATING AND COOLING UNITS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

- A. Section includes package rooftop heating and cooling units.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 22 Section "Natural Gas Systems" for natural gas equipment connection requirements.
 - 2. Division 23 Sections for temperature controls and other mechanical equipment not specified in this Section, but required for a complete installation.
 - Division 26 Sections for electrical work including motor starters, disconnects, wires/cables, raceways, and other electrical equipment devices not specified in this Section, but required for a complete installation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions. Provide short circuit current rating of units with factory mounted starter or variable frequency drive.

B. Shop Drawings:

- 1. Submit manufacturer's assembly-type shop drawings indicating dimensions, required clearances, and methods of assembly of components
- 2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure. Indicate coordinating requirements with roof membrane system.
- C. Wiring Diagrams: Submit wiring diagrams detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Operation and Maintenance Data: Submit maintenance data and parts list for each rooftop unit, including "trouble-shooting" maintenance guide, servicing guide and preventative maintenance schedule and procedures. Include this data in maintenance manual; in accordance with requirements of Division 1.

1.3 QUALITY ASSURANCE

A. Codes and Standards:

1. Gas-fired furnace section construction shall be in accordance with AGA safety standards. Furnace section shall bear the AGA label.

2. AHRI Compliance:

 Testing and rating of rooftop units under 135,000 btu/hr capacity shall be in accordance with AHRI 210 "Standard for Unitary Air-Conditioning Equipment", and provide Certified Rating Seal.

- b. Capacity ratings for air-to-air energy recovery equipment shall comply with AHRI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
- c. Capacity ratings for water coils shall comply with AHRI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."
- d. Sound testing and rating of units shall be in accordance with AHRI 270 "Standard for Sound Rating of Outdoor Unitary Equipment". Units shall bear Certified Rating Seal.
- 3. Refrigerating system construction of rooftop units shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
- Energy Efficiency Ratio (EER) of rooftop units shall be equal to or greater than prescribed by ASHRAE 90.1-2004 "Energy Standard For Buildings Except Low-Rise Residential Buildings".
- 5. Rooftop units shall be listed by UL and have UL label as a unit.
- Rooftop units shall be designed, manufactured, and tested in accordance with UL requirements.

1.4 SPARE PARTS

- A. General: Furnish to Owner, with receipt, the following spare parts for each rooftop heating and cooling unit.
 - 1. One set of matched fan belts for each belt driven fan.
 - 2. If HVAC equipment is used during the construction period, Contractor shall provide one set of filters (if system is designed to include pre-filters and after-filters, provide only pre-filters) when the unit is started and replace filters when needed, but not less than every month. On the day of substantial completion, the Contractor shall clean the unit and provide a new set of filters at each location in the unit.

1.5 SPECIAL WARRANTY

- A. Warranty on Compressor and Heat Exchanger: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors and heat exchangers with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
 - 1. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS AND MATERIALS

2.1 ROOFTOP UNITS LESS THAN 20 TONS

- A. Manufacturers: Subject to compliance with requirements, provide rooftop units of one of the following:
 - 1. Carrier Air Conditioning; Div of Carrier Corp.
 - 2. Daikin Applied
 - 3. Governair Corp.
 - 4. Johnson Controls, Inc.
 - 5. Lennox Industries, Inc.

- 6. Trane (The) Co; Div of American Standard Inc.
- 7. York Int'l Corp.
- B. General Description: Units shall be factory-assembled and tested, designed for roof or slab installation, and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, and dampers. Capacities and electrical characteristics shall be as scheduled on the Drawings.
- C. Casing: Provide manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1/2" thick, 1.0 pound density thermal insulation, knockouts for electrical and piping connections and an exterior condensate drain connection and lifting lugs.
- D. Roof Curbs: Curb shall be sloped to match roof structure to enable the rooftop unit to be installed level.
 - 1. Overall Roof Curb Height: Minimum 12 inches for roofs with no insulation, 15" for roofs with insulation or as scheduled on the drawings.
- E. Compressors: Provide serviceable, semi-hermetic, or fully hermetic compressors, complete with integral vibration isolators and crankcase heaters which de-energize during compressor operation.
- F. Evaporator Fans: Provide forward-curved, centrifugal, belt-driven fans with adjustable sheaves or direct-driven fans; and permanently lubricated motor bearings.
- G. Condenser Fans: Provide propeller-type, direct-driven fans with permanently lubricated bearings.
- H. Motors: Refer to Section "Common Motor Requirements for HVAC Equipment" for requirements.
- I. Coils:
 - General: Aluminum plate fin and seamless copper tube type. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing. Coils shall be mounted in the coil casing with same end connections accessible for service. Coils shall be removable from the unit through the roof or through the piping enclosure. Coil section shall be completely insulated.
 - 2. Steam heating coils: Provide non-freeze steam coils, pitched in unit casing for proper drainage. Coils shall be double tube type having accurately sized steam distributor tubes and evenly spaced orifices. Orifices shall discharge steam in the direction of condensate flow to ensure even distribution of steam over full length of each tube. Coils shall be designed for 100 psig working pressure at 400 F and pressure tested at 300 psig.
 - Water heating coils: Pitch coil in the unit casing for proper drainage. Coils shall have metering orifices and a supply header to ensure distribution of hot water to each tube. Coils shall be designed for 200 psig working pressure at 325 F and pressure tested at 300 psig.
 - 4. Water heating coil: Pitch coil in the unit casing for proper drainage. Coils shall be continuous tube type. Coils shall be designed for 200 psig working pressure at 325 F and pressure tested at 300 psig.
 - 5. Refrigerant cooling coils: Refrigerant coils shall have an equalizing type vertical distributor to ensure each coil circuit receives the same amount of refrigerant. Coils shall be designed for 300 psig working pressure and pressure tested at 450 psig., then cleaned, dehydrated, and sealed with a holding charge of refrigerant.
- J. Condensate Drain Pan: Provide galvanized or stainless steel condensate drain pan sloped to drain connection.

- K. Heat Exchangers: Provide manufacturer's standard construction for gas-fired heat exchangers and burners. Minimum efficiency for heat exchangers shall be 80 percent.
 - 1. Controls: Provide the following controls for the gas-fired heat exchangers:
 - a. Redundant gas valve;
 - b. Intermittent pilot ignition;
 - c. Electronic spark ignition system;
 - d. High limit cutout;
 - e. Forced draft proving switch.
- L. Filters Section: Provide 2" thick fiberglass throwaway pleated filters in filter rack, with maximum face velocity of 400 fpm and minimum MERV rating per ASHRAE 52.2 of MERV 8.
- M. Energy Recovery Section: Provide a factory mounted, wired, and tested energy recovery wheel. The energy recovery wheel shall have latent and sensible recovery capacities as required to meet or exceed the capacities scheduled on the drawings.
 - 1. Mount the energy recovery wheel in a rigid frame containing the wheel drive motor, redundant drive belts, wheel seals, and bearings.
 - Provide an energy recovery wheel constructed of a light weight polymer material with permanently bonded desiccant coating. The wheel shall be removable from the cabinet and cleanable using hot water or light detergent without degrading the latent efficiency.
 - 3. Provide a forward curved exhaust fan(s) with adjustable V-belt drive and a backdraft damper.
 - Provide a filter bank on the upstream side of each air stream with 2" thick fiberglass throwaway filters in filter rack, with maximum face velocity of 400 fpm and minimum MERV rating per ASHRAE 52.2 of MERV 8.
 - 5. The energy recovery section shall contain bypass dampers around the wheel for full economizer operation.

N. Dampers:

- 1. General: Dampers and their operators shall comply with performance requirements specified in Division 23 Section "Instrumentation and Control Devices for HVAC."
- 2. Outdoor Air Damper:
 - Provide outside air damper constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven.
 - b. Refer to schedules on the drawings for capacity and control method for the outdoor air damper of each unit.

O. Economizer Control:

- 1. Provide economizer system consisting of return and outside air dampers, outside air filter, fully modulating electric control system with dry bulb or enthalpy economizer control as scheduled on the drawings, and adjustable mixed-air thermostat.
- 2. System shall have 100 percent outside air capability.
- 3. Provide automatic changeover through adjustable control device.

P. Relief Control:

- 1. Damper: Include a relief damper with control type as scheduled on the drawings.
- Q. Safety Controls: Provide manual reset type safety controls for:

- 1. Low pressure cutout;
- 2. High pressure cutout;
- 3. Compressor motor overload protection.
- R. Unit Controls: Solid-state control board and components contain at least the following features:
 - Indoor fan on/off delay.
 - 2. Default control to ensure proper operation after power interruption.
 - 3. Service relay output.
 - 4. Unit diagnostics and diagnostic code storage.
 - 5. Field-adjustable control parameters.
 - 6. Dehumidification control with humidistat.
 - 7. Economizer control.
 - 8. Night setback mode.
 - 9. Return-air temperature limit.
 - 10. Fan-proving switch to lock out unit if fan fails.
 - 11. Dirty-filter switch.
 - Smoke alarm with smoke detector installed in ductwork as noted on the drawings.
- S. Thermostat: Programmable, electronic; with heating setback and cooling setup with seven-day programming; and the following:
 - Touch sensitive keyboard.
 - 2. Automatic switching.
 - 3. Degree F readout.
 - 4. LED indicators.
 - 5. Hour/day programming.
 - 6. Manual override capability.
 - 7. Time and operational mode readout.
 - 8. Status indicator.
 - 9. Battery backup.
 - 10. Subbase with manual system switch (on-heat-auto-cool) and fan switch (auto-on).
- T. Electrical: Provide a 125 VAC, 20 amp duplex convenience receptacle mounted to unit ready for field wiring through the curb with a cover UL listed for wet and damp locations when in use. Unit power connection shall be either through unit cabinet or within roof curb perimeter. Rooftop units shall be designed to meet minimum short-circuit withstand rating specified on the drawings.
- U. Refrigerant Type: Provide rooftop units designed to operate with R-410 refrigerant.
- V. Accessories: Units shall include the following accessories:
 - 1. Low ambient control: Head pressure control, designed to operate at temperatures down to 0 deg F (-18 deg C).
 - 2. Provide guards to protect the condenser coil from hail or other damage.

3. Thermostat: Assembly shall provide for staged heating and cooling with manual or automatic changeover on standard subbase.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF ROOFTOP HEATING AND COOLING UNITS

A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support:

- 1. Support rooftop units on roof curb. Attach curb to roof structure.
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- D. Ductwork: Refer to Division-23 section "Metal Ducts". Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection size.
- E. Piping: Piping installation requirements are specified in other Division 23 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties. The following are specific connection requirements:
 - 1. Condensate Drain Piping: Route condensate drain to nearest roof drain or to location shown on the drawings. Provide trap, minimum of 1" deeper than fan pressure in inches of water, at drain pan connection and install cleanouts at changes in direction (refer to manufacturer's recommendations for any additional requirements). Size condensate drain piping in accordance with local code and the following:

Piping Length Size

Less than 10 feet Same size as unit connection

More than 10 feet One pipe size larger than unit connection

F. Connect gas piping to gas-fired heat exchanger according to requirements of Division 22 section "Natural Gas Systems." Provide union with sufficient clearance for burner removal and service.

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust fan for required airflow in accordance with Section "Testing, Adjusting and Balancing for HVAC." Tighten belts as required for proper operation.
- B. Adjust damper linkages for proper damper operation.
- C. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, intake plenum cabinet, heat exchange surfaces, cooling/heating coil sections, filter sections, access sections, etc.

3.4 STARTUP

A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:

- 1. Remove shipping, blocking, and bracing.
- Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
- 3. Perform cleaning and adjusting specified in this Section.
- Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
- 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
- 6. Set outside-air and return-air mixing dampers to minimum outside-air setting.
- 7. Comb coil fins for parallel orientation.
- 8. Install clean filters. Do not operate air handling unit without pre-filters installed.
- 9. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full-open position.
- 10. Disable automatic temperature control operators.
- B. Start-Up Services: Provide the services of a factory-authorized service representative to start-up rooftop units in accordance with manufacturer's written start-up instructions. Do not operate units without filters installed. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - Energize motor, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a. Replace fan and motor pulleys as required to achieve design conditions.
 - b. Measure and record motor electrical values for voltage and amperage.
 - c. Shut unit down and reconnect automatic temperature control operators.
 - d. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for system testing, adjusting, and balancing.

3.5 TRAINING

- A. General: At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel for a minimum of two hours on the operation and maintenance of the equipment provided under this section.
- B. Content: Training shall include but not be limited to:
 - 1. Overview of the system and/or equipment as it relates to the facility as a whole.
 - 2. Operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention.
 - 3. Review data included in the operation and maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data."
- C. Certification: Contractor shall submit to the Engineer a certification letter stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The certification letter shall be signed by the Contractor and the Owner's representative indicating agreement that the training has been provided.
- D. Schedule: Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 237413

SECTION 237433

DEDICATED OUTDOOR AIR UNITS

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Section includes package units capable of supplying 100 percent outdoor air.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions. Provide short circuit current rating of units with factory mounted starter or variable frequency drive.

B. Shop Drawings:

- 1. Submit manufacturer's assembly-type shop drawings indicating dimensions, required clearances, and methods of assembly of components
- 2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure. Indicate coordinating requirements with roof membrane system.
- C. Wiring Diagrams: Submit wiring diagrams detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
- D. Operation and Maintenance Data: Submit maintenance data and parts list for each rooftop unit, including "trouble-shooting" maintenance guide, servicing guide and preventative maintenance schedule and procedures. Include this data in maintenance manual; in accordance with requirements of Division 1.

1.3 QUALITY ASSURANCE

A. Codes and Standards:

Gas-fired furnace section construction shall be in accordance with AGA safety standards.
 Furnace section shall bear the AGA label.

2. AHRI Compliance:

- a. Testing and rating of rooftop units of 135,000 btu/hr capacity or over shall be in accordance with AHRI 360 "Standard for Commercial and Industrial Unitary Air-Conditioning Equipment".
- Testing and rating of rooftop units under 135,000 btu/hr capacity shall be in accordance with AHRI 210 "Standard for Unitary Air-Conditioning Equipment", and provide Certified Rating Seal.
- Capacity ratings for air-to-air energy recovery equipment shall comply with AHRI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
- d. Capacity ratings for water coils shall comply with AHRI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

- e. Sound testing and rating of units shall be in accordance with AHRI 270 "Standard for Sound Rating of Outdoor Unitary Equipment". Units shall bear Certified Rating Seal.
- 3. Refrigerating system construction of dedicated outdoor air units shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
- Energy Efficiency Ratio (EER) of dedicated outdoor air units shall be equal to or greater than prescribed by ASHRAE 90.1-2004 "Energy Standard For Buildings Except Low-Rise Residential Buildings".
- 5. Dedicated outdoor air units shall be listed by UL and have UL label as a unit.
- 6. Dedicated outdoor air units shall be designed, manufactured, and tested in accordance with UL requirements.

1.4 SPARE PARTS

- A. General: Furnish to Owner, with receipt, the following spare parts for each dedicated outdoor air unit.
 - 1. One set of matched fan belts for each belt driven fan.
 - 2. If HVAC equipment is used during the construction period, Contractor shall provide one set of filters (if system is designed to include pre-filters and after-filters, provide only pre-filters) when the unit is started and replace filters when needed, but not less than every month. On the day of substantial completion, the Contractor shall clean the unit and provide a new set of filters at each location in the unit.

1.5 SPECIAL WARRANTY

- A. Warranty on Compressor and Heat Exchanger: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors and heat exchangers with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
 - 1. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS AND MATERIALS

2.1 DEDICATED OUTDOOR AIR UNITS (ALL SIZES)

- A. Manufacturers: Subject to compliance with requirements, provide dedicated outdoor air units of one of the following:
 - 1. Aaon, Inc.
 - 2. Addison
 - 3. AnnexAir
 - 4. Desert Aire
 - 5. Engineered Air
 - 6. Greenheck
 - 7. Innovent

- 8. Modine
- 9. Thomas & Betts Corp., Reznor HVAC Division
- 10. Trane Company
- 11. Valent Air Management Systems
- B. General Description: Units shall be factory-assembled and tested, designed for roof or slab installation, and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, and dampers. Capacities and electrical characteristics shall be as scheduled on the Drawings.
- C. Casing: Provide manufacturer's standard double wall casing construction with fiberglass or foam-injected insulation that provides a minimum R-6 R value. The manufacturer's standard cabinet construction shall incorporate a thermal break such that there is no through metal path between the interior and exterior surface of the unit casing at all panel frames, joining mullions, or corners. Casing shall have corrosion protection coating and exterior finish that meets ASTM B117 salt spray test of minimum 500 hours. Casings shall have removable panels or access doors for inspection and access to internal parts, knockouts for electrical and piping connections and an exterior condensate drain connection and lifting lugs.
- D. Roof Curbs:Curb shall be sloped to match roof structure to enable the rooftop unit to be installed level.
 - 1. Overall roof curb height shall be the greater of the following:
 - a. Minimum 12 inches for roofs with no insulation.
 - b. Minimum 15 inches for roofs with insulation.
 - c. As scheduled on the drawings.
- E. Compressors: Provide serviceable, semi-hermetic, or fully hermetic compressors, complete with integral vibration isolators and crankcase heaters which de-energize during compressor operation.
- F. Evaporator Fans: Provide forward-curved, centrifugal, belt-driven fans with adjustable sheaves or direct-driven fans; and permanently lubricated motor bearings.
- G. Condenser Fans: Provide propeller-type, direct-driven fans with permanently lubricated bearings.
- H. Motors: Refer to Section "Common Motor Requirements for HVAC Equipment" for requirements.
- I. Coils:
 - 1. General: Aluminum plate fin and seamless copper tube type. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing. Coils shall be mounted in the coil casing with same end connections accessible for service. Coils shall be removable from the unit through the roof or through the piping enclosure. Coil section shall be completely insulated.
 - 2. Steam heating coils: Provide non-freeze steam coils, pitched in unit casing for proper drainage. Coils shall be double tube type having accurately sized steam distributor tubes and evenly spaced orifices. Orifices shall discharge steam in the direction of condensate flow to ensure even distribution of steam over full length of each tube. Coils shall be designed for 100 psig working pressure at 400 F and pressure tested at 300 psig.
 - Water heating coils: Pitch coil in the unit casing for proper drainage. Coils shall have metering orifices and a supply header to ensure distribution of hot water to each tube. Coils shall be designed for 200 psig working pressure at 325 F and pressure tested at 300 psig.

- 4. Water heating coil: Pitch coil in the unit casing for proper drainage. Coils shall be continuous tube type. Coils shall be designed for 200 psig working pressure at 325 F and pressure tested at 300 psig.
- 5. Refrigerant cooling coils: Refrigerant coils shall have an equalizing type vertical distributor to ensure each coil circuit receives the same amount of refrigerant. Coils shall be designed for 300 psig working pressure and pressure tested at 450 psig., then cleaned, dehydrated, and sealed with a holding charge of refrigerant.
- J. Condensate Drain Pan: Provide galvanized or stainless steel condensate drain pan sloped to drain connection.
- K. Heat Exchangers: Provide manufacturer's standard construction for gas-fired heat exchangers and burners. Minimum efficiency for heat exchangers shall be 80 percent.
 - 1. Controls: Provide the following controls for the gas-fired heat exchangers:
 - a. Redundant gas valve;
 - b. Intermittent pilot ignition;
 - Electronic spark ignition system;
 - d. High limit cutout;
 - e. Forced draft proving switch.
- L. Outdoor Air Intake Hood: Provide intake hood or louver designed to inhibit wind-driven rain and snow from entering unit. Provide complete with birdscreen, ½" mesh aluminum or stainless steel.

M. Dampers:

1. General: Dampers and their operators shall comply with performance requirements specified in Division 23 Section "Instrumentation and Control Devices for HVAC."

N. Outdoor Air Damper:

- Provide outside air damper constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear.
- 2. Provide factory installed electric operator.

O. Relief Control:

- Power Exhaust Fan: Direct drive, propeller or backward inclined type designed for low tip speed. Motors shall be open drip-proof with internal motor protection and permanently lubricated ball bearings.
- P. Safety Controls: Provide manual reset type safety controls for:
 - 1. Low pressure cutout;
 - 2. High pressure cutout;
 - 3. Compressor motor overload protection.
- Q. Unit Controls: Solid-state control board and components contain at least the following features:
 - 1. Indoor fan on/off delay.
 - 2. Default control to ensure proper operation after power interruption.
 - 3. Service relay output.
 - 4. Unit diagnostics and diagnostic code storage.

- 5. Field-adjustable control parameters.
- 6. Fan-proving switch to lock out unit if fan fails.
- 7. Dirty-filter switch.
- 8. Smoke alarm with smoke detector installed in ductwork as noted on the drawings.
- R. Temperature Control: Provide space temperature sensor, wall mounted, with temperature adjustment at space sensor
- S. Electrical: Provide a 125 VAC, 20 amp duplex convenience receptacle mounted to unit ready for field wiring through the curb with a cover UL listed for wet and damp locations when in use. Unit power connection shall be either through unit cabinet or within roof curb perimeter. Rooftop units shall be designed to meet a minimum short-circuit withstand rating as specified on the drawings.
- T. Refrigerant Type: Provide units designed to operate with R-410 refrigerant.
- U. Accessories: Units shall include the following accessories:
 - 1. Provide guards to protect the condenser coil from hail or other damage.
 - 2. Provide smoke detector factory installed in supply air.
 - 3. Provide remote control panel containing control for fan, heating, cooling, and indicator lights.
 - 4. Provide anti-recycling compressor control.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which dedicated outdoor air units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF ROOFTOP HEATING AND COOLING UNITS

- A. General: Install dedicated outdoor air units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- B. Support:
 - 1. Support roof-mounted units on roof curb. Attach roof curb to roof structure.
 - 2. Support floor or on-grade units on cast-in-place concrete equipment bases.
 - Support suspended units from structural steel support frame using threaded steel rods and spring hangers. Comply with Division 23 section "vibration Isolation For HVAC Piping and Equipment".
- C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- D. Ductwork: Refer to Division-23 section "Metal Ducts". Connect supply and return ducts to unit with flexible duct connections. Provide transitions to exactly match unit duct connection size.

- E. Piping: Piping installation requirements are specified in other Division 23 sections. The Drawings indicate the general arrangement of piping, valves, fittings, and specialties. The following are specific connection requirements:
 - Condensate Drain Piping: Route condensate drain to nearest roof drain or to location shown on the drawings. Provide trap, minimum of 1" deeper than fan pressure in inches of water, at drain pan connection and install cleanouts at changes in direction (refer to manufacturer's recommendations for any additional requirements). Size condensate drain piping in accordance with local code and the following:

Piping Length Size

Less than 10 feet Same size as unit connection

More than 10 feet One pipe size larger than unit connection

3.3 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust fan for required airflow in accordance with Section "Testing, Adjusting and Balancing for HVAC." Tighten belts as required for proper operation.
- B. Adjust damper linkages for proper damper operation.
- C. Clean the entire unit including cabinet interiors just prior to substantial completion to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, intake plenum cabinet, heat exchange surfaces, cooling/heating coil sections, filter sections, access sections, etc.

3.4 STARTUP

- A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
 - 1. Remove shipping, blocking, and bracing.
 - Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 - 3. Perform cleaning and adjusting specified in this Section.
 - 4. Disconnect fan drive from motor and verify proper motor rotation direction and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 - 5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - 6. Comb coil fins for parallel orientation.
 - 7. Install clean filters. Do not operate air handling unit without pre-filters installed.
 - 8. Verify manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in the full-open position.
 - 9. Disable automatic temperature control operators.
- B. Start-Up Services: Provide the services of a factory-authorized service representative to start-up dedicated outdoor air units in accordance with manufacturer's written start-up instructions. Do not operate units without filters installed. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - Energize motor, verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - a. Replace fan and motor pulleys as required to achieve design conditions.

- b. Measure and record motor electrical values for voltage and amperage.
- c. Shut unit down and reconnect automatic temperature control operators.
- d. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for procedures for system testing, adjusting, and balancing.

3.5 TRAINING

- A. General: At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel for a minimum of two hours on the operation and maintenance of the equipment provided under this section.
- B. Content: Training shall include but not be limited to:
 - 1. Overview of the system and/or equipment as it relates to the facility as a whole.
 - 2. Operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention.
 - 3. Review data included in the operation and maintenance manuals. Refer to Division 1 Section "Operating and Maintenance Data."
- C. Certification: Contractor shall submit to the Engineer a certification letter stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The certification letter shall be signed by the Contractor and the Owner's representative indicating agreement that the training has been provided.
- D. Schedule: Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 237433

SECTION 26 00 00 - BASIC ELECTRICAL REQUIERMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section provides the Basic Electrical Requirements which supplement Document 00700: General Conditions and apply to all Sections in Division 26.

1.02 RELATED SECTIONS

A. Concrete Topping: Division 035300.

1.03 BASIC ELECTRICAL REQUIREMENTS

A. Quality Assurance:

- An Electrical Contractor holding a C-10 shall do electrical work and other licenses and permits required.
- 2. See other sections of these specifications for other qualification requirements.
- B. Drawings and Specifications Coordination:
 - For purposes of clearness and legibility, Electrical Drawings are essentially diagrammatic. Size and location of equipment is indicated to scale whenever possible. Contractor shall verify all conditions, data and information as indicated on Drawings and in Specification Sections where Electrical work is required.
 - 2. Electrical Drawings indicate required size and points of termination of conduits, number and size of wires, and suggest proper route for conduit. It shall be responsibility of Contractor to install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and meet all applicable code requirements. Routing of conduits may be changed, if approved by the City, provided that the length of any conduit run is not increased or decreased more than 10% of length indicated on Drawings.
 - 3. It is intended that outlets be located symmetrical with Architectural elements notwithstanding fact that locations indicated on Drawings may be distorted for clarity.
 - 4. Architectural and Structural Drawings take precedence over Electrical Drawings in representation of general construction work. Drawings of various trades take precedence in representation of work of those trades. Contractor shall refer to all Drawings to coordinate the Electrical work with work of other trades.

C. Terminology:

- Term "signal system" shall apply to clock, bell, fire alarm, annunciator, sound, public address, buzzer, public telephone, television, inter-communication, and security systems.
- 2. Term "low voltage" shall apply to systems operating at 600 volts and under.

- 3. Term "provide" used on Drawings and elsewhere in the Specifications shall be considered to mean "furnish and install".
- 4. Term "UL" means Underwriters Laboratories Inc.

D. Regulations:

 Electrical work shall meet requirements of the authorities having jurisdiction and the latest California Building Code. Material and labor shall conform to Regulations of the National Board of Fire Underwriters for Electrical Wiring and Apparatus. All material shall be new and shall be "UL" listed.

E. Structural Considerations for Conduit Routing:

- 1. Where conduits are to pass through or will interfere with any Structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, to accommodate the electrical work, such work shall conform to State Building Code, Part 2, Title 24, Section 1906 for conduits and pipes embedded in concrete and Section 2326.11.9 and 2326.11.10 for notches and bored holes in wood; for steel, as detailed on the Structural Drawings.
- 2.where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall, rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include manholes, pull boxes, vaults and buildings.
- 3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled and conduit nipple or coupling shall be welded to poles. Welds shall be by the electric arc process and shall be continuous around nipple or coupling.

F. Electrically Operated Equipment and Appliances:

- 1. Equipment and Appliances Furnished by Contractor:
 - a. Electrical work shall include furnishing and installing wiring enclosures for, and the complete connection of all electrically operated equipment and appliances and any electrical control devices which are specified to be furnished and installed in this or other Electrical Sections of these Specifications, except Electrical work specified or indicated to be in the Mechanical work. All wiring enclosures shall be installed concealed except where exposed work is indicated on Electrical Drawings.
 - b. Connections shall be made as necessary to completely install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets of incorrect Electrical characteristics or if any equipment fails to operate properly, Contractor shall report to the City in writing, listing buildings and rooms in which located, the name, make and serial number of equipment, and a description of defect.

2. Equipment and Appliances Furnished by Others:

 Equipment and appliances indicated on Drawings as N.I.C. (Not in Contract), "Furnished by Others", or "Furnished by the Owner", will be delivered to the Site. Required electrical connections shall be made for all such equipment and appliances in accordance with accepted trade practices under direction of the City Electrical Inspector. All motorized equipment will be furnished factory wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

- b. Connections to equipment furnished under other Sections of this Specification shall be part of the Electrical Work. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and other Sections of this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete Electrical installation. Work shall also include furnishing and installing conduit and boxes, for HVAC control system, furnished under Mechanical. Devices and equipment furnished shall be of same type used elsewhere on job or as specified.
- c. Electrical equipment furnished under other Sections of this Specification for installation and connection under work of this Section shall be delivered to the installation location by the Contractor furnishing the equipment.
- d. Mechanical equipment furnished under other Sections of this Specification, and requiring Electrical connection under this Section, will be set in place by Contractor furnishing equipment.
- e. Suitability and condition of equipment furnished by other Sections of this Specification, shall be determined in advance of installation. Immediate notice of damage, unsuitability or lack of parts shall be given to the Engineer.

G. Protection of Materials

Provide for safety and good condition of all materials and equipment until final
acceptance of project by the City. Protect all materials and equipment from damage and
provide adequate and proper storage facilities during progress of work. All damaged
and defective work shall be replaced prior to final inspection.

H. Cleaning

- Exposed parts of electrical work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.
- 2. Thoroughly clean all parts of apparatus and equipment. Exposed parts, which are to be painted, shall be thoroughly cleaned of cement, plaster and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and all corners and cracks scraped out. Exposed rough metal work shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.
- Contractor shall remove from the Site all debris and rubbish caused by the electrical work. He shall thoroughly clean building of dirt, debris, rubbish, marks, etc., caused by performance of work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS.

- A. Consult with City Electrical Inspector before starting work.
- B. All exposed conduits and boxes shall be painted to match the surfaces adjacent to installation.
- C. Coordinate Electrical work with the work of other trades.
- D. All trenches outside of barricade limits shall be backfilled and paved no later than 72 hours after being opened. During the time that trenches are open in traffic areas. The Contractor shall provide traffic plates.
- E. All electrical equipment shall be braced or anchored to resist horizontal force acting in any direction using the following criteria:

Fixed Equipment on Grade 20% of operating weight

Fixed Equipment on Structure 30% of operating weight

Emergency power and Communication

Equipment on Grade 40% of operating weight

Emergency power and Communication

Equipment on Structure 60% of operating weight

Flexible mounted equipment use 2x the above values.

Simultaneous vertical forces use 1/3x horizontal force. Where anchorage details are not indicated on drawings, the field installation shall be subject to approval of Structural Engineer and the City.

F. The Contractor to furnish accurate "As Built" Drawings after completion of the contract.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 REFERENCE

- A. General: Requirements in Addenda, Conditions and Division 1 collectively apply to this work.
 - 1. Examination of site prior to bidding: Bidding Requirements.

1.2 DESCRIPTION

- A. Principal Work Items are: Provide all labor, material, and equipment necessary to complete and test the electrical work as shown on the Drawings and as specified herein. Work includes but is not necessarily limited to the following:
 - 1. All electrical work for the data system, except as specified to be furnished or installed as a part of other Sections of the Specifications.
 - 2. Furnish and install all hangers, anchors, sleeves, chases, access panels and supports required for electrical work.
 - 3. Electrical conduit system rough-in.
 - 4. Excavation, backfill and concrete work required to complete items of this Section.
 - 5. Closing of all openings resulting from coring, sleeving, removal of conduit and/or equipment.
 - 6. Cleaning, patching, repairing and painting.
 - 7. Prime coat painting of all electrical equipment exposed to view in public areas.
 - 8. Shop drawings.
 - 9. Tests of all parts installed.
 - 10. Operating instructions.
 - 11. "As-built" Record drawings.
 - 12. Incidental items not indicated on the drawings nor mentioned in the specifications that belong to the work described, or are required to provide complete systems, as though called out here in every detail.
 - 13. Surface nonmetallic raceway system shall be used for branch circuit wiring and/or data, voice and other low-voltage wiring. The nonmetallic raceway system shall consist of raceway, appropriate fittings and device brackets to complete installation per electrical drawings.

1.3 SUBSTITUTIONS

A. General: Only written approval of Engineer will permit substitutions for materials specified; See Section 01600, Supplementary Conditions for procedure.

1.4 QUALITY ASSURANCE

A. Standards:

- 1. Comply with standards listed in the following:
 - a. Underwriters' Laboratories Inc. (UL).
 - The USA National Electric Code (NEC), 2016 edition, and all State Amendments local amendments thereto.
 - c. The USA National Fire Code (NFPA).
 - d. The National Electrical Manufacturers' Association (NEMA).
 - e. Institute of Electrical and Electronic Engineers (IEEE).
 - f. American National Standards Institute (ANSI).
 - g. California Code Of Regulations, Titles 8, 19 and 24, Part 3.
- 2. Off-Site Work: Conform to Governing Agencies requirements.
- 3. Earthquake Provisions: Comply with California Code Of Regulations, Title 24, Table 23P.
- 4. In case of conflict among the reference standards, the more stringent provisions shall govern and shall be resolved before installation at Contractor's expense. Prepare and secure approval for any clarifying details required by inspection authorities.
- 5. Nothing in the Contract Documents shall be construed as authority to permit work not conforming to codes, ordinances, standards or regulations.

B. Qualification Of Installers:

- 1. Throughout the progress of installation of the work of each Section, provide where required as indicated in respective Sections, at least one manufacturer's authorized representative who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, who shall be present at the job site and shall direct all work performed under that particular Section.
- 2. Cutting and patching finish work shall be performed by workmen of the proper trade.
- C. Qualification of Manufacturers:
 - 1. Manufacturers of the products supplied for this project shall have been in the business of manufacturing the particular product for at least five years and be able to prove a history of successful production acceptable to the Engineer. As a condition for approval and when directed by the Engineer, submit a list of past projects showing a minimum of five projects of similar scope to the Engineer for approval.

2. Provide together with the Shop Drawing submittal, where called for in these Specifications, a list of five projects which shall have been in satisfactory operation for the past five years.

1.5 SUBMITTALS

- A. General: Comply with provisions of Section 260500.
- B. Samples: Follow procedure under General Conditions. Submit duplicate samples showing manufacturers' standard finishes, colors and textures for all equipment exposed to view.
- C. Manufacturers Data: Within 30 calendar days after award of Contract, submit:
 - 1. Complete materials list of all items proposed to be furnished and installed.
 - 2. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
 - Unless specifically called for otherwise, provide bound copies of catalog cuts for standard products, not requiring specifically prepared Shop Drawings, for the following:
 - a. Pull boxes.
 - b. Conduit and raceways.
 - c. Outlet boxes.
 - d. Face plates for data outlets.
 - 4. Where more than one item, size, rating or other variations appear on a catalog cut sheet, clearly identify all items to be provided properly indexed and referenced to Engineer 's identification numbers, designations and/or details.
 - 5. No work shall be initiated or fabrication of any equipment started prior to Engineer 's return of reviewed submittals.
- D. Operating Instructions and Maintenance Manuals:
 - 1. Thoroughly instruct operating personnel designated by the District in the operation and maintenance of the components installed.
 - 2. Following approval of Shop Drawings of electrical and data network equipment and prior to acceptance of electrical work, prepare two (2) copies of operating and maintenance manuals in accordance with Section 260500, describing operating, servicing, and maintenance requirements of electrical equipment installed under Division 16 with particular emphasis on safety devices. Operation and Maintenance Manuals shall cover all components including but not limited to the following:
 - a. Hardware of data network system.
- E. Information contained in the manual for the above equipment shall include the following:
 - 1. Manufacturer's catalog cuts and printed descriptive bulletins.

- 2. Manufacturer's installation, operating, and maintenance instruction booklets.
- 3. Parts list and costs.
- 4. List of recommended spare parts for 12 months' operation.
- 5. Name, address, and phone number for closet source of spare parts.
- 6. Conduit schematic diagrams.

1.6 PRODUCT HANDLING

- A. Protection: Protect materials before, during, and after installation and protect installed work and materials of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary for the approval of the District Inspector and/or Engineer and at no additional cost to the District.
- C. Delivery and Storage: Deliver all materials to the job site in their original unopened containers, where applicable, with all labels intact and legible at time of use. Store in strict accordance with the manufacturers' recommendations as approved by the District Inspector.

1.7 PERMITS

A. General: Secure permits and pay all required fees for the installation of the electrical work.

1.8 RECORD DRAWINGS

A. General: Refer to Specification Section 260500, Contract Close-Out, "Project Record Documents", for requirements.

1.9 CERTIFICATES

A. General: Refer to Specification Section 260500, Contract Close-Out, for requirements.

1.10 GUARANTEE

- A. General: Refer to Specification Section 260500, Contract Close-Out, "Guarantee for Requirements."
- B. Manufacturers Guaranties: Submit guarantees for all applicable equipment and devices.

PART TWO - PRODUCTS

2.1 MATERIALS, GENERAL

- A. General: See General Conditions, Article titled "Materials".
 - 1. Engineer shall be the sole judge of material conformance to Contract Documents. Equal products shall be as selected by the Engineer.
 - 2. All materials and products shall be new and in perfect condition, and of the manufacturer's latest type and model. Unless otherwise noted, each material or product type shall be from one manufacturer only.

- All exterior mounted electrical boxes, devices and miscellaneous items shall be tamper-proof assemblies. Where not a standard feature, shop modify assembly to meet this requirement.
- 4. Where any devices or equipment is referred to or indicated in these documents or on the Drawings in the singular number, such reference shall be deemed to apply to as many such devices as are required to complete the intended installation as specified and/or as shown on the Drawings.
- 5. In case of conflicts among Drawings and Specifications, the more stringent requirement, larger quantities, better qualities and/or more proper application and installation for the particular situation shall govern.
- 6. Wherever "finishes" are indicated to be selected by the Engineer, such "finishes" shall include all standard as well as optional finishes offered by the Manufacturers.
- 7. All materials shall be U.L. listed where applicable.
- 8. The surface nonmetallic raceway system specified herein for data wiring shall be the 800, 2300, 2300D, NM2000 or 5500 systems as manufactured by The Wiremold Company. Substitution under provisions of Section 260500.
- The new construction box system specified herein for bringing power and low-voltage devices to one location in the same in-the-wall box and used to backfeed surface wiring systems shall be the Wall Source Box System as manufactured by The Wiremold Company.

B. Manufacturer and Catalog Numbers:

- 1. Where manufacturer and catalog numbers are indicated, the published data on the product by the manufacturer are deemed to be part of this specification.
- 2. Numbers used indicate basic minimum design and appearance required, and must be modified to meet all specific requirements of Contract Documents.
- 3. Where new equipment is intended to work with existing equipment or to be a part of existing equipment such as new circuit breakers or motor starters to be added to existing switchgear, the new equipment must match those existing in all respects. If this is not possible, then new equipment must be compatible with existing equipment. Contractor shall verify in field this requirement prior to submitting Bid.
- 4. Before submitting bid, verify availability of such modification. Where manufacturers cannot meet these modifications, notify Engineer 10 days prior to bid date and deem these products removed from approved list of equipment.
- 5. Act of submitting bid is certification that all equipment specified, with required modifications, is available from at least one manufacturer listed.

2.2 CONDUIT

- A. General: Provide only new conduit with UL listing or label and deliver to the site in standard lengths.
- B. Types:

- 1. Rigid Steel Conduit and Couplings: Hot-dipped galvanized or sherardized inside and out, with galvanized threads. Electro-galvanizing is not acceptable. Provide insulated throat metallic bushings.
- Electric Metallic Steel Tubing: Hot-dipped galvanized or sherardized inside and out, with galvanized threads. Electro-galvanizing is not acceptable. Provide insulated and bushed tap-on type connectors and couplings as made by Tomic or T&B, or wrench-tightened compression type couplings.
- Flexible Conduit: Manufacture from single strip steel, hot-dip galvanized on all four sides prior to conduit fabrication. Provide insulated die-cast connectors with ridges that thread into the inside of the conduit to ensure a force fit as made by D&H Electric Company or approved equal. Binding-screw type connectors are not acceptable.
- 4. Liquid-Tight Flexible Conduit: Identical to flexible steel conduit but with overall polyvinyl chloride plastic jacket. Provide insulating connectors, Appleton STN series, or approved equal.
- 5. Rigid Plastic Conduit: Extrude from virgin polyvinyl chloride compound, Schedule 40 heavy wall, in 10'-0" (3 m) lengths with couplings. Where threaded connection is required, provide Schedule 80 conduit.

2.3 OUTLET BOXES

A. General:

- Provide all boxes necessary for proper installation of electrical work in compliance with applicable codes and regulations whether required box is specifically indicated on the Contract Documents or not.
- 2. Boxes shall be 1-piece galvanized pressed steel knockout type, minimum size 4" (10 cm) square by 1-1/2" (38 mm), in all wall and ceiling locations unless otherwise indicated or required.
- 3. Cast boxes shall be ferrous or aluminum with threaded-hubs and dipped in rust inhibitor.

2.4 PULL BOXES

A. General:

- 1. Where pull boxes are indicated as required in wall, ceiling and in dry locations, provide boxes constructed of code-gauge sheet steel finished with one coat of metal primer and one coat of primer sealer.
- All pull boxes in wall or in ceiling shall be recessed or concealed unless otherwise noted.
- 3. Provide pull boxes with screw-on type covers. Provide a minimum 1" (2.64 cm) all around flange for recess mounted type.

B. Where located outdoors, in wet locations or indicated as weatherproof, provide pull boxes constructed in code-gauge steel, hot-dipped galvanized after fabrication and finish with one coat of metal primer and sealer. Install cover with stainless steel tamper-proof captive screws and neoprene gaskets. Seal around conduit entries with silicone sealant.

2.5 CONCRETE PULL BOXES

A. General:

- 1. Provide precast concrete pull boxes where pull boxes are indicated complete with cover, drain hole and two pull irons. Unless otherwise indicated, inside dimensions for pull boxes shall be 2'-6" (0.762 m) wide by 4' (1.22 m) long by 4' (1.22 m) deep.
- 2. Pull boxes shall meet all legal requirements as to size for conduits terminating therein.
- 3. Reinforced concrete shall be Class A, 20,684 kPa (3,000 psi) type.

B. Covers:

- 1. Covers shall be concrete with a cast-iron lid and frame.
- 2. Cast-iron lid shall have bead weld designation; "ELECTRICAL", "HIGH-VOLTAGE", "COMMUNICATIONS" etc., as required. Submit to the Engineer for review.
- 3. Provide traffic-type construction with traffic covers in areas involving vehicular traffic.
- C. Acceptable Manufacturers: Pre-cast concrete pull boxes shall be Quikset EPB-2100 Series or equal by Brooks Products.

2.6 SURFACE NONMETALLIC RACEWAY

- A. General: The wiremold 800, 2300, 2300D, NM2000, 5500 and 5400 raceway and all system components must be composed of UL listed materials and exhibit nonflammable self-extinguishing characteristics, tested to comparable specifications of UL94V-0. The raceway base and cover shall be manufactured of rigid PVC compound, available in ivory or white colors.
 - 1. The 800B and 800BA series base shall be manufactured of a rigid PVC compound. The base shall have a smooth texture, natural in color.
 - 2. The 800C series cover shall be manufactured of a rigid PVC compound. The cover shall have a matte texture, available in ivory color.
 - 3. The 2300B, 2300BA, 2300BD and 2300BDA series base shall be manufactured of a rigid PVC compound. The base shall have a smooth texture, ivory in color.
 - 4. The 2300C series cover shall be manufactured of a rigid PVC compound. The cover shall have a matte texture, available in ivory color.
- B. Raceways: The raceway shall be a two-piece design with a base and snap-on cover(s). The raceway base shall accept both a single cover that spans the entire base or two individual TwinSnap covers
 - 1. Total width of wiremold 800 shall be 1.31" by 0.44" deep with a cross sectional area of 0.27 square inches. The raceway base and cover sections shall have an

- approximate thickness of .065". The raceway base and cover shall be available in 5' lengths. The raceway base shall be available with adhesive tape backing.
- 2. Total width of wiremold 2300 or 2300D shall be 2.25" [57mm] by 0.69" [17.5mm] deep with a cross sectional area of 0.85 square inches [21.6mm] for single compartments. A dual compartment version shall be available with the cross sectional area of each compartment being .425 square inches [10.8mm²]. The raceway base and cover sections shall have an approximate thickness of .075" [1.9mm]. The raceway base and cover shall be available in 5' [1.525m] lengths. The raceway base shall be available with adhesive tape backing.
- 3. Total width of wiremold 5400 shall be 5.25" [133mm] by 1.75" [44.5mm] deep with an approximate thickness of .095" [2.4mm]. The base and cover shall be available in 8' [2.4m] lengths. The raceway shall be available with two (5400TB) wiring channels.
- 4. The 5400TB Series base shall have two wiring channels separated by one integral barrier. Each channel must be large enough to accept standard power and communication devices without restricting capacity of the adjacent channel. The 5400TBD Series base shall have three wiring channels separated by two integral barriers forming 1/2, 1/4 and 1/4 compartments. One channel must be large enough to accept standard power and communication devices without restricting capacity of the other channels. The 5400C Series cover shall span the entire width of the base concealing all of the wiring channels. The 5400TC Series cover shall have flanges for snapping onto the base side walls and center barrier. The cover shall span one-half the width of the base, providing independent access to services.
- C. Fittings: A full compliment of wiremold 800, 2300 & 2300D series fittings must be available including but not limited to flat, internal, and external elbows, tees, entrance fittings, cover clips, and end caps. The fittings shall have a matte texture, available in ivory and white colors to match the cover. They shall overlap the cover and base to hide uneven cuts. All fittings shall be supplied with a base where applicable to eliminate mitering. A transition fitting shall be available to adapt to other series raceways manufactured by The Wiremold Company. They shall be manufactured of a rigid PVC compound.
- D. Wiremold 800, 2300 & 2300D Series Device and Fixture Boxes
 - 1. Device boxes shall be available for mounting standard devices and face plates. A device box shall be available in single gang, two gang and three gang configurations and range in depths from 0.88" [22.2mm] to 2.75" [70mm] for shallow and extra deep devices. Round fixture and extension boxes shall be available to mount fixtures and other devices with 3.5" [89mm] or 4.06" [103mm] mounting centers. Round fixture boxes shall be 1" [25mm] deep by 4.75" [121mm] or 5.50" [140mm] in diameter. All device and fixture boxes shall be ivory and white in color to match the raceway cover.
 - 2. A series of boxes for divded applications shall be available in dingle-gang with depths of 1.75" and 2.75" [44mm and 70mm], as well as a divided two-gang box 2.5" [64mm] deep. The single boxes can be used with divided and undivided raceway. The two-gang divided box is dedicated to the divided raceway system. This series of boxes allow for installation anywhere along the raceway without having to cut the raceway base.
- E. Wiremold 5400 Series Device Brackets and Plates
 - 1. Device brackets shall be available for mounting standard devices in-line or offset from the raceway. A device bracket shall provide up to three single-gang openings at one

location. Faceplates shall be 5507 Series that match and fit flush in the device plate. They shall be manufactured of rigid PVC compound.

F. Raceway

- 1. The raceway shall be a two-piece design with a base and a snap-on cover. Total width shall be 6.68" by 1.75" deep with an approximate thickness of .10". The raceway shall be available with and without multiple wiring channels formed by integral barriers in the base.
- 2. The 5500B Series base shall have one wiring with integral ribs in the bottom to accept divider sections. Divider walls, which snap onto the base to form separate channels, must be available. The base shall be manufactured of rigid PVC compound. The base shall have a smooth texture, available in ivory and white colors.
- 3. The 5500BD Series base shall have three wiring channels separated by two integral barriers. The channels must be large enough to accept standard power and communication devices in each channel. The barriers shall be removable to form one or two channels. Divider walls must be available to replace the removed barriers. The base shall be manufactured of a rigid PVC compound. The base shall have a smooth texture, available in ivory and white colors.
- 4. The 5500C Series cover shall have flanges for snapping onto the base. The cover shall be manufactured of a rigid PVC compound. The cover shall have a matte texture, available in ivory and white colors to match the base.
- 5. The 5500C Series divider shall have integral slots which snap onto the 5500B base or the 5500D base after the integral barrier has been removed. The divider shall be manufactured of a rigid PVC compound. The divider shall have a smooth texture, natural in color.

G. Fittings

- 1. a full compliment of fittings (5500 Series) must be available including but not limited to flat, internal and external elbows, tees, entrance fittings, cover clips, and end caps. They shall be manufactured of a rigid PVC compound. The fittings shall have a matte texture, in ivory and white colors to match the base and cover. They shall overlap the cover and base to hide uneven vuts. All fittings shall be supplied with a base where applicable to eliminate metering. A transition fitting shall be available to adapt to Wiremold 400/800/2300 series raceways.
- H. Finish: All Wiremld products shall be ivory color or as selected by the Engineer.

2.7 DEVICE BOX:

- A. General: The box and all system components must be UL listed in full compliance with the standard for 514A and 514C; steel shall be galvanized with a minimum wall thickness of .063 [1.6mm] throughout. Backfeed brackets are .050 [1.2mm] min. steel with a gray or ivory ScuffCoat finish, suitable for field painting. The device mounting bracket is Valox engineered resin and the trim ring is PVC.
- B. Box: The four-gang box shall included the box, dividers and mounting brackets. The box dimensions shall be 9.18" [233mm] long x 5.02" [127mm] high x 3.28" [83mm] deem. Up and shall be manufactured of 0.063 [1.6mm] min. thick steel. The box shall accommodate standard power and communication devices.

- 1. The box shall have eight knockouts located on top and bottom, 2 1/4" [57mm] from the face to accommodate combinations of 1/2" [12mm], 3/4" [18mm] and 1" [25mm] trade size conduit with a separate ground for each gang.
- 2. The box depth shall adjust for a flush installation with the finished wall. There are positive stops for surface mounting to 1/2" [12mm], 5/8" [16mm], 1" [25mm] and 1 1/4" [32mm] thick wallboard. Adjusting screws are located outside the box for adjustment prior to installation.
- C. Device Mounting Bracket: The self-leveling device mounting bracket shall accommodate standard power devices, Interlink Activate connectivity inserts, and Wiremold 5507 Series faceplates. The bracket accommodates up to four powered devices or 12 communications inserts.
- D. Device Covers: Device cover plates for mounting the following commercially available devices must be available: duplex devices, and other rectangular faced plates. Single-gang and double-gang cover plates are of modular design and are compatible with Wiremold wire management systems.
- E. Communication Devices and Accessories: The box manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP (including Category 5), STP (150 ohm) Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting.
 - 1. A complete line of preprinted station and port identification labels, snap-in icon buttons and write-on station identification labels shall be available.
- F. Support Bracket: A support bracket for mounting on 16" [406mm] center studs must be provided.
- G. Dividers: Dividers must be removable without additional tools.

2.8 UNDERGROUND CONDUIT SYSTEM

- A. Underground Conduit System: Provide as shown on the Drawings and as specified.
- B. Excavation: Provide excavation for underground conduit system and manholes as shown on the Drawings and as specified herein before.
- C. Conduit for the underground conduit system shall be as shown on the Drawings, and as specified in Section 260500 and in Part Three of this Section.
- D. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4" (0.6cm) in a 10'-0" (3.1m) length.
- E. Conduit fittings shall be UL approved and shall conform to applicable standards, except that where NEMA Standards for conduit fittings do not exist, fittings shall be as recommended by the conduit manufacturer.
- F. Conduit fittings shall be of a type especially made for use with the conduit for electrical service. Plastic conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight root-proof joint.

PART THREE - EXECUTION

3.1 MATERIALS AND WORKMANSHIP

A. General:

- 1. All materials and equipment shall be installed in accordance with approved recommendations of the manufacturer and conforming to the Contract Documents. All devices and equipment are laid out per requirements of one manufacturer. Modify work and arrangements to suit actual equipment installed and pay for all additional cost incurred, if any. The installation shall conform to the applicable codes, rules, and regulations. The Drawings indicate, in diagrammatic form, the work to be done rather than exact routing, location and arrangement of equipment, conduit, and wiring. Make use of data in Contract Documents, verify against developed field conditions, install work in an orderly arrangement in a manner to overcome structural and other interference.
- 2. Study all Drawings and properly locate the outlets and cabinets so that they are readily accessible. Locate cabinets and outlets to avoid interference with mechanical or structural features. Do not support any electrical material, equipment or device from sheet metal roof decks or ductworks. If any conflicts occur necessitating departures from the Drawings, details of such departures and reasons therefore shall be submitted as soon as practicable for written approval.
- 3. Where developed conditions make revisions necessary to indicated locations and arrangements, Contractor shall make changes, at no additional cost, provided:
 - a. Change is ordered prior to time conduit is installed.
 - b. Length of conduit run is not changed more than 10-percent.
- 4. Architectural and structural drawings take precedence over electrical drawings in representation of general construction work, and drawings of various trades take precedence in representation of work of these trades. Refer to all Contract Documents and coordinate electrical work with other work.
- 5. Where discrepancies arise among the various Contract Documents, stop work in affected areas. Promptly notify Inspector of conditions.
- 6. Galvanic and chemical corrosion shall be prevented by isolating dissimilar metals and preventing contact of aluminum with concrete, plaster, mortar or earth.
- 7. All equipment shall be braced and/or anchored to resist a horizontal force per Table 23P, Title 24, California Code Of Regulations.
- 8. Prior to and during installation of the Wiremold products, refer to system layout drawing containing all elements of the system. Installer shall comply with manufacturer's installation instructions, which accompany system components as well as system instruction sheets.

3.2 CONDUIT AND TUBING

A. General:

1. Provide the type of conduit permitted in these Specifications or required for each location or condition per applicable codes and jurisdictions whichever is more stringent.

- 2. Minimum size of conduits above grade shall be 1/2" (12.7mm); underground, below grade, slab, or in slab shall be 3/4" (19mm) minimum.
- 3. Unless indicated otherwise, conduits shall be concealed within or behind finished walls and ceilings.
- 4. Where conduit penetrates fire-rated walls or floors, provide pipe sleeve two sizes larger than conduit; pack void around conduit with oakum and fill ends of sleeve with fire-resistive compound. Provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating. Seal opening around conduit with UL listed foamed silicone elastomer compound.

B. Conduit Usage:

- 1. Concrete or masonry in contact with earth and all concrete block walls are not considered as dry locations.
- Aluminum conduit may be used only where installed exposed in dry locations. Nonaluminum sleeves shall be used where aluminum conduit passes through concrete or masonry construction.
- 3. Electrical metallic tubing (EMT) may be installed only within buildings above grade, in dry locations, and where allowed to be surface mounted or exposed at not less than 7'-6" (2.3m) above floor or otherwise prohibited. EMT may be used only for sizes 2" (50mm) or smaller.
- Rigid plastic conduit, PVC Schedule40, may be used only underground and below slabs on earth.
- 5. Use rigid metal conduit where Code required; where indicated as hazardous area; where exposed to the weather; where exposed at less than 7'-6" (2.3m) above the floor in areas accessible to anyone other than authorized operating or maintenance personnel; where underground; and where other types of conduits are not allowed in this Specification.
- 6. Use flexible conduit only as follows:
 - a. Where indicated.
 - b. Final connections to motors, vibrating equipment, and where required for equipment servicing.
 - c. Concealed runs in dry locations where structural conditions prevent the use of other types of conduit and where such runs do not exceed 6 feet.
 - d. In damp locations or areas exposed to the weather, flexible conduit, where required, shall be of the liquid tight type provided the jacket temperature limitations will not be exceeded.
- 7. Provide, whether indicated on Drawings or not, a green insulated ground conductor of size as required by code in all feeders, flexible and PVCconduit runs. Increase conduit size to accommodate the ground wires where necessary.

C. Supports:

- 1. Support conduit at Code required intervals as a minimum. Provide additional supports where required or as directed by the Engineer. Perforated strap or plumber's tape are not acceptable for conduit supports.
- 2. Above suspended ceilings support conduit on or from the structure or from the ceiling channels (using No.16 gauge double annealed galvanized tie wire). Support conduit attached to the suspension system at maximum 4' (1.22m) intervals.
- 3. In steel stud construction: Rigidly tie conduit at maximum 4' (1.22m) intervals with No.16gauge double annealed galvanized wire so that conduit cannot move from vibration or other causes. Use galvanized steel hangers of types made specifically for the purpose to support conduits.
- 4. Conduit on concrete or masonry: Use 1-hole malleable iron straps with metallic expansion anchors and screws or from preset inserts. Use preset inserts in concrete when possible. Use pipe spacers (clamp backs) in wet locations.
- 5 Suspended conduit: Use malleable iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried minimum 3/8" (10mm) diameter, Kindorf or equal. For grouped conduits, construct racks with threaded rods and tiered angle-iron or uni-strut cross members. Clamp each conduit individually to a cross member. Where rods are more than 12" (0.3m) long, provide rigid sway bracing.
- 6 Supports at structural steel members: Use beam clamps. Drilling or welding may be used only as indicated or with written approval of the Engineer.
- 7 Wherever conduit may be affected by movements of the supporting structures or medium, and where secured on both sides of building control joints, provide suitable flexible or expansion devices.
- 8 Conduits or pipe shall not be welded to steel structures.
- 9 Wiremold raceway shall be securely supported in accordance to manufacturer's installation sheets.

D. Locations:

- 1. Route conduit to avoid drains, other gravity lines and all obstructions. Where conflicts occur, relocate conduit as required.
- 2. Keep conduit at least 6" (150mm) from the coverings on hot water and steam pipes; at least 18" (460mm) from the covering on exhaust flues and breechings; and at least 24" (600mm) from radiant heaters.
- 3. Where exposed conduit runs are permitted, run conduit parallel with or at right angles to structural members, walls or lines of the building. Route exposed conduit to preserve headroom, access space and work space.
- 4. Changes in direction of runs shall be made with symmetrical bends or cast metal fitting. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Bending radii shall not be less than those allowed in the NEC. Crushed or deformed raceways shall not be installed or when installed, shall be changed as directed by the Engineer.

5. Conduit may be run in concrete members or slabs only with previous written permission of the Engineer. Individual written permission shall be obtained for each conduit run or for conduits within each definitive area or for each particular condition.

E. Joints, Bends and Fittings:

- 1. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight. Seal all conduit entries with silicone sealant.
- 2. Threaded Conduit: Use red lead and oil applied to the male threads only and tighten joints securely. For underground or under slab conduits, apply a heavy coat of Pabco P & B No.2 paint after installation to surfaces within 6" (150mm) on both sides of fittings and to areas where wrenches or other tools have been applied. On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing "Galvabar", or equal.
- 3. Plastic Conduits: Use approved solvent-weld cement specifically manufactured for the purpose.
- 4. Bushings shall be installed on ends of all conduits and shall be of the insulating type where required by applicable codes.
- 5. Cut threads on rigid conduit to standard taper and to length such that bare metal exposed by the threading operation will be completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that joints will become secure and wrench tight before conduit ends butt together in couplings and before conduit ends butt into the ends or shoulders of other fittings. Securely tighten threaded connections.
- Keep bends and offsets in conduit runs to an absolute minimum. For the serving utilities, make large radius bends to meet their requirements. Replace deformed, flattened or kinked conduit.
- 7. Rigid metal conduit of 1-1/4" (32mm) trade size or larger: Provide large radius factory-made bends or field bend the conduit with a power bender designed for the purpose and utilizing bend forms sized for the conduit being bent.
- 8. Plastic Conduit: Apply heat for bends so that conduit does not distort or discolor. Use a spring mandrel as required to ensure full inside diameter at all bends.
- 9. Bend conduit to radius no less than Code required minimum.
- F. Underground Conduits and Duct Banks: Make installation in accordance with Section16403.
- G. Conduit Stub-ups:
 - 1. Use rigid steel conduit for stub-ups, 90-degree bends and risers to grade from other conduits. All stub-ups designated for future use shall be capped.

H. Empty Conduits:

1. Provide a nylon or polyethylene rope rated 250lbs (113kg) tensile strength in each conduit more than 10' (3m) in length and left empty for future use. Not less than 10" (25cm) of slack shall be left at end of the conduits.

- 2. Tag empty conduit at each accessible end identifying the purpose of the conduit and the location of the other end.
- 3. In wet, corrosive, outdoor or underground locations, use brass, bronze or copper No.16gauge tags or lead tags secured to conduit ends with No.16 or larger galvanized wire. Inscribe on the tags with steel punch dies clear and complete identifying information.
- 4. In dry interior locations use metal-rimmed paper tags securely affixed with nylon twine. Inscribe on the tags with India ink, clear and complete identifying information.
- All unused conduit openings shall be plugged or capped with a suitable device designed for the purpose. Caulking compound shall not be used for plugging empty conduits.

I. Completeness:

- 1. Work shall include furnishing all raceway and appropriate fittings and device plates to install a nonmetallic surface raceway system as indicated on the electrical and/or communication drawings and in the specification. Installer shall comply with detailed manufacturer's instruction sheets, which accompany the system.
- 2. All unused raceway openings shall be closed.

3.3 BOXES AND SUPPORTS

A. General:

- 1. Provide boxes in the raceway systems wherever required for pulling of wires, making connections or splices and mounting of devices.
- 2. Boxes for metallic raceways shall be the cast metal hub type where required by applicable codes, when located in normally wet locations, when surface mounted on outside of exterior surfaces, in hazardous areas, and when installed exposed up to 84" (2.133m) above interior finished floors, grades or walkways. Boxes in other locations shall be sheet steel. Cast conduit fittings may be used in addition to boxes. Cast metal boxes used in hazardous areas shall be rated properly for the classification of the areas.
- 3. Each box shall have the volume required by the NEC for the number of conductors enclosed in the box.
- 4. Aluminum boxes in contact with concrete, mortar, or plaster shall have a bituminous or other acceptable coating or bituminous-impregnated felt plastic sheet, or other acceptable material between the aluminum and the alkaline material.
- 5. Boxes installed for concealed wiring shall be provided with suitable extension or plaster rings, as required. Boxes for use in concrete or tile shall be standard boxes having square corner tile-type covers with ribs or extensions for casting in concrete. Cast metal boxes installed in wet locations and boxes installed flush with the outside of exterior surfaces shall be gasketed.
- 6. Boxes and supports shall be fastened with bolts to steel structural shapes, with bolts and expansion shields on concrete or concrete unit masonry and machine screws to metal studs and furring. Threaded studs driven in by powder charge and provided

- with lock washers and nuts, or nail-type nylon anchors, may be used in lieu of expansion shields or machine screws. Penetration into reinforced concrete shall avoid cutting any main reinforcing steel. Reinforcing steel location and depth shall be determined prior to making any penetration.
- 7. Support recessed boxes in suspended ceilings or stud partitions with galvanized steel box hangers of types made specifically for the purpose or attach directly to support structural members. Fully or partially hammer-driven screws are not acceptable.
- 8. Provide covers of the types most suitable for the devices used at the outlets.
- 9. Use extension rings with blank covers for making exposed conduit connections from flush wall or ceiling outlet boxes.
- 10 Use outlet boxes serving devices as pull boxes wherever practicable. In finished areas, provide the specific pull or junction boxes only as indicated or directed by the Engineer.
- 11. Take particular care in locating outlet boxes in acoustic tile, masonry, paneling or other modular type finishes. Where Engineer 's documents do not dictate location or control, consult with the trades concerned so that outlets may be symmetrically placed in the finished module.
- B. Boxes for use with raceway systems shall be not less than 1-1/2" (38mm) deep except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture and signal systems outlets shall not be less than 4" (100mm) square except that 4" (100mm) x 2" (50mm) boxes may be used where only one raceway enters the outlet.
- C. Where several feeders pass through a common pull box, the feeders shall be tagged to indicate clearly the electrical characteristics, circuit number, and panel designation.
- D. Wall Outlet Locations: The locations of wall outlets shall be measured from the finished floor to the center of the outlet or switch box. The edges of outlet and switch boxes for concealed work shall be not more than 1/4" (6mm) from the plane of the finished wall surface, except that boxes having flush plates shall not project beyond finished walls.
- E. Other Boxes: Use solid-type ganged boxes where required for more than two devices or for barriered outlets. Use concrete boxes for outlets in concrete construction.
- F. Recess Mounting: All wall outlet boxes shall be recess mounted in areas with finished walls, unless otherwise shown or required to be surface mounted when approved by the Engineer.
- G. Mechanical Safety: All raceway systems shall be mechanically continuous and connected to all data outlets, boxes, and cabinets, in accordance with manufacturer's installation instructions.
- H. Electrical Security: The WallSource Box shall be electrically continuous and connected to all data outlets, boxes, and cabinets, in accordance with manufacturer's installation instructions.
- I. Completeness: Work shall include installing box, device mounting bracket, devices, and device plates for a complete in-the-wall system. Backfeed applications included installing box, dividers, and plate when applicable, for a complete system as indicated on the electrical, communication and/or laboratory equipment drawings and in the applicable specifications.

3.4 TRENCHING AND BACK FILLING

- A. Perform excavation and back fill required for electrical work in accordance with the requirements of Division 2 and the following:
 - 1. Pits and trenches shall be of the minimum size required. Shoring and bracing shall be provided as required to prevent caving of banks.
 - 2. Provide necessary guard rails, barriers, and warning lights. Work shall be scheduled in a manner that excavations shall be open for a minimum period. Back fill shall be in accordance with the drawings.
 - 3. Where trenches occur in existing areas, restore backfill to match existing conditions.

3.5 EQUIPMENT CONNECTIONS

- A. General: Refer to other Sections and Divisions of the Specification for equipment requiring connections. In general, unless otherwise noted, all power consuming equipment and appliances including controls specified in the Specification or indicated on Drawings and those furnished by the District shall be connected and made operational under this Section of the work.
- B. Shop Drawing: Confirm with equipment supplier and/or respective shop drawings to verify specific connection method, location and requirement and provide the necessary connection accessories whether indicated on the Drawings or not.

3.6 PENETRATIONS

A. General: Penetrations in walls, floors or ceilings requiring protected openings shall be fire-stopped. Fire-stopping shall be of an approved material, securely installed and capable of maintaining its integrity when subjected to the time-temperature curve of State Fire Marshal Standard 12-43-3 and Standard 12-43-1. Manufacturer's instructions shall be made available to the inspection authority and kept at the job site.

3.7 MEMBRANE PENETRATION

A. General: Where penetration through membrane cannot be avoided, cut and re-seal membrane at point of penetration as required.

3.8 PAINTING AND FINISHING.

A. General: Paint all electrical equipment exposed to view in public areas with one coat of primer. Finish coat painting will be provided under Section 260500. For equipment inside electrical room, mechanical room and utility closets accessible only to authorized maintenance personnel, standard manufacturer's finishes are acceptable.

3.9 INSTALLATION

- A. General: The installation of the equipment in this section shall comply with all applicable requirements.
- B. Install the equipment in conformance with the manufacturer's installation instructions.
- C. Concrete Pull boxes:
 - 1. Install pull boxes in paved areas wherever possible but keep each box a minimum of 1' (30.5cm) clear of edge of paving. Tops of boxes shall align exactly with top

- surfaces of paving. In other locations, install boxes where runoff water will not drain to the box and set top of box 2" (5cm) above finished grade of surrounding earth.
- 2. Except where indicated or where absolutely necessary, make no splices in concrete pull boxes. Where conductors of 600 volt rating or below must be spliced, use in-line or straight-through type with a heat shrinkable plastic sleeve placed over the splice. Coat the splice thoroughly with Skotchkote Electric Coating.
- 3. Where different systems share the same pull box, provide transit barriers or other means to provide legal separations. Junction boxes inside concrete pull boxes shall be cast type with threaded hubs and gasketed covers.
- 4. Immediately below the drain hole in the pull box, install a 12" (30.5cm) diameter by 4' (1.22m) long clay pipe, or concrete pipe, and fill with 1/2" (1cm) size crushed rock.
- 5. Coat entire below-grade exterior surfaces with an approved waterproofing compound.
- 6. At end of job, seal the (traffic) cover to the pull box to prevent water entry.

D. Underground Conduit System:

- 1. All individual conduit and/or conduits that are grouped together to form a duct bank shall conform to all standards and to the requirements specified herein.
- 2. Duct bank or conduit shall have a minimum slope of 3" (7.6cm) in each 100' (30.5m) away from buildings and toward manholes and other necessary drainage points, and shall run in straight lines except where a change of direction is necessary.
- 3. Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25' (7.6m), except that manufactured bends may be used at ends of short runs of 100' (30.5m) or less, and then only at or close to the end of the run. The long sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18" (46cm) for use with ducts of less than 3" (7.6cm) in diameter and a minimum radius of 36" (91cm) for ducts of 3" (7.6cm) in diameter and larger.
- 4. Conduits shall terminate in end-bells where duct lines enter manholes.
- 5. Separators used in duct banks shall be of pre-cast concrete, high impact polystyrene steel, or any combination of these and shall be placed not less than 4' (1.2m) apart.
- 6. Joints of the conduit runs shall be staggered not less than 6" (15cm) in rows and tiers (layers) so as to provide a duct line having the maximum strength.
- 7. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of a duct line is complete from manhole (hand hole) to manhole (hand hole), a testing mandrel not less than 12" (30.5cm) long with a diameter 1/4" (0.6cm) less than the size of the conduit shall be drawn through each conduit, after which a brush with stiff bristles shall be drawn through until the conduit is clear of all particles of earth, sand, or gravel; conduit plugs shall then be immediately installed.
- 8. Underground conduit without concrete encasement shall comply with all applicable requirements of the Specifications and the following:

- a. Concrete encasement may be omitted for conduits located below slabs on grade within buildings or where indicated in landscaped areas or in unpaved areas not subject to vehicular traffic or where specifically indicated as not required.
- b. Conduits without concrete encasement shall be galvanized rigid steel or rigid plastic, minimum 4" (10cm) inside diameter unless otherwise indicated.
- c. The top of conduits shall not be less than 24" (61cm) below grade. Separation of conduits shall comply with requirements as specified for underground duct lines encased in concrete.
- d. There shall be not less than 3" (7.6cm) clearance from the conduit to each side of the trench. The bottom of trenches shall be graded carefully and shall be smooth; where rock, soft spots, and/or sharp edged materials are encountered, the bottom shall be excavated for an additional 3" (7.6cm) and filled and tamped level with the original bottom with sand or earth free from particles that would be retained on a 1/2" (1cm) sieve.
- e. Under roads, paved areas, areas subject to vehicular traffic and railroad tracks, conduits shall be encased in concrete and installed as specified for underground duct lines encased in concrete. The concrete encasement shall extend not less that 5' (1.5m) beyond the edge of paved areas and roads, and 12' (3.5m) beyond the outer rails of railroad tracks.
- f. When specified, conduits to be installed under existing paved areas, roads, areas subject to vehicular traffic and railroad tracks which are not to be disturbed shall be zinc-coated, rigid steel, jacked into place. Identification slabs (markers), back filling, and reconditioning of surface shall be as herein specified. The kind of conduit used shall not be mixed in any one duct bank.
- 9. Where corrosive soils are indicated on Drawings or encountered in field, rigid steel conduits, if used, shall be wrapped with Scothrap No. 50 tapes with a 30-percent tape overlap or encased in a minimum 3" concrete encasement using Type I or II cement. If concrete encasement is used, then other requirements for concrete duct banks shall apply.
- 10. An AWG No. 4/0 bare stranded copper ground wire shall be laid on top of each underground duct bank and extended into each manhole and clamped to the ground rod with a cast type grounding lug designed for the purpose, or bound with exothermic weld.
- 11. Duct-bank markers shall be located at the ends of all duct banks except at manholes, at approximately every 200' (61m) along the duct run, and at each change in direction of the duct run. Markers shall be placed approximately 2' (61cm) to the right of the duct bank when facing the longitudinal axis of the run and in the direction of the electrical load. Markers shall be made of class B concrete, 6" (15cm) square or round section by 3' (91cm) long. The top edges of the marker shall have a 1/2" (1cm) chamfer all around. The letter "D" with two arrows shall be impressed or cast on the top of the marker. One arrow shall be located below the letter and shall point toward the duct bank. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the duct bank.
- 12.A pull line such as "Poly Rope" shall be left in each empty duct.

13.All utility conduit runs outside of building, including stub-outs on the site, shall be marked on the Record Drawings As-Built Drawings, identified and dimensioned exactly from a referenced building signed by the Contractor and countersigned by the District Inspector Engineer.

3.10 TESTS

- A. General: In addition to tests required by other sections, perform or cause to be performed in the presence of the Engineer, all tests specified for electrical work when the work is substantially complete.
- B. Factory tests shall be conducted prior to shipping of the equipment specified in this Section. Factory tests shall comply with the performance data submitted for approval. Provide certified copies of the reports on all tests, including the complete test data.
- C. Field tests shall include testing of the field conduit runs to ensure the satisfactory operation of each system complete. Initiate moving parts and door, including locks and latches. All units and components shall operate within the efficiency, repeatability, and accuracy limitations approved and shall in all respects conform to the Drawings, Specifications, and approved submittals.
- D. Operating Test: Upon completion of the work and adjustment of all equipment, conduct an operating test and submit for approval at such time as the Engineer directs. Conduct the test in the presence of the Engineer and the District Inspector. Demonstrate all systems and equipment to:
 - 1. Operate in accordance with all requirements of the Contract Documents.
 - 2. Be free from all electrical and mechanical defects.
- E. Other Tests: Conduct all other and additional tests to assure the Engineer that the electrical work is free from short circuits, grounds other than intentional grounds, and defective or damaged insulation. In additional, perform all tests that are required by authorities having jurisdiction or are requested by the Engineer.
- F. Cost: All cost incurred, including required instruments and personnel for the tests shall be included on the bid price and paid for by the Contractor.

3.11 REPAIR OF EXISTING WORK

A. General: The work shall be laid out in advance, and where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of the conduit, raceways or other electrical work, this work shall be carefully done and any damage to building, piping or equipment shall, following review of damage, be repaired by craftsmen, skilled in the trades involved, at no additional cost to the District.

3.12 CLEANING

A. General: Periodically remove waste and rubbish and maintain order. Clean and polish finished metal surfaces. Exposed materials, equipment and apparatus shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and have all cracks and corners scraped out clean, and all surfaces carefully cleaned of grease and oil spots and be left smooth and clean, with all unfinished surfaces ready for painting. Clean all grease, oil and other foreign substances from floors, walls, ceilings and fixtures, and leave premises clean and free from

all debris and unused construction materials, where caused by work under this Section. Completely clean insides of all lighting fixtures removing all dirt, bugs and other foreign substances.

3.13 COORDINATION

A. General: Coordinate with all other trades involved in the construction project. All work shall be fully laid out in advance, coordinating all features of construction, including control wiring between different systems.

3.14 QUALITY CONTROL

A. General: Establish and maintain quality control for operations under this Section to ensure compliance with Contract requirements, and maintain records of quality control for all materials, equipment and construction operations.

3.15 INSPECTION

- A. Preparatory inspection shall be conducted prior to commencing work, as follows:
 - Check to see that all required Drawings and other submittals have been made, are complete, and approved. Where exceptions have been taken to submittals, but approved subject to correction, check to verify that proper corrections have been made.
 - 2. Check materials and equipment upon delivery at job site for compliance with approved submittal. Verify for proper storage.
 - 3. Check layout drawings and details of interfaces with existing work, with interfaces and interrelations with work under other Divisions of the Specifications, and with interfaces with work performed.
 - 4. Check the actual conditions on the site for conformance with the above. Verify that conditions are ready for new work.
 - 5. Review installation procedures and code requirements with each person involved in inspecting and performing the work.
 - 6. Review requirements of Drawings, Specifications, and the manufacturer's requirements and recommendations. In the event clarification or the Engineer's decisions are required, such shall be obtained before proceeding with the work.
 - 7. Quiz personnel doing work to ensure their understanding of Contract requirements including workmanship and techniques.
 - This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Engineer and the District Inspector at any time upon request.
- B. Initial inspection shall be conducted when a representative sample of the work is complete, as follows:
 - 1. Review the representative sample of the work against the Specification and code requirements previously discussed at preparatory inspection. Review shall include, but is not to be limited to:

- a. Layout and sub-grade work.
- b. Wireway installation.
- c. Cable installation.
- d. Equipment installation.
- e. Terminations and splices.
- f. Grounding.
- g. Man holes, hand holes, junction boxes, enclosures, etc.
- Note and discuss all deficiencies observed and corrective action to be taken. If corrective action is to be taken, an additional inspection shall be conducted for compliance.
- This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Engineer or the District Inspector at any time upon request.
- C. Follow-up inspections shall be conducted daily to ensure compliance with corrections required by initial inspection, as follows:
 - 1. Check completed work against corrected representative sample of work.
 - 2. Perform all tests required by Contract to ensure compliance.
 - 3. This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Engineer or the District Inspector at any time upon request.
- D. The three-phase inspection method outlined above shall be applied to each item of work. This inspection method and the records thereof are in addition to and part of the inspection and testing requirements specified in each of the Sections.
- E. Copies: Furnish the Engineer a copy of these records and tests, as well as records of corrective action taken.

END OF SECTION

SECTION 20 05 26 - GROUNDING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Section Includes: Provide and installs a grounding system as indicated.

1.2 RELATED SECTIONS

- A. See related Sections for their system grounding Requirements.
- B. Section 260526: Basic Electrical Requirements.

1.3 SYSTEM DESCRIPTION

- A. Grounding shall be as approved by the State of California, Division of Industrial Safety.
- B. All metallic objects on the premises that enclose electrical conductors or that are likely to be energized by electrical currents shall be effectively grounded.
- C. All metal equipment parts such as enclosures, raceways, and equipment grounding conductors and all earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.
- D. All metallic systems shall be solidly interconnected to the electrical system as provided by the service entrance and for each grounded separately derived system that is installed.
- E. A separately derived A.C. source shall be grounded to the equipment grounding conductor and to a separate made electrode.
- F. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by use of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of approved size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit over 6'-0" in length shall be provided with a green insulated grounding conductor of approved size.
- G. Cold water or other utility piping systems shall not be used as grounding electrodes, due to the District's use of insulating couplings and nonmetallic pipe in such installations. Grounding electrodes shall be "made electrodes" specified as follows:
 - 1. Grounding electrodes as specified in Article 2.01, Paragraph B of this Specification.
 - 2. Concrete enclosed electrode, which is made up of at least 20'-0" of #4 AWG, minimum size, copper conductor, encased by at least 2" of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar must be connected to copper wire using approved connections. An external electrode as specified in Article 2.01, Paragraph B of this Specification Section must be installed and connected to foundation or footing rebar.
- H. Non-current-carrying metal parts of high voltage equipment enclosure, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded.

- I. Metallic or semi-conducting shields, and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.
- J. Neutral of service conductors shall be grounded as follows:
 - 1. Neutral shall be grounded at only one point within school site for that particular service. Preferable location of grounding point shall be at service switchboard, or main switch.
 - 2. Equipment and conduit grounding conductors shall be bonded to that grounding point
 - 3. If other buildings on campus are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.
 - 4. Equipment grounding conductor is carried from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to "made electrode" for that building.
 - 5. Neutral of feeder shall not be grounded.
- K. If there is a distribution transformer at a building, secondary neutral conductor shall be grounded to "made electrode" serving building.
- Within every building, main switchboard or panel, shall be bonded to a 1" or larger cold water line with a 1" conduit with one #6 wire. Metallic piping systems (gas, fire sprinkler, etc.) shall be bonded to cold water line with 3/4" conduit with one #8 wire.

1.4 SUBMITTALS

A. Submit in accordance with Section 260526: Submittals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Yard boxes shall be precast concrete and shall be approximately 14" wide, 19" long, and I 2" deep (outside dimensions), or larger, if necessary, to obtain required clearances. Boxes shall be equipped with bolt-down, checkered, cast iron covers and a cast iron frame cast into box. Yard boxes shall be Brooks 36 or approved equal.
- B. "Made" electrodes shall be approved copper-clad steel ground rods, minimum 3/4" diameter, 10'-0" long.
- C. Ground enhancement material as manufactured by Erico Electrical Products shall be used packed inside a 3" diameter hole around ground rod. Manufacturer's installation instructions must be followed for each ground rod installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding electrodes shall be located in nearest usable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, concrete yard box shall be 2" above

planting surfaces.

- B. If concrete enclosed electrode is used, grounding wire shall terminate to a suitable copper plate with grounding lugs.
- C. Grounding rods shall be driven to a depth of not less than 8'-0". A permanent ground enhancement material as manufactured by Erico Electrical Products shall be used at each ground rod to improve grounding effectiveness. The manufacture's guidelines shall be used for each installation.
- D. Grounding electrodes shall have a resistance to ground of not more than 25 ohms.
- E. When using grounding rods, if resistance to ground exceeds 25 ohms, 2 or more rods connected in parallel shall be provided to meet grounding resistance requirement
- F. Minimum number of ground rods shall be as required by State electrical safety orders.
- G. Ground rods shall be separated from one another by not less than 6'-0".
- H. Parallel grounding rods shall be connected together with approved fittings and approved grounding conductors in galvanized rigid steel conduit, buried not less than 12" below finish grade.
- I. Electrical Contractor shall include in his bid, cost of services of an approved independent testing laboratory, to test grounding resistance of all made electrodes, ground rods, and bonding of building steel, water pipes, gas pipes and other utility piping. Tests to be performed are as follows:
 - 1. Visually and mechanically examine ground system connections for completeness and adequacy.
 - 2. Perform "fall of potential" tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable locations are not available, measurements will be referenced to a known dead earth or reference ground.
 - 3. Perform the two point method test per IEEE No. 81, Section 8.2.1 I to determine ground resistance between ground rod and building steel, and utility piping such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.
 - 4. Test shall be conducted in presence of the District Electrical Inspector.
- J. Three copies of test results shall be submitted to the District Electrical Inspector. Test results shall be submitted on an official form from the independent testing laboratory showing project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

END OF SECTION

SECTION 26 05 33

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wire ways, outlet boxes, pull and junction boxes, and handholes.
- B. Related sections:
 - 1. Wood Blocking.
 - 2. Applied Fireproofing.
 - Firestopping.
 - 4. Joint Sealers.
 - 5. Hangers and Supports.

1.2 REFERENCES

- A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.5 Rigid Aluminum Conduit.
- D. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. ANSI/NFPA 70 National Electrical Code.
- F. NECA "Standard of Installation."
- G. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- H. NEMA TC 2 Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- I. NEMA TC 3 PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as shown on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway as required to complete wiring system.
- B. Underground Installations:

- 1. More than Five Feet from Foundation Wall: Use rigid steel conduit; Plastic coated conduit maybe used.
- 2. Within Five Feet from Foundation Wall: Use rigid steel conduit.
- 3. In or Under Slab on Grade: Use rigid steel conduit.
- 4. Minimum Size: 3/4 inch.
- C. Outdoor Locations, Above Grade: Use rigid steel and liquid tight flexible metal conduit.
- D. Wet and Damp Locations: Use rigid steel and liquid tight flexible metal conduit.
- E. Dry Locations:
 - 1. Concealed: Use electrical metallic tubing.
 - 2. Exposed: Use rigid steel and electrical metallic tubing.

1.4 DESIGN REQUIREMENTS

A. Conduit Size: ANSI/NFPA 70.

1.5 SUBMITTALS

- A. Submit under provisions of Section 260533 Submittals.
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, fittings, and conduit bodies.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual routing of conduits larger than 2 inches.

1.7 REGULATORY REQUIREMENTS

- A. Regulatory Requirements: NFPA 70; products listed by UL or other agency acceptable to authority having jurisdiction; National Electric Code.
- B. Conform to the California Code of Regulations, Title 24 Building Standards, Part 3, 2016 Electrical Code with State Amendments.

1.8 FIELD SAMPLES

- A. Provide under provisions of Section 260533 Submittals.
- B. Provide field sample of conduit, two each at 2 feet long.
- C. Provide field sample of expansion/deflection fitting, two each.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 260533 – Material and Equipment.

- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

1.10 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tub and Conduit Corp.
 - 2. Triangle Wire and Cable, Inc..
 - 3. Thomas & Betts Corp.

Or approved equal

- B. Rigid Steel Conduit: ANSI C80.1.
- C. Rigid Aluminum Conduit: ANSI C80.5.
- D. Intermediate Metal Conduit (IMC): Rigid steel.
- E. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.2 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - Allied Tub and Conduit Corp.
 - 2. Triangle Wire and Cable, Inc..
 - 3. Thomas & Betts Corp.
- B. Description: Interlocked steel construction.
- C. Fittings: ANSI/NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

- 1. Allied Tub and Conduit Corp.
- 2. Triangle Wire and Cable, Inc.
- 3. Thomas & Betts Corp.
- 4. Description: Interlocked steel construction with PVC jacket.
- B. Fittings: ANSI/NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

- 1. Allied Tub and Conduit Corp.
- 2. Triangle Wire and Cable, Inc.
- 3. Thomas & Betts Corp.
- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, set screw

2.5 SURFACE NONMETAL RACEWAY

A. Manufacturers:

- 1. Carlon Electrical Products.
- 2. Hubbell Wiring Devices.
- Thomas & Betts Corp.
- 4. Walker Systems Inc.
- The Wiremold Co.
- B. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.
- C. Size: As indicated
- D. Finish: Gray.
- E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

2.6 WIREWAY

A. Manufacturers:

- 1. The Wiremold Co.
- 2. Carlon Electrical Products.
- 3. Appleton Electric Co.
- B. Description: General purpose type wireway.
- C. Knockouts: Manufacturer's standard.
- D. Size: As indicated on drawings.
- E. Cover: Screw cover.
- F. Connector: Flanged.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.
- I. Type.

2.7 OUTLET BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1.Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
- C. Wall Plates for Finished Areas: As specified in Section 260533 Wiring Devices.

2.8 PULL AND JUNCTION BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.

- 5. The Wiremold Co.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 - 1.Material: Galvanized cast iron.
 - 2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "ELECTRIC".
- D. Fiberglass Handholes: Die molded glass fiber hand holes:
 - 1. Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.
 - 2. Cover: Glass fiber weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 260533 Coordination: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

- A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.
- B. Remove concealed abandoned raceway to its source.
- C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if raceway servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- D. Ensure access to existing boxes and other installations which remain active and which require access. Modify installation or provide access panel as appropriate.
- E. Extend existing raceway and box installations using materials and methods compatible with existing electrical installations, or as specified.
- F. Clean and repair existing raceway and boxes which remain or are to be reinstalled.

3.3 INSTALLATION

- A. Install Work in accordance with the California Code of Regulations, Title 24 Building Standards, Part 3, 2016 Electrical Code with State Amendments. September
- B. Ground and bond raceway and boxes under provisions of Section 260533 Basic Electrical Materials.

- C. Fasten raceway and box supports to structure and finishes under provisions of Section 260533 Basic Electrical Materials.
- D. Identify raceway and boxes under provisions of Section 260533 Basic Electrical Materials.
- E. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION--RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route as required to complete wiring system.
- B. Install nonmetallic conduit.
- C. Arrange raceway supports to prevent misalignment during wiring installation.
- D. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- E. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 260533; provide space on each for 25 percent additional raceways.
- F. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- G. Do not attach raceway to ceiling support wires or other piping systems.
- H. Construct wireway supports from steel channel specified in Section 260533 Basic Electrical Materials.
- I. Route exposed raceway parallel and perpendicular to walls.
- Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- K. Route conduit in and under slab from point-to-point.
- L. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab larger than 1/2-inch trade size (DN 13).
- M. Maintain adequate clearance between raceway and piping.
- N. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- O. Cut conduit square using saw or pipecutter; de-burr cut ends.
- P. Bring conduit to shoulder of fittings; fasten securely.
- Q. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- R. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

- S. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inch size.
- T. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- U. Provide suitable fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.
- V. Provide suitable pull string or cord in each empty raceway except sleeves and nipples.
- W. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- X. Surface Raceway: Use flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- Y. Close ends and unused openings in wireway.

3.5 INSTALLATION--BOXES

- A. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- B. Adjust box location up to 10 feet prior to rough-in if required to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 260533 Wiring Devices.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Use adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Use gang box where more than one device is mounted together. Do not use sectional box.

O. Use gang box with plaster ring for single device outlets.

3.6 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 260533 Firestopping.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.
- C. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING

- A. Section 260533 Contract Closeout: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.8 CLEANING

- A. Section 260533 Cleaning: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 08 00 - ELECTRICAL TESTING AND COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:
 - 1. Qualifications of testing agencies and their personnel.
 - 2. Suitability of test equipment.
 - 3. Calibration of test instruments.
 - 4. Coordination requirements for testing and inspecting.
 - 5. Reporting requirements for testing and inspecting.
- B. Allowances: Electrical tests and inspections specified in various Division 13 and 16 Sections are covered by a testing and inspecting allowance specified in Division 1 Section "Allowances." See Division 1 Section "Allowances" for what is included in allowance amount, the amount of the allowance, payment procedures for allowances, changes to allowance amounts, and disposition of unused portions of allowance.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.
 - Independent Testing Agencies: Independent of manufacturers, suppliers, and installers of components to be tested or inspected.
 - a. Testing Agency's Field Supervisor for Power Component Testing: Person currently certified by the Inter National Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on site testing specified in Division 26 power component Sections.

- B. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.
- C. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL TESTS AND INSPECTIONS

- A. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and components are ready for independent agency testing. Include the following minimum preparations as appropriate:
 - 1. Perform insulation_resistance tests.
 - 2. Perform continuity tests.
 - 3. Perform rotation test (for motors to be tested).
 - 4. Provide a stable source of single_phase, 208/120_V electrical power for test instrumentation at each test location.
- B. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:
 - 1. Manufacturer's written testing and inspecting instructions.
 - Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
 - 3. Tabulation of expected measurement results made before measurements.

Tabulation of "as_found" and "as_left" measurement and observation results.

END OF SECTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. "Basic Electrical Requirements."
 - 2. "Basic Electrical Materials and Methods."

1.2 SUMMARY

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V or less.
- B. Related Sections: The following Division 26 Sections contain requirements that relate to this Section:
 - 1. "Overcurrent Protective Devices" for circuit breakers, fusible switches, fuses, and other devices used in panelboards.
 - 2. "Motor Controllers" for combination starters installed in panelboards.

1.3 DEFINITIONS

- A. Panel Boards: Shall have thermal magnetic circuit-breaker branches, bolt on type operating at 600V and below, 3-phase versions, and equipped with combination flush/surface mounting trim.
- B. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type panelboard, accessory item, and component specified.
- C. Shop drawings from manufacturers of panelboards including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 - 1. Enclosure type with details for types other than NEMA Type 1.
 - 2. Bus configuration and current ratings.
 - 3. Short-circuit current rating of panel board.

- 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
- 5. Spare Fuse Cabinets: Show materials, dimensions, and features including storage provisions for fuse cartons.
- D. Wiring diagrams detailing schematic diagram including control wiring, and differentiating between manufacturer-installed and field-installed wiring.
- E. Qualification data for field-testing organization certificates, signed by the Contractor, certifying that the organization complies with the requirements specified in Quality Assurance below. Include list of completed projects with project names, addresses, and names of Engineer and Owner plus basic organization qualifications data.
- F. Report of field tests and observations certified by the testing organization.
- G. Panel schedules for installation in panelboards. Submit final versions after load balancing.
- H. Maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual specified in Division 1 and in Division 26 Section "Basic Electrical Requirements." Include instructions for testing circuit breakers or switches.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.
- C. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code."
- D. NEMA Standard: Comply with NEMA PB1, "Panelboards."
- E. UL Standards: Comply with UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."

1.6 EXTRA MATERIALS

- A. Keys: Furnish six spares of each type for panelboard cabinet locks.
- B. Touch-up Paint for surface-mounted panelboards: One half-pint container.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. ABB Power Distribution, Inc.
 - 2. American Circuit Breaker Corp.
 - 3. Asco Electrical Products Co., Inc.
 - 4. Eaton Corp.
 - 5. General Electric Co.
 - 6. Siemens Energy & Automation, Inc.
 - 7. Square D Co.
 - 8. Wadsworth Electric Mfg. Co., Inc.
 - 9. Westinghouse Electric Corp.

Or approved equal

2.2 PANELBOARDS, GENERAL REQUIREMENTS

- A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 26 Section "Overcurrent Protective Devices," with OCPDs adapted to panelboard installation. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.
- B. Enclosures: Cabinets, flush or surface mounted as indicted. NEMA Type 1 enclosure, except where the following enclosure requirements are indicated.
 - 1. NEMA 3R: Raintight.
 - 2. NEMA 3S: Raintight and dust tight.
 - 3. NEMA 4X: Corrosion-resistant fiberglass enclosure, watertight, dust tight, and resistant to oil and coolant seepage.
 - 4. NEMA 12: Dust tight, dripproof, and resistant to oil and coolant seepage.
- C. Front: Secured to box with concealed trim clamps except as indicated. Front for surfacemounted panels shall be same dimensions as box. Fronts for flush panels shall overlap box except as otherwise specified.
- D. Directory Frame: Metal, mounted inside each panel door.

- E. Bus: Hard drawn copper of 98 percent conductivity.
- F. Main and Neutral Lugs: Compression type.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- H. Service Equipment Approval: Listed for use as service equipment for panelboards having main service disconnect.
- I. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the OCPD ampere ratings indicated for future installation of devices.
- J. Special Features: Provide the following features for panelboards as indicated.
 - 1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - 2. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.
 - 3. Split Bus: Vertical bus of indicated panels divided into two vertical sections with connections as indicated.
 - 4. Skirt For Surface-Mounted Panels: Same gage and finish as panel front with flanges for attachment to panel, wall, and floor.
 - 5. Contactors in Mains: Mechanically held, with current rating, poles, and connections as indicated. Conform to Division 26 Section "Motor Controller," except omit overload protection.
 - 6. Control Power Source: Control power transformer of capacity indicated, for contactor shunt trip or other devices. Mount in cabinet of panel indicated. Protect primary with current-limiting OCPD as indicated. Provide fused protection of control circuits.
 - 7. Extra Gutter Space: Dimensions and arrangement as indicated.
 - 8. Gutter Barrier: Arranged to isolate section of gutter as indicated.
 - 9. Auxiliary Gutter: Conform to UL 870, "Wireways, Auxiliary Gutters and Associated Fittings."
 - 10. Column-Type Panelboard Configuration: Narrow cabinet extended as wireway to overhead junction box equipped with ground and neutral terminal buses.
- K. Feed-Through Lugs: Sized to accommodate feeders indicated.
- L. Surge Arresters: IEEE C62.11, "Standards for Metal-Oxide Surge Arresters for AC Power Circuits," or IEEE C62.1, "Surge Arresters for Alternating Current Power Circuits."
 - 1. Description: Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL-recognized mounting device.

2.3 BRANCH CIRCUIT PANEL BOARDS

- A. Provide panelboards where indicated.
 - 1. General: Conform to above article "Panelboards, General Requirements" except as follows:
- B. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- C. Circuit Breakers for Switching Lights at Panelboards: Indicated type SWD.
- D. Circuit Breakers for Equipment Marked HCAR Type: Indicated HCAR type.
- E. Interiors: Provide physical means to prevent installation of more OCPDs than the quantity for which the enclosure was listed.
- F. Main, Neutral, and Ground Lugs and Buses: Have mechanical connectors for conductors.
- G. Double-Width Panels: Where more than 42 poles are indicated or where otherwise indicated, provide two panelboards under single front.
- H. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.4 DISTRIBUTION PANELBOARDS

- A. Doors: In panel front, omit single panelboard door in cabinet front for fusible switch panelboards except as indicated. Secure with vault-type with tumbler lock, all keyed alike.
- B. Branch-Circuit Breakers: Where OCPDs are indicated to be circuit breakers, use bolt-on breakers except circuit breakers 225-ampere frame size and greater may be plug-in type where individual positive locking device requires mechanical release for removal.
- C. Motor Starter Branches: Conform to Division 26 Section "Motor Controllers" and provide units equipped for panelboard mounting. Include the following accessories and pilot devices as indicated:
 - 1. Individual control power transformers.
 - 2. Fuses for control power transformers.
 - 3. Pilot lights.
 - 4. Extra interlock contacts.
 - 5. Pushbuttons.
 - 6. Selector switches.
- D. Motor Starter Disconnects: Include overcurrent protection as indicated. Mount integral with or, in same panelboard, adjacent to motor starter. Mechanically interlock starter door with disconnect device. Provide auxiliary contacts on disconnect to deenergize control connections to starter.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.
- C. Spare Fuse Cabinet: Identified, compartmented, lockable steel box or cabinet with compartments suitable for surface mounting on wall.

2.6 IDENTIFICATION

- A. General: Refer to Division 26 Section "Electrical Identification" for labeling materials.
- B. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Install panelboards and accessory items in accordance with NEMA PB 1.1,
 "General Instructions for Proper Installation, Operation and Maintenance of Panelboards
 Rated 600 Volts or Less" and manufacturers' written installation instructions.
- B. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, "Application Guide for Ground Fault Circuit Interrupters."
- C. Mounting Heights: Top of trim 6'-2" above finished floor, except as indicated.
- D. Mounting: Plumb and rigid without distortion of box. Mount flush panels uniformly flush with wall finish.
- E. Circuit Directory: Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.
- F. Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub two 3/4-inch empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future. Stub four 1-inch empty conduits into raised floor space or below slab other than slabs on grade.
- H. Auxiliary Gutter: Install where a panel is tapped to a riser at an intermediate location.
- I. Wiring in Panel Gutters: Train conductors neatly in groups, bundle, and wrap with wire ties after completion of load balancing.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs in accordance with Division 26 Section "Electrical Identification."

3.3 GROUNDING

- A. Connections: Make equipment grounding connections for panelboards as indicated.
- B. Provide ground continuity to main electrical ground bus indicated.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Independent Testing Organization: Arrange and pay for the services of an independent electrical testing organization in to perform tests on low-voltage power equipment and accessories.
- B. Pretesting: Upon completing installation of the system, perform the following preparations for independent tests:
 - 1. Make insulation resistance tests of panelboard buses, components, and connecting supply, feeder, and control circuits.
 - 2. Make continuity tests of circuits.
 - 3. Provide set of Contract Documents to test organization. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
- C. Quality Control Program: Conform to the following:
 - 1. Procedures: Make field tests and inspections and prepare equipment for satisfactory operation in accordance with manufacturer's recommendations and these specifications.
 - 2. Schedule tests with at least one week in advance notification.
 - 3. Reports by Testing Organization: Report written reports of tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include records of repairs and adjustments made.
 - 4. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating results of tests and inspections, responsible organization and person, and date.
 - 5. Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system configuration and parameters. Where discrepancies are found, recommend final protective device ratings and settings. Use accepted ratings or settings to make the final system adjustments.

- D. Visual and Mechanical Inspection: Include the following inspections and related work:
 - 1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
 - 2. Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - 3. Check panelboard mounting, area clearances, and alignment and fit of components.
 - 4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - 5. Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 26 Section "Overcurrent Protective Devices."
- E. Electrical tests: Include the following items performed in accordance with manufacturer's instruction:
 - 1. Ground resistance test on system and equipment ground connections.
 - 2. Test main and subfeed overcurrent protective devices in accordance with Section "Overcurrent Protective Devices."
- F. Retest: Correct deficiencies identified by tests and observations and provide retesting of panelboards by testing organization. Verify by the system tests that the total assembly meets specified requirements.

3.6 CLEANING

A. Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marks of finish to match original finish.

END OF SECTION

SECTION 28 46 21.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

SCOPE OF WORK 1.1

- Drawings and general provisions of the Contract, including General and Supplementary Α. Conditions and Division 01 Specification Sections, apply to this Section.
- B. The scope of work for this project shall consist of installation of a new, complete fire alarm system.
- The scope of work includes the acceptance testing to be witnessed by the authority having C. jurisdiction (AHJ) and the Owner's Representative/Fire Protection Engineer.
- D. The scope of work includes training the end-user/client/maintenance contractor on, required maintenance tasks and frequencies, and the locations of all equipment necessary to maintain and operate the fire alarm system.

1.2 **CODES AND STANDARDS**

- Α. Design, equipment, and installation shall be in accordance with the applicable provisions of the following:
 - 1. International Building Code (IBC), 2019 Ed.
 - International Fire Code (IFC), 2019 Ed. 2.
 - International Mechanical Code (IMC), 2019 Ed. 3.
 - California Building Code (CBC) 2019 Ed 4.
 - NFPA 70, National Electrical Code (NEC), 2014 Ed.
 - NFPA 72, National Fire Alarm and Signaling Code, 2016 Ed.
 - The latest published edition of the equipment manufacturers' product datasheets, 7. technical specifications, installation instructions and wiring guidelines.
- В. The systems shall be tested in accordance with the following:
 - 1. NFPA 72, National Fire Alarm and Signaling Code.
 - 2. The latest published edition of the equipment manufacturers' testing procedures and guidelines.

1.3 ORDER OF PRECEDENCE

- Α. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply.
- В. Should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:
 - Local/State Codes and associated amendments shall take precedence over this specification.
 - 2. The National Fire Protection Association Standards shall take precedence over this specification.
 - This specification shall take precedence over the drawings. 3.

1.4 **SUMMARY**

- Α. Section Includes:
 - Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - Notification appliances. 4.
 - Radio alarm transmitter. 5.

DEFINITIONS 1.5

- EMT: Electrical Metallic Tubing. Α.
- B. FACU: Fire Alarm Control Unit.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. ASSD: Air Sampling Smoke Detection.

ACTION SUBMITTALS 1.6

- Α. Product Data: For each type of product, including furnished options and accessories.
 - Include construction details, material descriptions, dimensions, profiles, and finishes. 1.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - Comply with recommendations and requirements in the "Documentation" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - Include details of equipment assemblies. Indicate dimensions, weights, loads, required 3. clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Include drawings of detailed connections to interfaced equipment, including, but not limited to, stair pressurization systems, elevators, HVAC units, door holders, and sprinkler systems.
 - Detail assembly and support requirements. 5.
 - Include voltage drop calculations for notification-appliance circuits. 6.
 - Include battery-size calculations based on the standby requirements, the alarm 7. requirements and spare capacity required herein.
 - Conduit/Raceway fill calculations. Raceway fill calculations, in chart form, indicating the 8. cross-sectional area percent fill for the worst case of every combination of wire/cable in each size of raceway used in the system.
 - Include input/output matrix with a sequence of operations including a detailed description 9. of the operation of each system function for all alarm, supervisory and trouble conditions.
 - Include statement from manufacturer that all equipment and components have been 10. tested as a system and meet all requirements in this Specification and in NFPA 72.
 - Include performance parameters and installation details for each detector. 11.

- 12. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
- 13. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
- 14. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
 - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
 - e. Locate detectors according to manufacturer's written recommendations.
 - f. Show air-sampling detector pipe routing.
- 15. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

- Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
- 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
- B. Following submittal of the current Working As-Built drawings for the Demonstration Test and following Client review and approval, the Contractor shall update the Working As-Built drawings as noted in the Client review and to reflect the final as-built configuration. Copy and bind into sets.
- C. On the bottom right corner of each drawing sheet, the Contractor shall stamp in red letters 1-inch high, the wording "RECORD DRAWINGS."

- D. The as-built drawings shall be in a final form for submission for final approvals. Once the asbuilt drawings are approved, the Contractor shall submit three copies and the updated AutoCAD/REVIT files to the Client for distribution.
- E. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 - 1. Items for "Operation and Maintenance Data," include the following
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" and "Documentation" chapters in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
 - g. Record copy of site-specific software.
 - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" and "Documentation" chapters in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - i. Manufacturer's required maintenance related to system warranty requirements.
 - Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- F. Software and Firmware Operational Documentation:
 - 1. The Contractor shall provide complete indexed bound sets of the Operation and Maintenance (O&M) manual, as outlined in NFPA 72. These O&M manuals shall include the following in addition to that required in NFPA 72:
 - a. The final Equipment List identifying the quantities and types of equipment listed by manufacturer's part number.
 - b. An equipment datasheet (or specification sheet) on every piece of fire alarm system equipment installed.
 - c. Standby power calculations and voltage drop calculations that coincide with the equipment that has been installed in the building.
 - d. A point ID list referencing the signaling line circuit loops and the devices on those loops.
 - e. Complete System Programming
 - 1) Program Software Backup: On magnetic media, compact disk or portable USB flash drive, complete with data files.
 - f. Device labels
 - g. The control unit configuration, serial number, access passwords, and a description of remote functions.
 - h. Software operating and upgrade manuals.
 - i. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 - 2. Manual Fire-Alarm Boxes: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 - 3. Smoke Detectors, Fire Detectors Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
 - 4. Detector Bases: Quantity equal to two] percent of amount of each type installed, but no fewer than one unit of each type.
 - 5. Keys and Tools: One extra set for access to locked or tamper proofed components.
 - 6. Audible and Visual Notification Appliances: One of each type installed.
 - 7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

1.11 SEQUENCING AND SCHEDULING

- A. The Contractor shall provide a schedule to the Client indicating the installation sequence and time frame prior to beginning work. No installation work shall begin until shop drawings and submittals are approved by the Client. This schedule shall include a detailed description as to how the new FACU switchover is to occur to ensure that the fire alarm system shall be out of service for not more than four (4) hours. The Contractor shall provide weekly updates to the Client. It is the Contractor's responsibility to have all wiring, circuit testing and device installation completed in time for the equipment supplier to make all final connections and conduct all tests as outlined in these specifications.
- B. If a fire watch is needed, the fire watch services shall be provided at the Contractor's expense while conversions are made from the existing system to the new system.
- C. The Contractor shall be responsible for coordinating the Demonstration Test for the system with the Client.
- D. The Contractor shall be responsible for coordinating the Acceptance Test for the system with the Client and AHJ.

1.12 WARRANTY

A. The Contractor shall guarantee all new equipment installed and new raceways, new wiring and connections to existing wiring and equipment from defects in workmanship and inherent mechanical and electrical defects for a period of Two (2) years from the date of written acceptance by the Client. Warranty shall include Parts and Labor.

- B. The Manufacturer or the authorized representative shall guarantee all new system equipment for a period of one (1) years from the date of written acceptance by the Client.
- C. Upon completion of the installation of the fire alarm system equipment including Acceptance Testing, Demonstration of existing fire alarm, and delivery of all record submittals and spare parts, the Contractor shall provide the Client with a signed Completion and Warranty Statement, substantially in the form as follows:
 - 1. "The undersigned, having been engaged as the Contractor on the Porterville Animal Shelter Fire Alarm Project, confirms that the fire alarm system equipment was installed in accordance with the system manufacturer's wiring diagrams, installation instructions and technical specifications provided to us by the manufacturer and the Client and that the installed system is warranted for a period of two (2) years effective upon completion Client's acceptance. The warranty includes parts and labor to repair or replace (at the Client's discretion) any and all defects in workmanship or inherent electrical and/or mechanical defects. The installed system includes all new equipment installed and new raceways, new wiring and connections to existing wiring."
- D. Emergency Warranty Calls: Provide 24-hr emergency phone number to the Client Designated Representative.
- E. Warranty Calls: The Contractor's Fire Alarm maintenance personnel shall respond around the clock, seven days per week to trouble services calls within four (4) from the time of notification of a trouble call. The maintenance personnel shall complete warranty call within five working days of notification.
- F. The Contractor's Fire Alarm Maintenance Personnel Qualification: Maintenance Personnel must have three years' experience in the installation of fire alarm systems, certified by the system manufacturer, and possess a minimum LEVEL II certificate from the National Institute for Certification in Engineering Technologies (NICET) in the subfield Fire Protection Engineering Technology (Fire Alarm Systems).

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 - 1. Manual stations.
 - 2. Smoke detectors.
 - 3. Automatic sprinkler system water flow.

- B. Fire-alarm signal shall initiate the following actions:
 - 1. Continuously operate alarm notification appliances.
 - 2. Identify alarm and specific initiating device at fire-alarm control unit, connected network control panels, off-premises network control panels.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Record events in the system memory.
 - 5. Indicate device in alarm on the graphic annunciator.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
 - Valve supervisory switch.
 - 2. Independent fire-detection and -suppression systems.
 - 3. User disabling of zones or individual devices.
 - 4. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
 - 1. Open circuits, shorts, and grounds in designated circuits.
 - 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 - 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 - 4. Loss of primary power at fire-alarm control unit.
 - 5. Ground or a single break in internal circuits of fire-alarm control unit.
 - 6. Abnormal ac voltage at fire-alarm control unit.
 - 7. Break in standby battery circuitry.
 - 8. Failure of battery charging.
 - 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
 - 1. Initiate notification appliances.
 - 2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels
 - 3. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
 - 4. Transmit system status to building management system.
 - 5. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
 - The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
 - 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.

- Include a real-time clock for time annotation of events on the event recorder and printer.
- c. Provide communication between the FACU and remote circuit interface panels, annunciators, and displays.
- The FACU shall be listed for connection to a central-station signaling system service.
- e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACU shall provide a minimum 500-event history log.
- 2. Addressable Initiating Device Circuits: The FACU shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
- 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACU shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
- C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1. Pathway Class Designations: NFPA 72, Class B.
 - 2. Pathway Survivability: Level 1.
- D. Smoke-Alarm Verification:
 - Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control
 unit.
 - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Sound general alarm if the alarm is verified.
 - 4. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- E. Notification-Appliance Circuit:
 - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 - 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
 - 3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the powersupply module rating.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium or Sealed, valve-regulated, recombinant lead acid

2.5 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, breaking-glass type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral /attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 3. Station Reset: Key- or wrench-operated switch.

2.6 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be two-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - a. Multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
 - 4. Each sensor shall have multiple levels of detection sensitivity.

- Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control 6. circuit.

2.7 NOTIFICATION APPLIANCES

- General Requirements for Notification Appliances: Individually addressed, connected to a Α. signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
 - Combination Devices: Factory-integrated audible and visual appliances in a singlemounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- В. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 85 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- Visual Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or E. nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 - Rated Light Output:
 - [15] [30] [75] cd. selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - Mounting Faceplate: Factory finished, red.
- F. Exit Marking Audible Notification Appliance:
 - Exit marking audible notification appliances shall meet the audibility requirements in
 - 2. Provide exit marking audible notification appliances at the entrance to all building exits.
 - Provide exit marking audible notification appliances at the entrance to areas of refuge 3. with audible signals distinct from those used for building exit marking.

2.8 GRAPHIC ANNUNCIATOR

- Graphic Annunciator Panel: Mounted in an aluminum frame with nonglare, minimum 3/16-inch-Α. thick, clear acrylic cover over graphic representation of the facility. Detector locations shall be represented by red LED lamps. Normal system operation shall be indicated by a lighted, green LED. Trouble and supervisory alarms shall be represented by an amber LED.
 - 1. Comply with UL 864.
 - 2. Operating voltage shall be 24-V dc provided by a local 24-V power supply provided with the annunciator.
 - 3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and a lamp test switch.

- 4. Surface mounted in a NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
- 5. Graphic representation of the facility shall be a CAD drawing and each detector shall be represented by an LED in its actual location. CAD drawing shall be at 1/8-inch per foot scale or larger.
- 6. The LED representing a detector shall flash two times per second while detector is an alarm.

2.9 ADDRESSABLE INTERFACE DEVICE

A. General:

- 1. Include address-setting means on the module.
- 2. Store an internal identifying code for control panel use to identify the module type.
- 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Control Module:
 - 1. Operate notification devices.
 - 2. Operate solenoids for use in sprinkler service.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from firealarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. Communication bus failure.

2.11 **NETWORK COMMUNICATIONS**

- Α. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- Provide network communications pathway per manufacturer's written requirements and B. requirements in NFPA 72 and NFPA 70.

PART 3 - EXECUTION

3.1 **EXAMINATION**

- Examine areas and conditions for compliance with requirements for ventilation, temperature, Α. humidity, and other conditions affecting performance of the Work.
 - Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 **EQUIPMENT INSTALLATION**

- Α. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - Devices placed in service before all other trades have completed cleanup shall be 1. replaced.
 - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

C. Manual Fire-Alarm Boxes:

- Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
- 2. Mount manual fire-alarm box on a background of a contrasting color.
- The operable part of manual fire-alarm box shall be between 42 inches and 48 inches 3. above floor level. All devices shall be mounted at the same height unless otherwise indicated.

Smoke- or Heat-Detector Spacing: D.

- Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
- 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.

- Smooth ceiling spacing shall not exceed 30 feet
- Spacing of detectors for irregular areas, for irregular ceiling construction, and for high 4. ceiling areas shall be determined according to Annex A in NFPA 72.
- HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air 5.
- Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting 6. fixture and not directly above pendant mounted or indirect lighting.
- E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
 - Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- G. in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- H. Audible Notification Appliances: Install with the tops of the appliances or not less than 90 inches above the finished floors and not less than 6 inches below the ceiling. Install on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all appliances at the same height unless otherwise indicated.
- I. Visual Notification Appliances: Install such that the entire lens is not less than 80 inches and not greater than 96 inches above the finished floor. Install all appliances at the same height unless otherwise indicated.
- J. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 **PATHWAYS**

- Α. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
 - Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - Supervisory connections at valve supervisory switches.

3.5 **IDENTIFICATION**

- Identify system components, wiring, cabling, and terminals. Comply with requirements for Α. identification specified in Section 270553 "Identification for Communications Systems."
- Install framed instructions in a location visible from fire-alarm control unit. B.

3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" and documentation chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visual appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train or train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.
- B. The Contractor shall submit a proposed training agenda for review at least 60 days prior to authorization to proceed.
- C. The final, approved training agenda shall be submitted at least 30 prior to the final system acceptance test.
- D. Provide three (3) four (4) hour training sessions in the operation and use of the system.

3.11 EQUIPMENT DEMOLITION

- A. Contractor shall not start demolition of existing fire alarm system until new system has been fully installed, tested, and approved by Owner and AHJ, in writing.
- B. Contractor shall coordinate demolition schedule with Owner prior to start of demolition work.
- C. All existing fire alarm system conductors shall be removed. Existing conduit and junction boxes may remain in place if concealed above inaccessible ceiling systems or within walls.

- Where left exposed, provide cover plates for junction boxes. Cover plates shall be painted to D. match adjacent surroundings.
- E. Penetrations and/or damage to partitions, interior finish, or other building elements resulting from the project work shall be repaired by Contractor at no charge to Owner.
- F. Contractor is responsible for surveying building and ensuring all existing fire alarm system components are demolished.
- Upon completion of demolition, contractor shall schedule walk-through with Owner and Owner's G. consultant for final acceptance.

END OF SECTION

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SECTION 32 00 20 - SITE DEVELOPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included: Furnishing all labor, materials and equipment necessary to provide, construct and install improvements to the City of Porterville standards.

1.3 QUALITY ASSURANCE

- A. Standards: Comply with the following standards:
 - 1. All applicable sections of the Standard Specifications for Public Works Construction ("The Greenbook") latest edition adopted by the City of Porterville, the Standard Plans and Specifications of the City and with the specific requirements of the Special Provisions (Appendix A) unless noted otherwise.
- B. All work shall comply with the rules and regulations of the Division of Industrial Safety and all other local, state and federal agencies having jurisdiction. Nothing contained herein shall be construed as permitting work that is contrary such rules, regulations and codes.

1.4 SUBMITTALS

- A. Submit all product data to the City Engineer of Porterville, to include but not limited to:
 - 1. Concrete mix designs and supporting test data.
 - 2. Product data for concrete mix
 - 3. Asphalt Concrete mix design and product data.
 - 4. Piping data sheets.
 - 5. Water Meter boxes data.
 - 6. Water Meter assembly data.
 - Backflow Preventer data.
- B. All submittals shall comply with the City of Porterville requirements.
- C. Submit all test reports for compaction.

1.5 SCOPE OF WORK

A. On-site improvements include, but are not limited to, demolition, clearing and grubbing, pavement and concrete removal, relocating or reconstructing interfering existing utilities, constructing permanent pavement, underground utilities, concrete curb and gutter, concrete sidewalks and drive approaches as indicated on the plans, in these specifications, and in conformance with the City of Porterville Standard Plans and Specifications.

1.6 EXISTING CONDITIONS

- A. Contractor shall be held to have visited the site prior to submitting proposal to determine existing conditions, nature of materials to be encountered and to evaluate other information concerning or affecting the work to be performed under the contract.
- B. Before commencing excavation, the Contractor shall notify all utility authorities or utility companies having possible interest in the work of the Contractor's intention to excavate proximate to existing facilities and Contractor shall verify the location of any utilities within the work area.
- C. The Engineer has made a diligent attempt to show on the Construction Drawings all pertinent intersecting and parallel utilities which may affect the work. The Contractor shall exercise caution while performing excavation for this project and shall protect existing utilities from damage, in as much as their exact location is unknown until exposed by the excavation.
- D. Because of the close proximity of certain existing parallel or intersecting utilities and the depth of the proposed facilities, it may be necessary for the Contractor to provide special protection for the existing utility, and/or provide for its temporary and/or permanent relocation in order to construct the facilities shown on the Plans. Bracing of power poles may be necessary. The contractor shall coordinate said work and shall be responsible for complying with the requirements of the utility authority involved. Full compensation for all costs involved in such special protection and/or relocation, including all appurtenances and incidentals, shall be included in the amount bid for the various bid items, and no separate payment shall be made therefor.
- E. All existing utility mains and service lines shall be kept in constant service during the construction of this project. Hand excavating shall be employed where necessary to safely expose existing utilities.
- F. Full compensation for all costs involved in locating, verifying, protecting, exposing, relocating, reconstructing and otherwise providing for utilities shall be included in the amount bid for the various items of work and no separate payment shall be made therefor.

1.7 DUST AND TRAFFIC CONTROL

A. Dust Control:

- 1. Dust control shall comply with the San Joaquin Valley Air Pollution Control District Regulation VIII requirements.
- 2. The contractor shall maintain dust control about the site of the work, including any haul roads to or from the site, by whatever means are necessary, such as watering and sweeping, so as to cause the least possible dust nuisance to the public. Any dust control measure ordered by the Architect and/or City shall be promptly and immediately carried out.
- 3. If the Contractor fails to provide dust control measures so ordered within a period of 2 hours from the time ordered by the Architect and/or City, the Contractor shall pay to the Owner a penalty of Twenty-five (25) Dollars for each one half (½) hour, or portion thereof, that elapses beyond the 2 hour warning period, until dust control measures ordered by the Architect and/or City are completely carried out and the dust nuisance eliminated or prevented.
- 4. Such penalty shall be deducted from any monies owed the Contractor. In addition to the penalty as specified above, if conditions warrant, the Owner may employ other forces to eliminate or prevent the dust nuisance. The full cost thereof, in addition to

- the penalty as herein provided, shall be deducted from any monies owed the Contractor.
- 5. Full compensation for dust control shall be included in the amount bid for the various items of work and no separate payment will be made therefor.

B. Traffic Control

- Traffic control measure shall be fully and completely carried out at all times to the satisfaction of the City of Porterville. If the Contractor fails to provide satisfactory traffic control the Owner may obtain services from other sources and deduct from the contract the cost thereof.
- Through traffic shall be provided for during non-working hours including, but not limited to, weekends, holidays and at night.
- 3. The Contractor shall comply with all requirements of the City of Porterville encroachment permit(s).

1.8 PROTECTIVE MEASURES

- A. Furnish, place and maintain all supports, shoring, and sheet piling which may be required for the sides of excavation or for protection of adjacent existing improvements. The adequacy of such systems shall be the complete responsibility of the Contractor.
- B. Maintain all bench marks, monuments and other reference points. If disturbed or destroyed, replace as directed.
- C. Forty-eight (48) hours prior to beginning of construction, the Contractor shall notify the owners of all properties adjacent to the proposed constructions. The Contractor shall also provide the property owners with an estimate of the length of time that their properties will be affected by his construction activities.

1.9 PERMITS

- A. The Contractor shall secure and pay for all permits required for work under this contract including, but not limited to, the encroachment permit from the City of Porterville.
 - 1. Contractor shall provide Certificates of Insurance and Bond as required by the City of Porterville.
- B. All costs associated with obtaining permits as required by construction and as indicated herein shall be included in the price bid for the various items or work and no separate payment will be made therefor.
- C. The Contractor shall pay all inspection fees required by governmental agencies.
- D. The Contractor shall obtain a permit from the Division of Industrial Safety of the State of California prior to the commencement of construction. Full compensation for said permit shall be included in the price bid for the various items of work and no separate payment will be made therefor.

1.10 FINISH ELEVATIONS AND LINES

A. Unless otherwise stipulated in the contract documents, the Contractor shall secure and pay for the services of a Civil Engineer or Land Surveyor, licensed in the State of California and acceptable to the Architect, to perform all staking required for offsite construction. The cost

of surveying and staking shall be included in the price bid for the various items of work and no additional payment will be made therefor.

B. Carefully preserve all data and monuments set by the Owner's Civil Engineer or Land Surveyor and, if displaced or lost, the Contractor's Engineer shall immediately replace to the satisfaction of the Architect and at no additional cost to the Owner.

1.11 MONITORING OF CONSTRUCTION SITE

- A. The Contractor shall monitor the construction site on a regular basis during non-working hours, including weekends and holidays to ensure that no situations arise, relating to the condition of the work site, which could pose a threat to public safety. In addition, the Contractor shall furnish to the Owner and to the City Engineer, prior to the issuance of the "Notice to Proceed", a list of persons, together with their addresses and home telephone numbers, who are authorized to act on behalf of the Contractor in an emergency arising out of conditions at the work site after normal work hours.
- B. Safe pedestrian crossings shall be maintained at all existing crosswalks and intersections.
- C. The Contractor shall secure the site of work at all times. Children shall not be allowed in or along the excavation, on spoil piles or at other undesirable locations within the work. The Contractor shall provide suitable traffic and pedestrian warning devices and signs necessary at or near the work as required by safety considerations and/or jurisdictional authorities. Convenient pedestrian detours and/or flagmen and/or safe temporary bridges over excavations, complete with adequate safety rails, shall be provided as necessary.

1.12 HOURS OF WORK

- A. City of Porterville Noise Ordinance allows construction from 6:00 a.m. to 9:00 p.m. Monday through Friday, and 7:00 a.m. to 5:00 p.m. on Saturday and Sunday.
- B. City of Porterville inspectors are available from 8:00 a.m. to 5:00 p.m. Monday through Friday. Contractor is responsible for payment of all inspection fees, including any surcharges for weekend or special inspections outside of normal inspection hours.

1.13 COMPACTION AND COMPACTION TESTS

- A. The Contractor shall be fully responsible for timely compaction and suitability of material for compaction. Where necessary, wet and pumping material shall be removed from the trench or excavation by the Contractor and replaced with suitable approved material as necessary to complete operation within the time allowed.
- B. Compaction requirements for all excavations within public streets, shall be in accordance with the City of Porterville Encroachment Permit and in accordance with the City of Porterville Standard Plans and Specifications.
- C. Initial compaction testing shall be provided by Owner. The contractor shall file adequate notice to the Architect when he desires compaction testing. Locations of tests shall be determined by the City Public Works Inspector. All required compaction retesting of backfill because of failure to pass original test shall be at the expense of the Contractor.

D. Full compensation for all costs involved in meeting and satisfying the above requirements shall be included in the amount bid for the various items of work and no separate payment will be made therefor.

PART 2 - MATERIALS

2.1 GENERAL

- A. All materials incorporated in on-site construction shall conform with the City of Porterville Standard Plans and Specifications.
- B. Construction of on-site facilities shall be performed in accordance with the City of Porterville Standard Plans and Specifications.
- C. The Contractor shall be responsible to protect all other existing and proposed utilities and improvements affected by his work.
- D. The Contractor shall cooperate with all other contractors on the job to insure that his activities do not delay or hinder the construction activities of others.
- E. All excess earth from trenching and offsite grading may be deposited within the boundaries of the site at a location specified by the Architect for incorporation in site grading activities. All such earth shall be free of organic material, large rocks, hardpan, asphaltic paving and other deleterious materials.
- F. The Contractor shall coordinate his efforts with other forces performing on-site work such that said forces are provided with adequate access to the site.
- G. The City of Porterville Inspector will have the primary inspection responsibility and will conduct the day-to-day inspection. The contractor shall notify the City of Porterville Engineering Department at (559) 782-7462 forty-eight (48) hours prior to beginning construction. Inspection requests may be made Monday-Friday, 9:00 a.m. to 4 p.m.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

APPENDIX A SPECIAL PROVISIONS

PART 1 - CONSTRUCTION MATERIALS & METHODS

CONSTRUCTION MATERIALS

Construction materials shall comply with all applicable sections of the following:

- 1. Standard Specifications for Public Works Construction (Greenbook), latest edition adopted by the City of Porterville.
- 2. Standard Plans and Specifications of the City, current edition.
- 3. Standard Specifications, State of California Department of Transportation (Cal-Trans), latest edition adopted by the City of Porterville.

The Standard Plans and Specifications of the Agency and with the specific requirements of the Special Provisions.

CONSTRUCTION METHODS

Construction methods shall comply with all applicable sections of the Standard Specifications for Public Works Construction ("The Greenbook") latest edition adopted by the City of Porterville, the Standard Plans and Specifications of the City and with the specific requirements of the Special Provisions unless noted otherwise herein.

Rejected Work. The Engineer may reject work, which is not done in accordance with the contract. All work, which has been rejected, shall be remedied or removed and replaced by the Contractor in an acceptable manner and no compensation will be allowed for such removal, replacement or remedial work.

Any work done beyond the boundaries established by the engineer or any work as hereinafter specified which is done without proper permits, inspection and testing, will be considered as unauthorized work and will be rejected. Upon order of the Engineer, unauthorized work shall be remedied, removed, or replaced at the Contractor's expense.

Upon failure of the Contractor to comply promptly with an order, the Engineer may cause rejected or unauthorized work to be remedied, removed or replaced, and deducts the cost from any money to become due to the Contractor.

PART 2 - TECHNICAL SPECIFICATIONS

1.0 GENERAL

The Contractor shall provide all labor, materials, equipment and perform all operations necessary to furnish and install the site improvements for the City of Porterville Animal Shelter Facility in accordance with the Drawings and these Specifications. Contractor shall provide a complete product, ready for operation, and shall include connections to existing structures or those constructed by others. All materials shall be new, free from defects impairing strength, durability, and appearance, shall be of the best commercial quality for the purposes specified and made with structural properties to withstand all stresses and strains to which they normally will be subjected. Items furnished, unless otherwise specified, shall be standard approved products of recognized manufactures and fabricated in accordance with the best shop methods. All incidental items and accessories not shown on the Drawings or specified herein, but which are required to fully carry out the specified intent of the work, shall be furnished and installed in accordance with the latest revisions of Standards listed herein.

1.1 ABBREVIATIONS

ACI

AISC	The American Institute of Steel Construction
AISI	The American Iron and Steel Institute

ANSI The American Iron and Steel Institute

ANSI The American National Standards Institute

APCD The local air pollution control district
API The American Petroleum Institute

The American Concrete Institute

ASME The American Society of Mechanical Engineers
ASCE The American Society of Civil Engineers

ASTM The American Society of Testing and Materials

AWS The American Welding Society
AWWA The American Water Works Association
CSA The Canadian Standards Association
EPA The Environmental Protection Agency

ICBO The International Conference of Building Officials
IEEE The Institute of Electronic and Electrical Engineers
NEMA The National Electrical Manufacturers Association

NFPA The National Fire Protection Association
NSF The National Sanitation Foundation

PSIA Absolute pressure in pounds per square inch

1.2 COOPERATION WITH OTHERS

Contractor is hereby notified that work by others may be occurring concurrently with his work. Contractor shall extend full cooperation to others performing work authorized by the City of Porterville. Contractor shall not authorize or permit any act which will interfere with the work of others, including work being done by City employees. Contractor shall coordinate his work with others so that interference is minimized and the constructed product is that which is required by this contract and the contracts of others.

Contractor shall further conduct his work operations in a manner that does not create an obstacle, hindrance, or blight, as determined by City Staff, to nearby businesses in the area of work.

1.3 CONNECTION TO EXISTING FACILITIES

Where proposed improvements connect to existing facilities, the Contractor shall, prior to beginning construction verify the location (horizontal and vertical), size and type of the existing facility. In the event that the actual location, size, or type differ from that shown on the drawings. Contractor shall notify the Engineer immediately for resolution of the condition.

1.4 CONSTRUCTION WATER

The Contractor shall be responsible for bringing construction water to the site as necessary. A fire hydrant is available near the project site. Water usage and location of water supply shall be coordinated with and approved by the City of Porterville.

1.5 EXISTING UTILITIES

Prior to any excavations the Contractor shall notify Underground Service Alert (U.S.A.) as required by law. Notification shall be provided a minimum of forty-eight hours (48 hrs) prior to any excavation. The Contractor shall exercise care in avoiding damage to any and all utilities as he will be held responsible for their repair and loss-of-use charges if damaged.

1.6 PRE-CONSTRUCTION MEETING, PROGRESS OF WORK AND TIME OF COMPLETION

Prior to the start of construction a pre-construction meeting shall be held between City Staff and the Contractor. The Contractor shall be called upon to indicate at this meeting the proposed operations to accomplish the work and submit a written schedule of work.

The Contractor shall begin work as soon as authorized by the City of Porterville and he shall complete all work under this Contract within forty-five (45) working days from the date of authorization.

(END OF SECTION)

2.0 MOBILIZATION, DEMOBILIZATION AND CLEAN UP

Mobilization and demobilization shall include all labor, tools, equipment and transportation of personnel, equipment, and operating supplies to and from the site, establishment of portable sanitary facilities, obtaining an adequate supply of fresh water if necessary, final cleanup work and all bonds, insurance, overhead, permits, and costs of work not specifically included in any other contract item such as fire hydrant relocation and other noted item relocations and other miscellaneous items.

The Contractor shall provide demolition, grading, paving, concrete, and landscaping services; all tools, accessories, power, fuel, materials, supplies, lighting, water and other support equipment, and experienced personnel necessary to conduct efficient work operations. Contractor shall be responsible for the protection and storage of the jobsite and his materials and equipment. Contractor shall take all necessary precautions for protecting equipment, materials, and the work site from pedestrian traffic and the general public for the duration of the project.

During the progress of the work, the Contractor shall maintain the site and related equipment in a clean, orderly condition, free from unsightly accumulation of rubbish. Upon completion of the work and before the final estimate is submitted, the Contractor shall at his own expense remove from the vicinity of the work all weeds, rubbish, uninstalled materials and other like materials, belonging to him or used under his direction during construction. In the event of his failure to do so, the same may be removed by the City of Porterville after ten days written notice to the Contractor. Such removal shall be at the expense of the Contractor and will be deducted from the final payment due him. Where construction crosses public or private property, it shall be restored by the Contractor to the complete satisfaction of the City, at the Contractor's expense.

At the completion of the project, the Contractor shall completely wash off all paved and concrete surfaces prior to turning the parking lot over to the City.

2.1 TRAFFIC CONTROL

Contractor shall furnish and install all necessary construction and traffic signage to complete the project scope of work while keeping 'D 'street open to the public with a minimum of one-way traffic being maintained. Contractor shall conduct all operations, signage, and traffic control as directed by the City of Porterville. Contractor shall provide all necessary flagmen, cones, signage, etc.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made on a lump sum basis for "Mobilization & Demobilization" as described in this section and no additional compensation will be made therefore.

(END OF SECTION)

3.0 EARTHWORK/DEMOLITION

3.1 SCOPE

The Contractor shall provide all labor, materials and equipment, and perform all operations necessary to complete all earthwork required under this Contract. Included are demolition, earthwork for pipe trenching and planting, earthwork for structures and surfacing, clearing and grubbing, overexcavation, scarification, backfill, compaction, and all other miscellaneous earthwork as specified in these Specifications or shown on the Drawings.

Contractor shall be responsible for conducting efficient measures wherever dust control is necessary. Contractor shall prevent the tracking of dirt, mud, etc. on to 'D' Street. Contractor shall clean all streets adjacent to the construction area at the end of each work day to ensure its cleanliness.

Contractor shall provide a minimum of one-way access along adjacent roads at all times and provide areas for access thereto by property owners and business patrons.

Barriers and flagging shall be placed at the perimeter of all excavations and such places as may be necessary to warn all pedestrians and vehicular traffic in and around the construction area.

Any existing pavement or concrete damaged by the Contractor's operations not to be removed shall be sawcut vertically beyond the limits of all damage and restored at the expense of the Contractor to the satisfaction of the City.

3.2 CLEARING AND GRUBBING AND DEMOLITION

The limits of the area to be demolished and removed are shown on the Drawings. The removed material shall be disposed of off-site by the Contractor.

The limits of paving and concrete to be removed that are adjacent to existing surfaces to remain shall be sawcut vertically for their full depth in a fashion that will not disturb, damage, or undermine the surfaces to remain. Any damage or undermining shall be repaired, restored, or fixed as directed by City Staff at the sole expense of the Contractor. The Contractor shall remove and dispose of all concrete, paving, aggregate base, trees, roots, plants, irrigation system components, masonry block walls, signs, light standards, conduit, wires, and other miscellaneous items as noted by City Staff within the limits shown.

Clearing and grubbing shall consist of the removal and disposal of grass, vegetation, stumps, and roots larger than one-inch (1") in diameter, and matted roots from the construction areas. In addition all rocks, debris, and other demolished items shall be cleared and grubbed. Depressions made by clearing and grubbing shall be filled with suitable materials and compacted to make the surface conform with the original adjacent surface of the ground, unless further excavation is required. Major excavations to remove existing structures, trees, stumps, and roots shall be cleaned of all loose material and backfilled and compacted as specified herein to ninety percent (90%) relative compaction minimum.

Upon completion of the work, the Contractor shall perform all required clean-up operations as directed, including all excavation, backfill, and grading to lines shown on the Drawings or as directed in order to leave affected areas in a condition satisfactory to the City. Materials or debris not acceptable for backfill shall be disposed of off-site by the Contractor.

Approval by the City of any of the Contractor's operations or methods for demolition, clearing, grubbing, and disposing of materials shall not relieve the Contractor of his responsibilities for the protection of work and properties under other sections of these Specifications.

3.3 DISPOSAL OF MATERIALS

In general, suitable materials obtained from contract excavation will be acceptable for backfill requiring no compaction or for compacted backfill or embankment provided that said compaction shall be performed by mechanical means. Excess or unsuitable excavated material shall be deposited at other acceptable locations off-site. All demolition materials such as AC paving, concrete, aggregate base, trees, roots, stumps, etc. shall be removed and disposed of in a legal and acceptable manner. Temporary embankments or excavations shall have reasonably even and uniform surfaces as approved by the City.

3.4 GRADING TOLERANCES

All excavation and earthwork shall be graded to provide uniform surfaces to the lines and grades shown on the Drawings or as specified or as directed by the City. Tolerances for finished earth line and grade elevations and thickness shall be as given below.

- 1. Excavation or embankment lines adjacent to concrete construction shall have a tolerance of plus/minus (±) 0.1 foot or be governed by concrete tolerances, whichever is more restrictive.
- 2. All other excavation or earthwork lines shall have a tolerance of plus/minus (\pm) 0.1 foot, surfacing lines and grades (fine grading and aggregate base) shall have a tolerance of \pm 0.05 foot.
- 3. All specified material thicknesses shall have a tolerance of plus/minus five percent $(\pm 5\%)$.

3.5 TRENCH EXCAVATION FOR PIPELINES

The Contractor shall perform all necessary excavation for pipelines to the required lines, grades, and depths, all in conformance with these Specifications and details shown on the Drawings or as directed. All trench widths shall be of adequate width for proper pipe/conduit installation. Trench excavation shall include removal and disposal of all materials of whatever nature encountered, including all obstructions that would interfere with the proper construction and completion of the work. The work shall also include all pumping, ditching, and other required measures for the removal or exclusion of water. All trenches shall be backfilled in eight-inch (8") maximum lifts and compacted to ninety percent (90%) minimum compaction.

Insofar as practicable, material excavated shall be used for backfill; otherwise, it shall be wasted as directed. Organic material shall not be used as backfill. When water is encountered in the trench, it shall be removed by pumping or draining.

Earthwork trenching and compacting operation costs shall be included in the bid amount for the applicable bid item in the Bid Schedule.

3.6 NORMAL EXCAVATION FOR STRUCTURES/TREES

The Contractor shall perform all excavation required to construct or furnish and install structures to the lines and grades as specified or shown on the Drawings. The Contractor shall prepare the foundations at structure sites by methods which will provide firm foundations for the concrete structures. Normal excavation for structures includes bracing and shoring as required, stockpiling, re-handling or disposal of excavated material, including topsoil, as directed, and all other work and materials necessary to maintain the excavation in good order during construction.

If natural foundation or subgrade material is disturbed or loosened during the excavation process or over excavation performed by the Contractor for any purpose or reason, except as may be authorized in writing by the City, it shall be compacted to a degree satisfactory to the City or, where directed, it shall be removed and replaced with approved material and compacted, all at no additional cost to the City.

All trees, stumps, plants, roots larger than one-inch (1") in diameter, and root mats shall be excavated and removed and disposed of properly by the Contractor. The excavations shall be prepared and backfilled as outlined herein.

Backfill around concrete structures, foundations, and areas of excavation for tree and root removal shall be compacted to ninety percent (90%) relative compaction, unless noted otherwise, based on ASTM D1557 test methods and in accordance with these Specifications. Concrete structures shall be allowed to adequately cure prior to placing backfill material against such surfaces. Earthwork excavation and backfill operations costs for concrete structures and foundations and demolition shall be included in the applicable bid item in the Bid Schedule.

3.7 EXCAVATION

The limits of the concrete sidewalks, AC paving, and drive approaches shall be excavated and graded as necessary for the installation of aggregate base, AC paving and concrete to the lines and grades shown on the Drawings. The Contractor shall scarify twelve-inches (12") and recompact to ninety-five percent (95%) relative compaction as outlined herein.

3.8 COMPACTION AND MOISTURE CONDITIONING

- A. <u>Laboratory Density Determination</u>: Backfill shall be compacted to not less than the percent specified or shown of laboratory standard maximum soil density determined in conformance with ASTM D1557.
- B. <u>Compaction Requirements</u>: Compaction equipment and methods shall be adequate for, and consistent with, achieving the specified degree of compaction. Earthfill or backfill materials shall be compacted to densities specified or shown on the Drawings; where not specified or shown, a minimum of ninety percent (90%) of the laboratory standard maximum density will be required. Compacted subgrade for the parking lot, sidewalks, and other appurtenances shall be to ninety-five percent (95%) relative compaction. Areas to receive fill shall be scarified to a minimum depth of twelve-inches (12") unless specified otherwise, uniform moisture conditioned to above optimum, and compacted to the specified percent relative compaction. Areas beneath asphalt concrete paving within City rights-of-way shall be compacted to ninety-five percent (95%) relative compaction.
- C. <u>Moisture Conditioning</u>: Prior to and during compaction, all earthwork materials specified to be compacted, including but not limited to embankment, backfill, refill, and foundation subgrade, shall have an approved moisture content which shall be uniform in each layer of material compacted. If the moisture content is less than the approved requirement, compaction operations shall not proceed until the Contractor has added the necessary amount of water. If the moisture content is greater than the approved requirement, compaction operations shall not proceed until such time as the materials have dried sufficiently or have been otherwise mechanically dewatered or replaced with materials having the approved moisture content.

No adjustment in the price of any bid item will be made for any or all operations of the Contractor pertaining to moisture conditioning or from delays occasioned thereby. The cost of all

such work shall be included in the unit prices stated for applicable bid items requiring compaction of earthwork materials.

3.9 BACKFILL

- A. <u>General</u>: Backfill for all structures, pipe, and minor structures shall be compacted mechanically to a minimum of ninety percent (90%) relative compaction. Backfill for the compacted subgrade beneath the concrete curbing, and concrete sidewalk shall be to a minimum of ninety-five percent (95%) relative compaction. Areas noted on the Drawings as landscape planters shall not be compacted.
- B. <u>Native Backfill and Bedding Materials</u>: Native backfill materials for placement shall be approved, suitable materials, and either shall be obtained from contract excavation or shall be obtained from an approved borrow site.
- C. <u>Placement of Backfill</u>: All backfill, regardless of whether specified or shown on the Drawings to be compacted or shown to be uncompacted shall be deposited with care and shall be placed in uniform layers.

Backfill to be compacted by mechanical procedures shall be so compacted by bringing the backfill material to an approved moisture content, depositing it in layers of approved thickness, and by compacting each layer to the appropriate density by approved methods.

Each layer or lift of compacted backfill shall be inspected and approved by the City. Backfill or compacted fill shall be spread in loose horizontal lifts with a maximum thickness of 8-inches. Regardless of the method or methods authorized by the City and employed by the Contractor for densification or compaction of backfill, the resulting dry density shall be shown on the Drawings and/or as specified.

The Contractor shall take all necessary precautions to prevent flooding or ponding in backfill areas and to limit any application of water to a rate which shall not be harmful to the project. Unless otherwise directed, pipe trenches shall be backfilled within 48-hours after the time the pipe has been installed, provided, however, that no backfilling shall be performed until trenching and pipe installation have been approved.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made on a lump sum basis for all Earthwork including all work and materials for sawcutting, demolition, removal, disposal, clearing and grubbing, over excavation, backfill, and compaction. Such payment shall constitute full compensation for all labor, tools, equipment, and other items necessary and incidental to the completion of work.

(END OF SECTION)

4.0 ASPHALT CONCRETE PAVING

4.1 GENERAL

The work involves the placement of paving and aggregate base over a compacted subgrade for the project as shown on the Drawings. This work shall include all labor, materials, equipment, tools and services required for the placement and compaction of new asphalt concrete paving. Materials for paving and surfacing shall conform to the applicable provisions of the State of California, Department of Transportation "Cal Trans" Standard Specifications for local projects, most recent edition. Place all new paving after all trenching and backfilling or other work which may damage the paving is complete.

All earthwork shall be in accordance with Section 3.0 "Earthwork" herein and the Contract Drawings.

4.2 AGGREGATE BASE

Aggregate base shall be a Class II aggregate base conforming to the applicable requirements of "Cal Trans" Standard Specifications Section 26. The maximum size aggregate shall be three-quarter inch (3/4").

4.2.1 PLACEMENT OF AGGREGATE BASE

The subgrade of areas to receive aggregate base shall be watered or dried as required to bring the soil to optimum moisture content and compacted to ninety-five percent (95%) relative compaction in the upper twelve inches (12") for new paved areas. The aggregate base shall not be placed until the subgrade is approved by the City. Immediately prior to placing aggregate base upon areas having been properly compacted, additional rolling shall be required to assure the upper surface is compacted. The finished aggregate base surface shall not vary more than .05 foot above, nor .10 foot below, the planned grade.

The aggregate base material shall be spread on the prepared subgrade by spreading devices approved by the City. The Contractor shall avoid spreading the base materials in a manner that will segregate the large and fine particles of aggregate. It shall be free from pockets of large and fine base material, organic material, etc. The aggregate base shall be compacted to ninety-five percent (95%) relative density. The finished aggregate base surface shall be within 0.05 foot of the planned grade.

4.3 ASPHALT CONCRETE MATERIALS

Asphalt concrete shall conform to the applicable requirements of Section 39 of the "CalTrans" Standard Specifications for Type B, half-inch ($\frac{1}{2}$ ") maximum size medium grade. Paving grade asphalt, Performance Graded (PG), PG 64-10 asphalt binder, conforming to the requirements in Section 92 shall be used as the asphalt binder in the mix composition as set forth in Section 39 of the "CalTrans" Standard Specifications.

4.3.1 PRIME COAT

The prime coat shall be MC-70 liquid asphalt conforming to the requirements of Section 93 of the "CalTrans" Standard Specifications.

4.3.2 TACK COAT

The paint binder shall be SS-1 or SS-1H grade emulsified asphalt conforming to Section 94 of the "CalTrans" Standard Specifications.

4.3.3 SEAL COAT

The seal coat shall be a fog seal coat conforming to the requirements of Section 37 of the "CalTrans" Standard Specifications.

4.4 PAVING INSTALLATION

4.4.1 TACK COAT APPLICATION

In advance of spreading bituminous material upon an existing bituminous or portland cement concrete surface, a tack coat shall be applied to all areas to be surfaced and to all butting existing vertical surfaces. When two or more lifts of asphaltic concrete are required, a tack coat shall be applied between each lift. Immediately before applying the tack coat, the area to be surfaced shall be cleaned of all loose or extraneous material.

The tack coat shall be applied by pressure distributors or hand-spray equipment. The rate of application shall be one gallon per square yard. Emulsified asphalt shall not be applied when the atmospheric temperature is below forty degrees Fahrenheit (40° F).

4.4.2 ASPHALT CONCRETE PLACEMENT

Bituminous mixtures shall be delivered to the site at temperatures specified in the Cal Trans Standard Specifications. Spreading of the mixture shall be in accordance with the said Standard Specifications. All loads shall be covered with tarpaulin or other material during transportation to the site.

The pavement thickness in the parking lot shall be three-inches (3") thick in City Rights-Of-Way. The asphaltic concrete shall be compacted by rolling methods in accordance with Section 39 of said Standard Specifications. Compaction by vehicular traffic is not permitted. The joints between old and new pavements or between successive days of work shall be carefully made in such a manner as to ensure a continuous bond between old and new sections of the course. Edges of existing pavement shall be exposed, cleaned, and edges cut to straight, vertical surfaces. All joints shall be painted with a fresh, uniform tack coat before the asphalt concrete is applied.

The completed surfacing shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. Any ridges, indentations, or other objectionable marks shall be eliminated by rolling or other means. The use of any equipment that leaves ridges, indentations, or other objectionable marks in the asphalt concrete shall be discontinued, and acceptable equipment shall be furnished and used by the Contractor. Finished surfaces shall be within a tolerance of 0.02 feet using a twelve-foot (12') straight edge.

After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled, hardened, and a minimum of six-hours have passed. This work shall be coordinated so as not to impact the operations of the City of Porterville.

4.4.3 SEAL COAT APPLICATION

A seal coat shall be applied to the upper surface of all installed asphalt concrete. Place seal coat after installation of asphalt concrete and again after completion of all other construction. It shall be applied in accordance with the applicable requirements of Section 37, Bituminous Seals, of the Standard Specifications.

MEASUREMENT AND PAYMENT

Measurement and payment shall be made on a lump sum basis for all of Class II aggregate base and asphalt concrete paving installed. This includes the cost of all work and materials necessary for compaction, moisture conditioning, placement of aggregate base and asphalt concrete paving, ramps, striping, and other appurtenances. Such payment shall constitute full compensation for all labor, tools, equipment, and other items necessary and incidental to the completion of work.

(END OF SECTION)

5.0 MISCELLANEOUS CONCRETE

5.1 SCOPE

The Contractor shall provide all labor, materials and equipment, and perform all operations required to furnish, install, and complete, all concrete and mortar work as shown on the Drawings and specified herein. This includes sawcutting and removing existing concrete, constructing concrete drive approaches, concrete curbing, concrete sidewalks, concrete gutters, concrete v-gutters and cross gutters, curb ramps, sidewalk, and stamped concrete. All concrete work shall conform to City Standards, the Drawings, and these Specifications. Included under this section of the Specifications is the following work:

- 1. Provide all required concrete and mortar materials, including cement, aggregates, reinforcing steel, curing compound, and all specified and approved mixtures.
- 2. Perform all required placement and installation of miscellaneous steel components and appurtenances as shown on the Drawings.
- 3. Perform all mixing, forming, placing, and finishing operations required to provide concrete of the strength and mix design as specified herein. Included is placement of reinforcement steel.
- 4. Perform all operations required for repairing, curing, protecting, and maintaining concrete work until final acceptance.
- 5. All other miscellaneous work that is required to complete the work specified under this section of the Specifications.

Contractor shall guarantee all concrete work for a period of one-year and install necessary construction and expansion joints to prevent cracking. All sections of concrete curbing, gutter, or sidewalk that are cracked within this time period shall be removed and replaced at the Contractor's expense.

5.2 CONSTRUCTION REQUIREMENTS

All poured-in-place concrete work shall be constructed in conformance with details shown on the Drawings or as directed. At all times, the construction of poured-in-place concrete work shall be coordinated with other affected trades. Concrete work shall be properly formed and prepared to allow utilities and metalwork to pass through or to be embedded in concrete work in conformance with details shown on the Drawings. The exact sequence of construction of concrete work shall be as determined by the Contractor, subject to the approval of the City. Location and dimensions of poured-in-place concrete work and formed openings therein may be subject to such modifications as deemed necessary by the City in order to meet unforeseen conditions. If any required field modification should result in an increase or decrease of material quantities, payment will be revised to reflect such changes in conformance with the unit price submitted in the Bid Schedule. Unless otherwise shown or directed, all anchor bolts and dowels shall be cast in concrete; where shown or directed, anchor bolts and dowels shall be installed in preformed or drilled holes. Unless otherwise shown, specified or directed, approved cast-iron sleeves or flanged castings shall be furnished and installed to sheath openings for pipes and ducts passing through concrete work.

5.3 COMPOSITION

- A. <u>General</u>: Concrete shall be composed of cement, aggregates, water, and any specified admixtures of the qualities and proportions specified herein, all well mixed and brought to the proper consistency. Mortar and grout, unless otherwise specified herein, shall consist of cement, water and sand, and any required admixtures, all mixed in proportions as directed or approved by the City. All fine or coarse aggregate to be used in preparation of any concrete or mortar mix shall be in a saturated, surface dry condition.
- B. <u>Maximum Size of Aggregate</u>: The maximum size of coarse aggregate in concrete for any part of the work shall be the largest of the specified sizes that is practicable from the standpoint of satisfactory concrete placement. Aggregate size shall be as follows:

Sections eight-inches (8") or less in thickness shall be three-quarter inch (3/4") maximum.

Sections greater than eight-inches (8") shall be one and one-half inches (1½") maximum.

- C. <u>Concrete Mix Proportions</u>: The mix designs shall be prepared at the Contractor's expense by an independent inspection and testing laboratory, acceptable to the City, and shall show the expected strength and corresponding slump and all ingredient weights and other physical properties necessary to check each design mix. Mix design shall be submitted for review to the City at least fifteen (15) days before placing of any concrete. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.
- D. Mortar Mix Proportions: Unless otherwise specified, shown on the Drawings or directed, mortar shall be mixed in proportions of not less than one part by volume of cement to two parts by volume of clean, well-graded sand. Mortar shall contain sufficient water to obtain the proper, approved consistency for the type of mortar used. To improve mortar workability, the Contractor may use an approved admixture.

E. <u>Concrete Mix Design</u>: No concrete slump shall exceed four inches (4") when tested in conformance with ASTM C143. For a given type of work, the minimum twenty-eight (28) day compressive strength as determined by the City in accordance with ASTM C39 and other mix design requirements shall be as shown in the following tabulation:

Concrete Class	Type of Work	Requirements
A	All structures	Minimum 28-day strength: 3,000 psi; water-cement ratio: 0.55 ± 0.02; transitions, and all minimum 6 sacks of Type II cement miscellaneous concrete per C.Y. of concrete: 5 ½ sacks with air entrainment.
В	Concrete for Posts	4 sacks of Type II cement per C.Y. of post concrete minimum.

5.4 CONCRETE MATERIALS

- A. Cement: All cement shall be furnished by the Contractor and shall be portland cement Type II for all concrete and mortar in conformance with ASTM C150. Cement shall be tested by the manufacturer for false set in accordance with the latest revisions of Bureau of Reclamation Test for False Set in Cement. Initial penetration shall be 35 mm ± 2 mm. For any cement samples tested for false set, no intermediate or final remix penetration shall be less than fifty percent (50%) of the initial penetration. Any cement sample having intermediate or final penetration(s) less than fifty percent (50%) of the original penetration shall be considered to have false set, and any or all lots of cement from which the sample was taken shall be subject to retest or rejection and replacement, as determined by the City. The Contractor shall obtain from the cement company a certificate stating that the cement delivered to the work complies with the above-requirements, including those for freedom from false set. Two copies of the certificate shall be furnished to the City.
- B. <u>Water</u>: Water used in mixing concrete, mortar or grout shall be clean and free from injurious quantities of silt, organic matter, sulfates, alkali, salts, and other impurities.
- C. <u>Aggregates</u>: Fine and coarse aggregates shall conform to requirements of ASTM C33. Aggregates shall be free from deleterious coatings, clay balls, roots, bark, sticks, rags, and other extraneous materials. All natural aggregates shall be thoroughly and uniformly washed before use.
- D. <u>Air-Entrainment Agent</u>: Unless otherwise directed, the Contractor shall use an approved air-entraining agent in all concrete; said agent shall be in conformance with_ASTM C260. The amount of air-entraining agent added shall be such as to effect the entrainment of from four percent (4%) to five percent (5%) of air, as required.
- E. <u>Other Admixtures</u>: Except for the use of an air-entraining agent, no admixture shall be added to any concrete mix without the written authorized approval of the City. All admixtures shall be batched accurately by means of reliable, approved mechanical

dispensers. In no case shall the Contractor add any admixture containing chlorides as CL in excess of one percent (1%) by weight.

F. Special Grouts and Bonding Agents: Where shown on the Drawings or required, a special nonshrink grout shall be placed as bedding for structural framing or fill around pipe penetrations. Grout shall consist of an approved mixture of cement, sand, and water. Non-shrink grout shall conform to ASTM C1107, Grade B Post-Hardening Volume-Adjusting with no shrinkage as measured by ASTM C827. Furnish a premixed product, consisting of properly proportioned amounts of non-metallic, dimensionally stable material to which water is added. Mix design shall ensure workability for hand packing or poured placement as required and shall be in conformance with the manufacturer's recommendations, subject to the approval of the City. Nonshrink grout shall have a minimum twenty-eight (28) day compressive strength of 8,000 psi when tested by the City in conformance with ASTM C109. The bonding agent shall be 713 Dowel Bar and Anchor Bolt Adhesive as manufactured by Epoxy Systems, Inc. or Sikadur Hi-Mod or approved equal.

5.5 MIXING

Concrete may be mixed at the site of the work or by transit-mix methods as defined and specified in ASTM C94. Provisions of ASTM C94 shall govern mixing and transporting concrete from a central plant to the jobsite. The maximum time between introducing cement to the aggregates and discharging concrete shall be ninety (90) minutes, or before 250 revolutions of the mixing drum, whichever comes first. Each load of transit-mixed concrete that is delivered to the jobsite shall be accompanied by a ticket showing the volume of concrete, the concrete mix identification number, the total amount of water added, together with the amount of cement aggregates, and admixtures. The ticket shall also show the time of day that materials were batched and the initial reading of the revolution counter at the time the truck mixer was charged. Any waivers of provisions of said specifications shall be obtained in writing from the City.

5.6 HANDLING AND PLACING

A. <u>General</u>: No concrete shall be placed until all form work, installation of parts to be embedded, and preparation of surfaces involved in placing have been approved. All surfaces of foundations upon or against which concrete is to be placed shall be free from standing water, mud, and debris. The surfaces of absorptive foundations against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete.

Construction joints shall be cleaned of all laitance, loose, or defective surface concrete and foreign materials by sandblasting and shall be thoroughly moist before concrete is placed against them.

Concrete shall not be deposited around any metal reinforcement until the Engineer has approved the reinforcement placed in the forms. The concrete in each integral part of a structure shall be placed continuously. The Contractor will not be allowed to commence work on any monolithic part of a structure unless the inspected and approved materials on hand are sufficient to complete the part without interruption in placing of the concrete. The concrete shall be placed as nearly as possible in its final position by means that avoid segregation of the materials and displacement of reinforcement. No concrete shall be dropped freely into place from a greater height than six feet (6') in unexposed work and four feet (4') in exposed work. Tremies shall be used where the drop exceeds these limits. The City shall be notified at least two working days in advance of concrete placement for inspection and approval of steel reinforcement.

- Required Temperatures for Concrete: The temperature of concrete as mixed and B. placed shall be not less than fifty-five degrees Fahrenheit (55° F) or greater than ninety degrees Fahrenheit (90° F). If, during day or night, the ambient temperature falls below or is predicted to fall below forty degrees Fahrenheit (40° F), concrete shall be protected from freezing during placement and curing by means of heating of materials and other approved methods, as directed by the City. The concrete mix for cold weather placement shall be maintained at a minimum temperature of fiftyfive degrees Fahrenheit (55° F) during placement, and this minimum temperature shall be maintained for the first seventy-two hours (72 hrs) of curing, minimum. At all times, the maximum temperature of concrete as placed shall be less than ninety degrees Fahrenheit (90° F). When the temperature of concrete as placed may be ninety degrees Fahrenheit (90° F) or higher, as may be reasonably foretold from current temperatures of materials and the likelihood of rises in weather temperatures, the Contractor shall employ effective means, as necessary, to maintain the temperature of concrete as placed below ninety degrees Fahrenheit (90° F).
- C. <u>Pumping Concrete</u>: Pump size shall be based on rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete. Aluminum pipes shall not be used for delivery and installation of concrete. Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:

3/4-inch maximum aggregate: 2-inch minimum ID 1 ½-inch maximum aggregate: 4-inch minimum ID

Before pumping is started, the delivery pipe or hose shall be primed by pumping mortar through the line using five gallons (5 gal) of mortar for each fifty feet (50') of delivery line. Final lengths of pipe or hose shall be inclined upwards to prevent segregation of the concrete.

Vibration: All concrete placed in forms shall be placed in layers not over twenty-four D. inches (24") deep, and each layer shall be vibrated into place to its maximum practicable density, free from pockets of coarse aggregate, and in such a manner that surfaces shall be smooth and free from voids. Vibrators shall not be used to move concrete horizontally. Approved internal vibrators shall be used for all sections which are sufficiently large and shall be supplemented by platform or screed-type vibrators in the event that satisfactory top surfaces cannot be obtained solely with the internal type; or internal vibrators shall be supplemented with vibrators operated against the outside of forms to improve vertical surfaces, as required. Form vibrators shall be used when sections are too small for the internal type. Vibrators shall be adequately powered and capable of transmitting to the concrete not less than 5,000 impulses per minute when operating under load. The vibration shall be sufficiently intense to visibly affect the concrete over a radius of at least 18-inches. A sufficient number of vibrators shall be used so that the required rate of placement vibration is achieved uniformly throughout the entire volume of each layer of concrete and maximum consolidation of concrete is secured. With form or internal vibrators, vibration shall be such that concrete becomes uniformly plastic and there shall be at least twenty (20) seconds of vibration per square foot of surface of each layer of concrete, computed on the basis of the visibly affected radius and taking overlapping into consideration; however, over vibration will not be allowed. At all times, the Contractor shall have available at least one spare, workable vibrator of each type used. Either over-vibrated or under-vibrated concrete is subject to test and rejection.

5.7 FORMS

All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grades, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete.

Suitable and effective means shall be provided on all forms of holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets or similar surface defects in the finished concrete. The forms shall be tight in order to prevent the loss of water, cement, and fins during placing and vibration of the concrete.

Adequate cleanout and inspection openings shall be provided at the bottom of each lift of forms in locations that will not mar the architectural finish. The size, number, and location of such openings shall be approved by the City.

Exterior corners in concrete members shall be provided with three-quarter inch (3/4") chamfers. Re-entrant corners in concrete members shall not have fillets unless otherwise shown on the Drawings.

Adequate and suitable means shall be provided for removing all forms without injury to the surface of the finished concrete. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. Wherever, in the opinion of the City, additional forms are required to maintain the necessary progress, such additional forms shall be provided by the Contractor at his own expense.

Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of concrete. The maximum diameter of removable cones for rod ties shall not exceed 1-inch, and all such fasteners shall be such as to leave holes of conical shape for reaming. Wire ties for holding forms will not be permitted. No form-tying device or part thereof other than metal shall be left embedded in the concrete, nor shall any be removed in such a manner as to leave a hole extending through the interior of the concrete member. The use of form-tying methods which cause spalling of the concrete upon form stripping or tie removal will not be permitted. Form ties shall be provided with integral waterstops.

All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is called for on the Drawings or explicitly authorized by the City. The dimensions of concrete members shown on the Drawings apply to formed surfaces, except where otherwise indicated, not less than 1-inch of concrete shall be added where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The surfaces of all forms shall be treated with a bond breaker, nonstaining mineral oil or other lubricant approved by the City. Any excess lubricant shall be satisfactorily removed before placing the concrete. In addition, all plywood not treated with the bond breaker specified above shall be given a preliminary oil treatment by the form manufacturer or shall be oiled by the Contractor at least two weeks in advance of its use as forms. Care shall be exercised to keep form oil off the surface of steel reinforcement and other metal items to be embedded in the concrete.

Forms may be reused if they are in good condition and if they are approved by the City. In determining the extent to which forms may be reused, particular attention shall be given to maintaining a uniform surface texture on all exposed concrete surfaces. Light sanding between uses will be required wherever necessary in the opinion of the City to obtain such uniform texture. Unused tie rod holes shall be plugged with corks, shaved flush, and sandpapered on the concrete surface side. Patching of forms, other than filling tie rod holes, will not be permitted. The use of metal discs on plywood forms will not be permitted.

Forms may be stripped from concrete in accordance with the following schedule, except in the case the concrete has been placed at outside air temperature under fifty degrees Fahrenheit (50° F), it must be first determined that the concrete has properly set:

Formwork	Removal with Moderate Temperatures	
Sides of footings	24 hours	
Walls and columns not yet supporting load	48 hours	
Vertical sides of beams, girders, and similar members	48 hours	
Slabs, beams, and girders	10 days	
Shoring for slab, beams, and girders	21 days	

The voids and spaces caused by removed forms between concrete surfaces and landscaping shall be filled in by the Contractor with approved materials and the landscaping replaced and replanted.

5.8 REINFORCEMENT

The Contractor shall furnish and place steel reinforcement for poured-in-place concrete as shown on the Drawings or as directed. Reinforcing steel shall conform to ASTM A615, Grade 40 for billet steel bars for concrete enforcement, intermediate grade, and shall have deformations conforming to ASTM A615. Welded wire fabric shall conform to ASTM A185. Before the reinforcing bars are placed, the surfaces of the bars and the surfaces of any metal supports for the bars shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease or other foreign substances. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in concrete. Reinforcing bars shall be accurately spaced and secured in position so that they will not be displaced during the placing of the concrete, and special care shall be taken to prevent any disturbance of the reinforcing bars in the concrete that has already been placed. Length of splices shall be 36 bar diameters or eighteen-inches (18"), whichever is longer, minimum. All splices shall be staggered unless otherwise indicated. Contractor shall furnish to the City a certified mill copy of mill tests on each heat showing physical and chemical analysis. Reinforcing steel placement shall be inspected by the City prior to placing concrete. Reinforcing steel shall have a minimum coverage of two inches (2") measured from the surface of concrete, EXCEPT that where concrete is placed against earth. The minimum coverage shall then be three inches (3").

5.9 CURING

All concrete shall be cured for not less than 14 days after placing in accordance with the methods specified herein for the different parts of work and described in detail in the following paragraphs:

Surface to be Cured	Method	
Unstripped wooden forms	1	
Vertical and horizontal construction joints	2	
Surfaces requiring architectural finish	3	
All concrete surfaces not specifically provided for elsewhere in this subsection	4	

Method 1 - Wooden forms shall be wetted immediately after concrete has been poured and shall be kept wet with water until removed. The exposed concrete surfaces shall then be cured by Methods 2 or 3.

Method 2 - The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period or until the new concrete in the adjacent section is placed.

Method 3 - The surface shall be kept wet with water for the duration of the curing period. This shall be accomplished by keeping the forms wet prior to stripping and by means of an approved combination of fog nozzles, soaker-type hoses, hand sprinkling, and burlap or other types of mats. NO CURING COMPOUND MAY BE APPLIED TO SURFACES CURED UNDER METHOD 3.

<u>Method 4</u> - The surface shall be sprayed with a liquid curing compound which will not affect the bond of paint to the concrete surface. It shall be applied in accordance with the manufacturer's instructions at a maximum coverage rate of 300 square feet per gallon in such a manner as to cover the surface with a uniform film which will seal thoroughly. The exterior surfaces of buried portions or partially buried walls shall be given two additional coats of curing compound at the specified coverage rate, making three coats in all. Curing compound shall be white-pigmented liquid membrane forming compound conforming to ASTM C309. The pigment shall be in a thoroughly mixed condition at the time of use.

Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

Wherever curing compound may have been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, the said compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

Where curing compound is specified, it shall be applied immediately after completion of the finish or unformed surfaces, and within two hours after removal of forms on formed surfaces. Repairs required to be made to formed surfaces shall be made within the said two-hour period; provided, however, that any such repairs which cannot be made within the said two-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound, following which repairs shall be made as specified hereinafter.

5.10 REPAIR OF DEFECTIVE CONCRETE

As soon as forms are removed, all surfaces shall be carefully examined and all rough sections, rock pockets, and defective areas shall be removed and replaced.

The material used for repair purposes shall consist of cement mortar composed of one part cement well mixed with three parts of sand by volume and just enough water so that the mortar will stick together on being molded into a ball with slight pressure of the hands; and it shall be thoroughly compacted into place. Sand shall pass a No. 16 sieve.

Defective surfaces to be repaired shall be cut back from true line to a minimum depth of one inch (1") over the entire area. Feathered edges shall be avoided. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions by means of an efficient sandblast.

Dry pack mortar shall be placed and packed in layers having a compacted thickness of about 3/8-inch. Surface of each layer shall be scratched to promote bonding of next layer. Before the mortar is applied, the surface of the sandblasted concrete shall be coated with an epoxy bonding compound.

Major repairs shall be made for the following defined defective areas:

- 1. Areas of more than one foot square (1' 2) and deeper than the reinforcing steel.
- Major repair areas shall be filled with pneumatically applied concrete after prepared surfaces have been sandblasted.
- 3. Areas with cracks wider than 1/16 of an inch.

For major repairs, the filling shall be reinforced and doweled securely to the old concrete. The exposed surface shall be neatly finished to match the surface and texture of the adjacent concrete. All patches shall be cured. Cracked areas shall be sawcut vertically and removed as directed by the City and new concrete placed.

Holes left by tie rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with mortar and epoxy and cured in accordance with the requirements of the curing section of these specifications. Other imperfections having a depth greater than their last surface dimension shall not be reamed but shall be repaired in an approved manner with epoxy bonding compound and drypacked mortar.

All repairs shall be built up and shaped in such a manner that the completed work will conform to the finish requirements of this specification using approved methods which will not disturb the bond or cause sagging or horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

5.11 CONCRETE FINISHES

Finished concrete surfaces shall be straight, flat, free from rock pockets and voids. There shall be no measurable deflection or distortion. Concrete surface finishes shall be in accordance with the following concrete finish schedule and concrete finish definitions:

A. Unless otherwise shown on the drawings, given in these specifications, or directed by the City, provide finish specified in the City Standard Plans and Specifications.

B. <u>Stamped Concrete Surfaces</u>:

Stamped concrete shall be constructed where shown on the Contract Drawings. Submittals shall be furnished by the Contractor including color samples and stamp patterns. The Contractor shall furnish a minimum of three (3) 4' x 4' x 4" samples of each concrete finish at the job site for selection and approval by the City and haul them away after approval. Approved samples shall be standards for finishes in stamped concrete work and shall be selected by the City. Contractor shall have a concrete foreman who has a minimum of five (5) years experience in the construction of stamped concrete and who can provide proof of completion of at least three (3) public works projects involving stamped concrete. Concrete shall be two (2) colors - a base color and a release color. Base color shall be a Davis Standard Color that is integrally mixed into the concrete.

The color shall be Fox Red No. 413 as selected by the City of Porterville. The release color and brand shall be selected by the City of Porterville. Stamped concrete shall be sealed with an oil based lacquer compliant with State of California Regulations. All concrete shall be cured and finished as recommended by the Color Manufacturer's application specifications. Stamped concrete shall be patterned stamped with an in-line brick pattern as selected by the City of Porterville. All concrete shall have expansion joints with polymer insert at a minimum of twenty-foot (20') on center or more frequently as determined by the City or Contractor.

5.12 JOINTS AND WATERSTOPS

Unless otherwise specified, all details as to location, spacing, and construction of joints shall be shown on the Drawings. All joint surfaces shall be clean and free from water, foreign material, laitance, and loose or defective surface concrete during all phases of joint construction. Waterstops shall be installed in joints where shown on the Drawings and shall be of the type and size specified herein unless otherwise shown on the Drawings.

Waterstops shall be polyvinyl material. The material shall be resistant to chemical action with portland cement, shall be resistant to alkalies, and shall not be affected by mildew or fungi. It shall show no affect when immersed for ten (10) days in a ten percent (10%) solution of sulphuric or hydrochloric acids, saturated lime solution or salt water. All waterstops shall be such that any cross-section will be dense, homogeneous, and free from porosity and other imperfections. They shall be symmetrical in shape. When tested in accordance with applicable test methods of Federal Standard No. 601, the material shall meet the following requirements:

Tensile strength, psi, minimum	2,000
Elongation, ultimate, percent, minimum	250
Water absorption, percent by weight, maximum	5
Compression set, percent, maximum	30
Tensile strength after accelerated aging (48 hr, 70° C 300 psi) percent minimum	80
Durometer hardness, Shore A	60-70

Field splices for polyvinyl material shall be performed by heat sealing adjacent surfaces in accordance with the Manufacturer's specifications.

5.13 JOINT SEALANT

The joint sealant shall be a two-part, self-leveling or gun grade, non-staining, polyurethane sealant which cures at ambient temperature to a firm, flexible, tear-resistant rubber. The sealer shall be resilient and have excellent recovery characteristics after extended periods of compression or elongation.

Technical Requirements

Consistency: Gun Grade

Tack Free Time: 8 hours at 77° F and 50% R.H

Pot Life: 1 - hours Hardness: 25 Shore A \pm 5

Elongation: 800%
Shrinkage: Negligible
Tensile Strength, ASTM D412: 80 psi

Peel Strength on Concrete: 18 P.L.I. Cohesive Temperature Service Range: -40° F to +175° F

Joint backup material shall be closed cell polyethylene rod, 3/4-inch in diameter or bond breaker polyethylene tape. All joint materials shall be compatible.

5.14 TOLERANCES FOR CONCRETE CONSTRUCTION

Deviations from established lines, grades, and dimensions will be permitted to the extent set forth in the following list of tolerances:

Elevation of top of structures $\pm 1/8$ -inch

Elevation of bottom of structures \pm 1-inch

Variation of structures from specified grades,

alignment or plumb in vertical members or ½-inch in 10 feet concrete lining surface irregularities

Departure from cross-section dimensions of + 1/8-inch

structure members

5.15 TESTING

- A. General: All field tests as specified or required herein to ensure quality control of concrete materials and mix design will be performed by the City at no cost to the Contractor. Materials not meeting specified requirements will be rejected and replaced with suitable materials and the Contractor may be charged the cost of all such retesting as is required because of previously rejected concrete materials or mix designs. The Contractor shall provide such facilities as required for procurement and handling of representative test samples. For each shipment of reinforcing steel arriving at the jobsite, the Contractor shall furnish the City with two certified copies of manufacturer's certification of conformance with designated governing reference specifications.
- B. <u>Compressive Strength</u>: Compressive strength shall be determined at the end of twenty-eight (28) days on standard six-inch (6") by twelve-inch (12") test cylinders in accordance with ASTM C39. The compressive strength shall not be less than 3,000 psi for Type A concrete and 2,500 psi for Type B concrete.

C. <u>Concrete Cylinders</u>: The City will take four concrete cylinders for each fifty cubic yards (50 cy) of concrete and each day's pour. The Contractor shall furnish the concrete for such tests. Cylinders will be cured under job conditions.

5.16 ENFORCEMENT OF CONCRETE STRENGTH REQUIREMENTS

<u>Cylinder Tests</u>: If any cylinders fail to meet the strength requirements for the portion of the structure in which the concrete is used, core tests will be taken at the Contractor's expense to demonstrate the adequacy of the concrete in place.

If both core tests and cylinder tests fail to meet the specification, the concrete shall be considered defective and shall be replaced or adequately strengthened in a manner satisfactory to the City.

MEASUREMENT AND PAYMENT

Measurement and payment for all work and materials for furnishing and constructing in place concrete work, including reinforcing steel therefore and complying with the provisions of these Specifications, shall be made on a lump sum basis. This includes sawcutting and removal of concrete where necessary, construction of concrete drive approaches, concrete curbing, concrete sidewalks, stamped concrete, concrete v-gutter and cross gutter, concrete curb and gutter, curb ramps, trench and sidewalk drains, and miscellaneous concrete. Such payment shall constitute full compensation for all labor, tools, equipment, and other items necessary and incidental to the completion of the work.

(END OF SECTION)

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative steel fences.
- B. Steel gates.
- C. Automatic gate operators.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 Cast-in-Place Concrete.
- B. Section 05 50 00 Metal Fabrications: Galvanizing requirements.
- C. Section 09 91 13 Exterior Painting.

1.03 REFERENCE STANDARDS

- A. General: Refer to most recent edition or edition adopted by authorities having jurisdiction, including all applicable amendments and supplements.
- B. ASTM A276/A276M Standard Specification for Stainless Steel Bars and Shapes.
- C. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- D. ASTM D523 Standard Test Method for Specular Gloss.
- E. ASTM D822/D822M Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- F. ASTM D2244 Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
- G. ASTM D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact) .
- H. ASTM D3359 Standard Test Method for Rating Adhesion by Tape Test.
- I. ASTM F2200 Standard Specification for Automated Vehicular Gate Construction.
- J. ASTM F2408 Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets.
- K. CLFMI WLG 2445 Wind Load Guide for the Selection of Line Post and Line Post Spacing.
- L. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum).
- M. NFPA 70 National Electrical Code.
- N. UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations.
- O. UL 50E Enclosures for Electrical Equipment, Environmental Considerations.
- P. UL 325 Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

1.05 SUBMITTALS

- A. See Division 01 sections, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- C. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.
- D. Shop Drawings:
 - 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components. Include details of infill and connections.
- E. Samples: Submit two samples of fence panels, slat infill, 6 inch (150 mm) by 6 inch (150 mm) in size illustrating construction and colored finish.
- F. Manufacturer's Installation Instructions: Indicate installation requirements and foundation requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.
- J. Field Inspection Records: Provide installation inspection records that include post settings, framework, fittings and accessories, gates, and workmanship.
- K. Manufacturer's Warranty.
- L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
 - 1. See Section 01 60 00 Product Requirements, for additional provisions.
 - 2. Tools: One each of every special tool required for maintenance of gate operators.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

1.08 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.
- B. Provide five year manufacturer warranty for finish.

PART 2 PRODUCTS

2.01 BASIS OF PERFORMANCE

- A. Design and Performance Requirements:
 - 1. Design Wind Speed for site is 110 mph.
 - 2. Layout shall be as indicated on Drawings for Base Bid and Alternate conditions.

B. Basis of Cost:

- Manufacturer: Omega Fence Systems; www.omegafence.com. Manufacturer's Representative: Nira Casey, Chaparral Incorporated, T 818.761.0655 x 101, ira@chaparral-inc.com; chaparral-inc.com.
- 2. Installer:
 - a. Fenceworks, Jerry Kay, jkay@fenceworks.us, 805-933-4522
 - b. Republic Fence, Brian Woolf, bwoolf@republicfenceco.com, 818-341-5323
 - c. Alcorn Fence, Linda Ridgley, Iridgley@alcornfence.com, 818-983-0650
 - d. Perimeter Security Group, Nick Guerrero, nickg@perimetersecuritygroup.com, 213-293-0035
- 3. See Schedule for specific models of fence for project.
- 4. Substitutions: See Division 01 section for requirements and procedures.

2.02 MANUFACTURERS

- A. Automatic Gate Operators:
 - 1. Basis of Design: Liftmaster; www.liftmaster.com.
 - 2. Substitutions: See Section 01 60 00 Product Requirements.

2.03 FENCES

- A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
 - Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.
- B. Electro-Deposition Coating: Multi-stage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
 - 1. Total Coating Thickness: 2 mils (0.058 mm), minimum.
 - 2. Color: As selected by Architect from manufacturer's standard range.
 - 3. Coating Performance: Comply with general requirements of ASTM F2408.
 - a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
 - b. Impact Resistance: ASTM D2794; 60 inch pounds (6.8 N m).
 - c. Weathering Resistance: ASTM D523, ASTM D822/D822M and ASTM D2244; less than 60 percent loss of gloss.
- C. Steel: ASTM A653/A653M; tensile strength 45,000 psi (310 MPa), minimum.
 - 1. Hot-dip galvanized; ASTM A653/A653M, G60.
 - 2. 62 percent recycled steel, minimum.
- D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
 - 1. Tamper-proof security bolts.
- E. Hinges: Finished to match fence components.
 - 1. Mounting: Center.

2.04 WELDED STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Fence Panels: Fusion welded; 6 feet (1.8 m) high by 6 feet (1.8 m) long.
 - 1. Panel Style: Two rail.
 - 2. Attach panels to posts with manufacturer's standard panel brackets.
- C. Posts: Steel tube.
 - 1. Size: 2-1/2 inches (63 mm) square by 12 gage, 0.109 inch (2.76 mm thick), with manufacturer's standard cap.
- D. Flexibility: Capable of following variable slope of up to 1:2.

2.05 STEEL GATES AT TRASH ENCLOSURE

- A. Gate Panels: Profiled steel panel, painted finish per 09 91 13, 18 gage galvanized steel. Design-build gates to meet design intent as indicated on Drawings and quality requirements as indicated in this section.
 - 1. Weld steel panels to gate frame of steel angles or tubes.
- B. Posts: Steel tube.
 - 1. Size: 5 inches (125 mm) square by 1/4 inch thick, with anchor plate and standard cap.
 - Post Cap: Flush plate.
- C. Finish: Paint per 09 91 13.
 - 1. Color: As selected by Architect.
- D. Hardware:
 - 1. Hardware for Double Swinging Gates: 180 degree heavy duty hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; heavy duty cane bolts at each gate with 12

inches by 6 inch palv pipe embedded in concrete with sleeves to hold gate in place at both open and closed positions; keepers to hold gate in fully open position.

- 2. Hinges: Finished to match fence components.
 - a. Brackets: Square.
 - b. Mounting: Center.
 - c. Closing: Manual.
- 3. Other hardware: As indicated on Drawings, including padlockable slide bolt, door handle on each leaf, and gate wheels.

2.06 AUTOMATIC GATE OPERATORS

- A. Sliding Gates: Prewired, pedestal-mounted gate operator for horizontal sliding gates, per ASTM F2200 and UL 325.
 - Basis of Design: Liftmaster CSL24UL with keypad KPW250 mounted on gooseneck pedestal PED42.
 - 2. Operating type: Drive belt.
 - 3. Control Functions: Open, Pause, Close.
 - 4. Maximum Open/Close Time: 10 seconds.
 - Access: Card.
 - 6. Maximum gate weight: 500 pounds (187 kilograms).
 - 7. Horsepower Rating: Suitable for connected load.
 - 8. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge or NEMA 4X photo eye sensors as required with momentary-contact control device.
 - Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - a. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1) Outdoor Locations, direct splashing: Type 4.
 - b. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set fence posts in accordance with the manufacturer recommended spacing.
- C. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
 - Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
 - 2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
 - 3. Provide gate hardware by the manufacturer of the gate and install in compliance with manufacturer's recommendations.
- D. Install operator in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6.3 mm).
- B. Maximum Offset From Indicated Position: 1 inch (25.4 mm).
- C. Minimum Distance from Property Line: 6 inches (152 mm).

3.05 FIELD QUALITY CONTROL

- A. See Section 01 40 00 Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Post Settings: Randomly inspect three locations against design for:
 - 1. Hole diameter.
 - 2. Hole depth.
 - 3. Hole spacing.
- D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- E. Workmanship: Verify neat installation free of defects.

3.06 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.
- F. See Section 01 74 19 Construction Waste Management and Disposal, for additional requirements.

3.07 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 Demonstration and Training, for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.
- D. Demonstration: Demonstrate operation of system to Owner's personnel.
 - 1. Use operation and maintenance data as reference during demonstration.
 - 2. Conduct walking tour of project.
 - 3. Briefly describe function, operation, and maintenance of each component.
- E. Training: Train Owner's personnel on operation and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - Location: At project site.

3.08 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

3.09 FENCING SCHEDULE

- A. MTL-1: Decorative Fence; Omega Architectural, https://www.omegafence.com/en/omega.php
- B. MTL-2: Standard Fence; Omega Elite Double Wire, https://www.omegafence.com/en/elite.php

C. MTL-3: Fixed Louvered Fence, Omega80 (Orsogril Style), https://www.omegafence.com/en/omega80.php

END OF SECTION

SECTION 32 84 00 IRRIGATION

PART 1 - GENERAL

1.01 DEFINITIONS

See General Conditions for General Project Definitions – Definitions noted below are those most commonly utilized within these specifications, those contained within the General Conditions are noted, additional definitions specific to Landscape Development are further described here, should duplication occur the definitions within the General Conditions shall prevail.

- A. Owner, Client, and City of Porterville (COP): See General Conditions – Definitions
- B. Construction Manager (CM): See General Conditions - Definitions.
- C. Owners Representative or Project Manager (PM): Shall mean the person(s) from the Public Works Department or other assigned Department within the City of Porterville that has been made responsible to communicate, make and relay decisions for the COP and give direction to the PM and Contractor regarding the project.
- D. Project Inspector Inspector of Record (IOR):
 See General Conditions Definitions
- E. COP Staff: Shall mean all employees of the COP that are not the PM which may be requested/directed by the PM to provide direct information to the CM, PM, LA and/or Contractor.
 - Any contact with COP Staff shall only occur with the permission of the PM/CM.
 Meetings and conversations shall only occur in the presence of the PM/CM and
 documented by the Contractor and PM/CM.
- F. Maintenance and Operations Staff (M&O): Shall be the COP staff responsible for maintenance and operation of the COP physical plant. Specific M&O staff will be identified by the PM/CM as the individuals who may provide the Contractor with information. See Contact requirements above.
- G. Contractor:

See General Conditions - Definitions.

- H. Contractors Representative: Shall mean an owner, principal and/or managing employee of the Contractor who has been authorized by the Contractor to discuss details of the project with the CM, PM, IOR, Architect and Landscape Architect.
 - 1. The Contractors Representative shall be authorized by the Contractor to receive information from and make binding decisions with the CM and/or PM.
- I. Sub-Contractor:

See General Conditions - Definitions.

J. Architect (PA):

See General Conditions - Definitions

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- K. Landscape Architect (LA): Shall mean the project Landscape Architect/Landscape Architectural Firm that has been retained directly by the COP or Architect to design, review, and report and provide recommendations to the COP via the Architect and/or PM as directed by the Owner.
- L. Arborist: Shall mean an Arborist retained by the COP. If required in the specifications or plans the Arborist shall be contacted prior to construction and trenching, and shall be the authority related to tree protection, evaluating excavation and trenching within the designated drip zone and aid the IOR in determining compliance with the specifications.
- M. Sub Consultants: Including but not limited to the Landscape Architect (LA), Civil Engineer (Civil), Electrical Engineer (EE) that are sub consultants to the Architect (including the LA) that have been retained directly by the Architect to design, review specific portions of the project, report and provide recommendations to the COP via the Architect and/or PM as directed by the Architect.
 - The Contractor may be directed through the specifications, references, plan notes, details and legends or PM to refer to the sub consultant documents to coordinate their work for Landscape Architecture generated and related specification sections, plans, notes, legends and details.
 - 2. Conflicts shall be immediately brought to the attention of the Architect and Landscape Architect in writing and direction requested and received prior to proceeding with any work.

N. Discrepancies:

See Instructions to Bidders - Interpretation of Contract Documents and General Conditions

Discrepancies shall mean any difference in quantity, quality, size, product, method etc. between the specifications, notes, legends, plans or the Architects and sub consultants plans and specifications that the Contractor is directed to. In the case of any discrepancy the Contractor shall:

- 1. Immediately notify the Architect in writing. Specifically noting and including
 - The exact nature of the discrepancy
 - The exact location(s) of any discrepancy on the plan(s), note(s), legend(s), b. detail(s). Contractor shall provide a legible and marked up plan or document showing the exact locations. Discrepancy reviews will be return without review until the marked up plans or specs are received from the Contractor.
- The Contractor shall not proceed with construction affecting the discrepancy until the 2. Architect or PM has responded with direction and authorization to proceed.
- 3. The Contractor shall be responsible for all work, materials, equipment and incidentals needed to properly install the work in completely at no additional cost to the Owner.
- Field Adjustments: During the course of the construction the contractor shall make any Ο. and all field adjustments as needed and or recommended by the CM/PM/LA to accommodate minor changes in the project layout or due to adjustments to relocation of utilities, site paving, structures or previously unknown existing conditions. The Contractor shall make these minor adjustments at no additional cost to the owner.
 - Should the Contractor Request Field Adjustments for their conveniences, which are approved by the COP, these shall be at no additional cost to the Owner.

Ρ. Protect:

See General Conditions - Protection of Work and Property

- Q. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- Remove and Salvage: Carefully detach from existing construction, in a manner to prevent R. damage, protect, clean and store (ready for reuse). Include fasteners or brackets needed for reattachment elsewhere.
- Spare Parts: All materials shown on the plans or required in the notes, legends or S. specifications shall be considered the property of COP.
 - Any that are not used during construction shall be considered spare parts and delivered in clean unused condition to the PM/CM prior to the start of the Maintenance Period, at no additional cost to the owner.
 - For Example: if the plans show 200 pop-up spray heads with swing joints and nozzles and due to any reason, only 180 are installed, the remaining 20 shall be considered spare parts and delivered to the CM prior to the start of the maintenance period.
 - 2. Any additional spare parts required in these specifications shall be considered the property of COP and shall be available for use in addition to the parts and materials shown on the plans and/or required in the notes, legends or specifications.
 - The contractor shall provide all labor, materials, equipment and miscellaneous parts needed to properly install these items as recommended by the LA and/or required by the COP CM/PM/IOR at no additional cost to the Owner.
 - These spare parts shall be available to the COP to be used on the site in the b. event of changes in site/field conditions that might require modifications to
 - For Example: Should there be 200 pop-up spray heads with swing joints and C. nozzles be shown on the plans and all are installed, and due to any reason, an additional number of heads indicated as needed by the Landscape Architect, the contractor shall install those additional heads (up to the total spares required below in these specifications) at the locations recommended by the LA/PM. The Contractor shall be including and provide all trenching, plumbing materials, backfill, labor, equipment and materials needed to properly install all spares noted in the specifications at no additional cost to the Owner. Any spares that are not used/installed shall be considered spare parts and delivered to the CM prior to the start of the maintenance period.
- T. Submittals and Samples:

See General Conditions - Submittals, Shop Drawings and Submittals, and Samples

Shall be the Contractors required, product and materials submittals shown and/or noted in the specifications and on the plans, and soil samples to be submitted in the time and format require:

- Clearly marked manufactures cut sheets for all material and products to be used. 1.
- 2. Physical materials and/or product samples where called for in the specification.
 - Physical Samples shall be accompanied with the Manufactures cut sheet and product information data
- Contractor shall be responsible for the delivery and cost of all submittals, including 3. physical submittal samples to the Architect and from the Architect to the Landscape Architect.

- U. Tree Dripline (Dripline): Shall mean the outer most portions of existing tree(s) canopy, (branches, leaves or stems with or without leaves). (Irrigation water delivery tubing shall be noted as 'Drip Line')
 - Driplines shall be determined by a vertical plumb line from the outermost portions of the canopy in a vertical line.
 - 2. The contractor shall verify the exact location with the IOR prior to any work. In case of discrepancy between the IOR and Contractor the LA shall be the final arbiter.
- Temporary Irrigation for Sub Surface Drip in Turf Areas: See Plans to determine if the V. system is temporary or required to remain as a permanent improvement. A temporary irrigation spray system to be installed to establish turf at pavement edges, or areas which will be permanently irrigated by sub surface drip system.
 - If shown and labeled on plans as required, the Contractor shall install per plans. The system shall be used to establish the turf and the system sh
 - If shown and labeled on plans as Contractors Option: 2.
 - Should the contractor choose to install this option the contractor shall provide an additional valve identical to those specified and it shall be tied to the controller. All components and requirements for the temporary system shall be identical to the designed turf system, including depths, pipe, pipe sizing, and irrigation heads.
 - The Contractor shall utilize side strip nozzles or full-size heads as needed at b. spacing per manufacture.
 - The contractor shall use the system for turf establishment only and then shall C. utilize the sub surface drip system for the entire maintenance period and shall make all watering and schedule adjustments needed to insure that the turf at pavement edges is equal in quality to the balance of the turf.
 - d. Should the contractor choose to install this temporary irrigation system; it shall be left in place and intact at no additional cost to the Owner.
 - W. Establishment: Shall be the establishment of plant material, from delivery, storage, planting, throughout the Construction period, into and through the maintenance period.
 - The Contractor shall provide all services needed to maintain plant material in a 1. healthy and actively growing state. This shall include but not limited to, adequate and timely application of water to meet the plant material needs based on hydrozone, corrective pruning (only as recommended by the LA or COP Arborist and as directed by the PM), weeding, pest management or other recommendations approved by the PM.
 - X. Maintenance: Shall be the maintenance of all components contained within the Contractors contract. The Contractor shall be required to maintain all improvements:
 - During construction. 1.
 - 2. Phased improvements until the completion of all phases
 - For the duration of the Maintenance period, length noted elsewhere 3.
 - Record Documents:

See General Conditions - Contract Close Out

See General Conditions: Substitution Warranty Form, Guarantee, Guarantee and Warranty

Water Efficient Landscape Ordinance (WELO): California State Law - 2015 Updated Model Water Efficient Landscape Ordinance for efficient application of water to landscape

areas. The Contractor shall confirm to all WELO required irrigation system installation, application of water, performance, scheduling, testing and documentation requirements. Should the State of California modify WELO requirements during the Bidding or Construction period the Contractor shall submit a Request for Information (RFI) to the Architect for clarification.

BB. Contract Grow: If required shall mean contracting with Nursery suppliers to grow and or secure plant material specifically for this project. See submittal, approvals and time line requirements the Contractor shall comply with to secure plant material.

1.02 DESCRIPTION OF WORK

- A. Work Shall Include: All labor, materials, tools and the transportation and performance of all the work required as indicated on the Drawings and Specifications and reasonably incidental to:
 - 1. Submittals All products and materials, including physical samples
 - 2. Coordination between all phases and with other contractors.
 - 3. Trainings, Certifications and Verification of same
 - 4. Weed Control, from the start of construction, during construction and maintenance
 - 5. Field Adjustments
 - 6. Connection to water supply (see Civil Plans)
 - 7. Water service line from Water Meter to Backflow (see Civil Plans)
 - 8. Installation of Backflow Device (see Civil Plans)
 - 9. Master Valve and Flow Sensor and Wiring
 - 10. Communication wire and conduit from the controller to the building for Ethernet connection to master irrigation control/monitoring system
 - 11. Isolation Valves
 - 12. Electric Control Valves and Assemblies
 - 13. Moisture Sensors
 - 14. Pressure regulators/reducers (if required)
 - 15. Trenching, backfill and compaction
 - 16. Irrigation mainlines, couplings, restraints, and thrust blocks
 - 17. Mainline Pressure Testing & Certification
 - 18. Laterals and couplings.
 - 19. Confirmation of wire conductivity
 - 20. Irrigation spray heads, nozzles and risers
 - 21. Bubbler Deep Watering System with swing joints with Bubblers/Drip Emitters.
 - 22. Sub Surface Drip System & all Components
 - 23. Installation of Temporary Irrigation Systems required for establishment of sub surface drip areas.
 - 24. Quick coupler valves.
 - 25. Gate valves.
 - 26. Air Relief Drain Valves and drip Operation indicates
 - 27. Valve boxes installation
 - 28. Water Audit by Independent 3rd party selected by COP and paid for by the Contractor.
 - 29. Backflow Preventer Testing and Certification
 - 30. Drinking Fountain Purchase and Installation
 - 31. Ensure that any existing improvements and completed planting phases are continuously served with irrigation during the construction to later phases.
 - 32. Install, if needed, any allowance/spare parts listing within the specifications
 - 33. Provide any unused allowance parts and spare parts to the PM/CM prior to the start of the Maintenance Period.

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- 34. Provide completed 'As Build/Record Document' drawings to the PM/CM per General conditions.
- 35. Clean Up and Legal disposal of waste.
- 36. Connection of Potable Water to Drinking Fountain(s)
- 37. Sanitation of Potable Water lines to drinking fountain(s) See Civil Plans & Specs.
- 38. Drinking Fountain(s) drainage system & plumbing
- B. Complete Project: See General Conditions Sample Contract.

 The Contractor shall be responsible to provide all materials, labor, equipment, and incidentals, whether mentioned specifically or not, necessary to complete the work and provide a completely operational landscape irrigation system and related and other items shown on the plans.
 - 1. Example: If locking valve boxes are required, and stainless steel locking bolts normally used to lock valve boxes are not specifically called for, the Contractor shall provide the locking stainless steel bolts recommended by the manufacture for use with each specific valve box type at no additional cost to the Owner.
 - a. This shall requirement shall extend to all products providing a similar function, in the example above, vaults and other in ground enclosures containing irrigation components shall also be required to be provided with stainless steel bolts recommended by the manufacture.

1.03 RELATED WORK & DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this Section.
- B. Architect, Civil Engineer, Electrical Engineer, Mechanical Engineer and other related plans and specifications.
- C. Multiple Prime Contractor or General Contractor Specifications for this Project
- D. City of Porterville Contractor Contract Requirements.
- E. 2015 Updated Model Water Efficient Landscape Ordinance State of California
- F. Product Manufactures specifications, requirements and recommendations
- G. California Products and Materials Preference See General Conditions.
- H. Storm Water Pollution Prevention Plans (SWPPP)
- I. Air Quality Control Requirements
- J. City of Porterville Standard Details, Specifications, and requirements

1.04 SITE CONDITIONS

A. Traffic Control: Maintain and coordinate access for vehicular and pedestrian traffic as required for all construction activities.

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- В. Erosion Control and Storm Water Runoff: Co-ordinate with PM/CM whom is responsible for maintaining Erosion Control measures and any requirements related to temporary removal/adjustment/replacement for execution of work within this section.
- C. Air Quality: Review, comply and maintain all project measures need or required for Air Quality Control.
- Verification of Job Conditions: See General Conditions. Contractor shall verify actual D. conditions and report any discrepancies between the plans and actual conditions immediately to the PM/CM, refraining from doing any work in said areas until given approval to do so.
 - It is the responsibility of the Contractor to coordinate his work with other trades and be familiar with the locations of drain lines, utility lines and other on grade and subsurface improvements that could affect the work.
 - Contractor shall call for location of Utilities via USA North 811. 2.
- E. Obstruction to Irrigation & Planting Operations: If rock, plaster, concrete, asphalt, or other debris, electrical cables, conduits or utility lines are encountered and cause conflict with irrigation or planting operations, notify the CM/PM to arrange relocation to avoid unmovable buried objects and/or cleanup work which is not the responsibility of the Contractor.
- F. Contamination: If washout areas or equipment emissions by other Contractors (i.e.: paint, thinners, concrete slurry, cleaning fluids, oils, fuel, hydraulic fluids, etc.) are encountered, Notify the PM/CM verbally and in writing. No planting is to occur until the area has been cleaned and contaminated soil remove and disposed of by others and new clean approved import fill soil has been imported, amended to match the site, placed, compacted and approved for planting by COP.
- G. Utilities: The contractor shall make themselves familiar with all existing and proposed utilities within the Project Work Limit Line. Prior to commencement of any excavation, trenching, grading or tilling the Contractor shall contact the CM for review of plans and confirmation of any utilities which have been installed or that may be in conflict with the Contractors work.
 - 1. The Contractor shall protect all work previously performed by others. Damage by the Contractor of the work of others shall be brought to the attention of the PM/CM immediately. The PM/CM shall direct the repairs and assign costs for the repairs.
- Weed Control: Weeds shall be eradicated from the site starting immediately after site Η. rough grading and the construction of the building pads.
 - During building construction weeding shall occur at minimum monthly. Weeds shall not be allowed to set seed. All weed debris shall be removed from the site and disposed of legally.
 - Noxious weeds, such as Nut grass, Nut sedge, Bermuda Grass, Johnson grass, star 2. or Russian thistle, or others that may be identified shall be sprayed regularly with a herbicide as recommended by the Contractors Pest Control Advisor and approved by the COP approved herbicide Round up or equivalent and eradicated from the site.

1.05 **QUALITY ASSURANCE**

A. Examine all sections of Specifications and Drawings for Work related to this Section.

- B. Submittals: See General Requirements - Specifications. Shall be provided to the Architect for all materials and products contained within this specification and shown on the plans, including notes and legends.
 - Submittals shall be provided within 31 working days after the award of the contract to the General Contractor or Landscape/Irrigation Contractor on Multiple Prime projects or as otherwise required by the General Conditions. Confirm conformance with the General Conditions.
 - If a Landscape Contractor has not been selected the General Contractor shall be responsible for all submittals within the Submittal period
 - 2. Cut Sheets: are required for all materials and products
 - Cut sheets shall be clearly marked with the Manufacture, size and model number of the exact item being submitted that matches the specifications and/or plans.
 - If there are any variations marked from what is specified, the contractor shall b. provide a cover sheet stating the Manufacture/size/model number specified and a written explanation as to why the specified item is not shown.
 - For example: If a manufacture has discontinued or modified a product that was specified and replaced it with another product than that change is required to be noted.
 - If the original product exists and the Contractor is requesting/attempting 2) a substitution the submittal will be rejected without review. See General Conditions for Substitution Requirements.
 - An indexed cover sheet shall be included with the submittal package with the 3. contact information for the specific supply house, wholesaler and sales representative contact information for each product to be supplied by the Contractor.
 - 4. The COP/PM/CM/PA/LA reserve the right to contact the manufacturers and suppliers directly with any questions they may have regarding the products submitted by the Contractor for use on the project.
 - 5. The contractor shall provide complete submittals for all irrigation and planting requirements:
 - The 1st Submittals shall be complete and contain all components within each specification section
 - Irrigation 1)
 - 2) Soil Preparation
 - 3) **Planting**
 - All other Landscape Construction related sections 4)
 - The Contractors 1st submittal shall be reviewed by the LA and/or other design consultant needed specific to the submittal item, which will make recommendations for acceptance, conditional acceptance, or denial requiring resubmittal for incomplete documentation, missing items and/or substitution requests.
 - If, in the opinion of the LA, the submittal is provided without a indexed 1) cover sheet listing all items contained with or 5% or more of the submittal items are not clearly identified as to the specific product, incomplete or missing items the Contractor shall be notified that the submittal is considered void. The submittal package will not be returned to the Contractor. The contractor shall be required at their sole expense to provide a new complete submittal package.
 - Substitutions are not allowed within submittal packages. 2)
- C. Incomplete Submittals: Any conflicts between the General Conditions and these requirements, the General Conditions shall prevail. If, in the opinion of the LA, 5% or more of the submittal items are not clearly identified as to the specific product, incomplete or

combined with missing items the Contractor shall be notified that the submittal is considered void and rejected without review.

- 1. The submittal package will not be returned to the Contractor.
- 2. The contractor shall be required at their sole expense to provide a complete new submittal package.
- 3. Substitutions requests are not allowed within the submittal packages.
- 4. The Contractors 2nd submittal shall contain all items required to be corrected or completed, including any previously missing items.
 - a. If, in the opinion of the LA, 5% or more of the resubmittal items are not clearly identified as to the specific product, incomplete or missing items the Contractor shall be notified that the submittal is considered void. Incomplete submittal package will not be returned to the Contractor. The contractor shall be required at their sole expense to provide a complete submittal package.
- D. Subsequent Re-Submittals: If additional submittal reviews, beyond the first two (2) due to rejection based on incompleteness, missing items, substitution, omission, error or other any other cause, than
 - 1. The Contractor shall be responsible for the COP, CM, PA and LA costs associated with the review of the Contractors Submittals.
 - These costs will be invoiced at the current (date of submittal) billing rates including but not limited to hourly time, reimbursable expenses (including travel and per diem if incurred).
 - b. These items shall be back charged to the Contractor as allowed in the General/Special/Supplemental Conditions of the Contractors contract and deducted from the Contractors payment.
- E. Submittals Physical Samples: See General Conditions
 - Physical Samples 3 of the following are required, each accompanied with clearly marked manufactures cut sheets (independent of those required above)—(these samples shall not be considered as part of the spares). After recommended approval one sample shall be retained by the PA, one by the LA and one sample shall be retained by the PM/CM/IOR on the job site for comparison with the materials delivered to the site by the Contractor. The Contractor shall be responsible for all packaging, shipping, and costs of the physical samples to and from each party:
 - a. Sub Surface Drip system (5' long section)
 - b. Sub Surface Drip Fittings
 - c. Swing Joints
 - d. Pop Up Spray Body with Nozzles
 - e. Wire (2' long sections)
 - f. DBY connectors
 - g. Deep Root Water Sleeve and bubbler
- F. Submittals Manufacture Specification and Cut Sheets:
 - 1. PVC Pipe & Fittings all schedules
 - 2. Galvanized Pipe & Fittings
 - 3. Electrical Conduit & Fittings
 - 4. Pipe for Sleeving & Fittings
 - 5. Solvent and Glue
 - a. Wet Weather
 - b. Cold Weather
 - c. Hot Weather
 - d. Average Weather
 - 6. Cement for pads, curbs & Thrust Blocks

- 7. Backflow Device, Cage, Polar Blanket
- Air Relief Valve 8.
- Hydrometer / Flow Sensor / Master Valve 9.
- Controller, remotes and Moisture sensors
- All Wire types & connectors 11.
- Isolation Valves & Keys 12.
- **Gate Valves** 13.
- 14. Irrigation Valves - All types
- Quick Couplers & Keys 15.
- Valve Boxes All types 16.
- Sub Surface Drip System and fittings 17.
- Pop Up Spray Heads & Nozzles 18.
- 19. **Swing Joints**
- 20. Deep Root Water sleeves and bubblers
- G. Installation: Install irrigation system in accordance with all applicable codes and regulations.
- Experience: Installer shall have had the minimum years' experience and a demonstrate ability, Н. as required in the General Conditions, in the installation of irrigation systems of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship.
- Confirmation: Contractor shall check and confirm the water meter size, service line size, Ι. static pressure at the irrigation point of connection to the water supply before beginning work and notify IOR, Project Manager, Architect and Landscape Architect in writing of the pressure available as well as any deviation from the sizes of meter and water lines shown on the plans.
- Schedule: Contractor, within the time required in the General Conditions after signing their J. contract, and prior to commencement of work, shall provide the PM/CM, IOR and Landscape Architect with a complete schedule of work to be performed; the schedule shall include benchmark dates for all phases of the project. The schedule shall be updated as required in the General Conditions during construction of the Irrigation system and provided to the PM/CM and shall include anticipated dates when each work phase is anticipated to be ready to be inspected.
- Inspections & Reviews: Contractor shall notify the IOR, as required in the General K. Conditions, in advance when each work phase is ready to be inspected.
 - Required Inspections, but not limited to, shall be:
 - Pre-Construction Meeting shall include required participation by the Contractors Owner/Manager, Project Supervisor and Project Foreperson.
 - Tree protection limits and procedures (if existing trees are present on site or b. immediately adjacent to the site)
 - Verification of Point of Connection service line, meter size and static pressure
 - d. Point of Connection components installation
 - Irrigation Layout including plumbing layout of sleeves, service lines, booster pump, backflow, all valves including hydrometer, flow sensor, master valve, fertigation, etc.
 - f. Hand Trenching limits (if required)

 - Verification of Glue, Controller Training and Contractor ID List and Cards h.
 - Conduit locations and installation i.
 - j. Installation of mainlines and valves

- Verification of Dripline Emitters facing UP prior to flushing k.
- Verification of proper installation of Sub Surface Drip components Ι.
- Flushing m.
- Mainline pressure test(s) n.
- Installation of spray heads
- Installation of drip lines and header connections p.
- Installation of bubblers and deep root watering systems q.
- Successful operation of all driplines prior to backfill
- **Backfill** compaction s.
- Valve and Wire splice box installation t.
- Wire Conductivity Tests
- Spray System Coverage ٧.
- Third Party Water Audit W.
- Backflow Devise Testing and Certification Χ.
- Controller operation у.
- Submittal of Spare Parts Z.
- aa. Submittal of 'As Builds'

L. Utilities: The Contractor shall

- Contact USA Locate a minimum of 72 hours in advance of any potholing, trenching, digging or any other type of excavation or grading.
- 2. Prior to any exaction, digging or trenching the Contractor shall contact the PM/CM for verification of where other buried utilities or objects exist. Any markings provided by the PM/CM shall be maintained by the Contractor during the course of the project.
- 3. Maintain continuous power and water supply to all facilities that are directly or indirectly affected by this construction,
- 4. Arrangements are to be made with, and approval received from the PM/CM/Owner for temporary shut-offs. Provide at least 2 business days' notice.

Protections: The Contractor shall M.

- Protect the public health, safety and welfare
- Protect all existing and newly installed site improvements during all phases of the 2.
 - Contractor shall immediately notify the PM/CM and not cover any buried a. utilities or improvements that are exposed, nicked, cracked, broken or cut.
 - The Contractor shall immediately report to the IOR any damage to any work b. of others or existing improvements.
 - C. The Contractor shall not patch or attempt repairs to work performed by others without specific approval by the PM/CM.
- Spare Parts: Contractor's price shall include an amount to install the following items at no N. additional cost to the Owner. Any of the following items not installed shall be provided to the PM/CM prior to the start of the maintenance period as 'spare parts'.
 - Four (4) additional sprinklers bodies of each type with swing joints and nozzles, 1.
 - One (1) deep root watering units 2.
 - One hundred (100) square feet of drip system including all fittings, headers and 3. lateral lines as needed to properly install.
 - 4. No (0) additional irrigation solenoid valves with decoders of each type and size from that quantity shown on the drawings, including valve boxes for each valve.
 - All unused sprinklers, shown on the plans but not used shall be considered spares 5. and delivered to the PM/CM prior to the start of the Maintenance period.

- Ο. Field Changes: Provide all Nozzle changes and sub surface drip modifications to accommodate existing conditions and field modifications/adjustments shall be provided at no additional cost to the Owner.
- Ρ. Crew Training: Is required for Solvent Weld PVC, Irrigation Controller, Deep Root Watering System Installation, Sub surface Drip system installation. Contractor shall schedule training a minimum of 10 days prior to the installation of any of these items on the site.
 - Contractor shall inform the PM/CM and IOR a minimum of 10 days in advance of the 1. training.
 - 2. Training shall be a minimum of 5 working days prior to the installation of any of these items on the site.
 - 3. The Contractor shall be required to provide their supervisor, foreman, crew leaders and crew members for mandatory training and certification that will supervise or install the irrigation systems.
 - Unless previously certified in the past 2 years proof required.
 - Contractor shall provide photo ID badges signed by the trainer certifying b. training for each individual.
 - Individuals not trained or not wearing their identification tags shall not 1) work on the systems and components requiring training.
 - Any components installed by untrained individuals shall be removed 2) and replaced by the Contractor at no additional cost to the owner, no additional work days are to be scheduled/granted.
 - 4. The Contractor shall schedule, co-ordinate and provide all materials requested by the Manufactures representatives needed to provide training.
 - Solvent Weld (Glued) PVC Glue Manufacture Rep
 - b. Irrigation Controller management and operation - Irrigation Controller Tech
 - Drip System components Manufactures Rep C.
 - d. Valve Installation - Valve manufacture Rep
- Communication: All meetings and correspondence with the CM/PM/IOR/PA/LA, including Q. training, shall be conducted in English. The Contractor shall provide an interpreter, at the Contractors expense, to translate for his/her non-English or poor English speaking representative(s).
- R. Pressure Tests:
 - All Service and Mainlines shall be Pressure tested.
 - 2. All glued joints shall have set a minimum of 24 hours prior to pressure tests.
 - 3. Gauges for pressure tests shall read in 1 psi minimum increments and recently tested for accuracy.
 - Mainline pressure tests shall be at 125 psi for a minimum of 48 hours. 4.
 - Contractor shall install temporary air release valves at ends of lines or high points, as needed, to bleed air. Temporary air release valves shall be removed prior to final punch list review.
 - Mainline joints shall not be cover pipe shall be sufficiently center loaded to prevent 5. pipe from floating or lifting during tests.
 - 6. Any drop in pressure shall indicate a leak, leaks shall be located.
 - Leaking joint shall be totally removed and replaced, and the joint discarded.
 - 7. Mainlines may be tested in sections
 - Mainlines to be laid under paving, through sleeves shall be pressure tested prior to covering.
 - Approved sections maybe backfilled with the exception of the ends which will b. be connect to the future sections
 - New sections shall be tested with previously tested section. C.

- d. Once all sections have been completed the entire mainline shall be tested.
- All irrigation backflow, valves, gate valves, isolation valves and other connections 8. shall be installed prior to the final pressure test.
- Final pressure test with all valves installed shall be at 100 psi for 48 hours. Any drop 9. in pressure shall indicate and leak. The Contractor shall locate, replace/repair as noted above and retest until the system has successfully passed.
- All Tests shall start and stop in the presence of and certified by the IOR. 10.
- S. Certifications: COP will select a California Certified Water Audit Inspector, and the Contractor shall arrange the time for the review and pay for:
 - The Independent 3rd party water assessment by a certified Water Auditor will perform a Water Audit and the Contractor shall make all recommended modifications to the irrigation system, controller schedule and other items as needed and recommended at no additional cost to the Owner.
 - Backflow Preventer inspection and certification 2.
- T. As Built Plans/Record Documents: 'As Built' original plans shall be provided and updated per the General Conditions.
 - As Built plans shall be updated per General Conditions
 - Dimensions shall be marked on the plans from: 2.
 - Mainlines, all mainline turns under pavement, valve boxes, quick couplers, wire splices, air relief valves, popup drip operation indicators, flush valves, irrigation headers & footers, master valve and flow sensor, and moisture sensors.
 - The Contractor updates to the 'As Build' plans shall be clearly legible. 3.
 - Field marked 'As Builds' shall be converted into a digital format with clearly designated layers distinguished by different colors.
 - Dimensions shall be in bright Red a.
 - Mainlines in Black b.
 - Relocated Mainlines shall be in dark Blue C.
 - Relocated lateral lines shall be in dark Green d.
 - All notes shall be in dark Yellow
 - Provide As Built plans General Conditions: 5.
 - Provide full size PDFs
 - 4 copies shall be reduced in size, laminated with vinyl film, (1) copy shall be b. installed in the controller and the remaining (3) copies and shall be provided to the PM/CM prior to the commencement of the maintenance period.
- U. Guarantee
 - Shall be per the General Conditions. 1.
 - Any pumps, controllers, wire, pipes, valves, decoders, heads, planting, and paving which have settled shall be reinstalled or replaced to the proper level at no cost to the Owner.
 - Wire conductivity shall be confirmed to meet manufactures specifications b.
 - Completely restore all damaged planting, paving, or other improvements C. damaged or anticipated to be damaged by settlement due to irrigation trenching settlement or other installation activities which have damaged other improvements.
 - d. Leaks will be repaired and pressure tested.
- V. Support Warranties, Product Data, Manuals and Owner Training
 - Provide copies of all instructions to the Owner's maintenance personnel in the operation and maintenance of the system per the General Conditions.
 - 2. Provide copies of all warranties, product data and manuals

- 3. These shall be bound together with in 9" by 12" black 3 ring binders.
 - The binder shall be clearly labeled on the Front, Back and spine of the binder with the project name.
- 4. Include 1 folded full size 'As Build' plan in each binder
- Include 2 reduced site irrigation plans showing zones in each binder 5.
- Provide a minimum of 1 4 hour training to COP maintenance staff in the proper 6. operation of all system components and operations.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS:

- See General Conditions: Submit on the required forms, within the required timelines, with Α. required supporting equal or better documentation and Guaranties.
 - Substitution requests without complete point by point, feature by feature, specification/tolerance by specification/tolerance documentation of equal or better status shall be rejected without review.

2.02 ACCEPTABLE MANUFACTURERS

- A. **Hunter Industries**
- B. Paige
- C. Nibco
- D. Applied Engineering
- E. Pacific-Western
- F. Christy
- G. Other manufactures specifically noted in these specification and/or on plans and details
- Η. Other manufactures maybe recommended/requested by the Contractor
 - Any requested substitutions shall be included on the Contractors bid form to be considered -
 - Items not included on the bid form will not be considered.
 - Items submitted on the Bid Form are not guaranteed to be accepted or b. reviewed base on the criteria in # 2 below.
 - The 100% burden of identical, equal or better is the responsibility of the Contractor. 2.
 - Materials submitted without proof of this requirement shall be rejected without review.
 - Any questions posed to the identical, equal or better status by the b. COP/CM/PM/PA/LA shall be responded to by the contractor within 72 hours.
 - (1) Lack of response within that time frame shall be grounds for rejection without review and no further submittals shall be accepted.
 - Only one requested substitution request will be reviewed per item. All other reviews 3. approved by the COP – all other substitution review costs for the COP/CM/PM/PA/LA shall be billed/invoiced to the contractor and shall be deducted from the Contractors payment.

- 2.03 MATERIALS: All materials shall be as indicated on the plans, irrigation legend, notes, details, and as specified herein.
 - A. Piping and Fittings:
 - Polyvinyl Cloride pipe:
 - ASTM D2241 Gasket and Solvent Weld, rigid, un-plasticized PVC, extruded from virgin parent material. Provide pipe homogeneous through and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents.
 - Main Line smaller than 4" diameter: Schedule 40 PVC. 1)
 - Main Line 6" diameter or larger: Class 200. 2)
 - 3) Main Line 4" or smaller for Irrigation Valve Manifolds
 - Manifolds shall be Sch. 80 PVC Solvent Weld Glued pipe.
 - Lateral Lines: Schedule 40 PVC. 4)
 - Headers and Footers for inline emitter dripline shall be Schedule 40 5)
 - Sleeves shall be Schedule 40 for 4" diameter or smaller and Class 200 6) for 6" and larger.
 - 2. Gasket and Solvent Weld (Glued) Polyvinyl (PVC) pipe and fittings:
 - Fittings for all changes in direction on Solvent Weld pipe shall be Sch. 40 PVC, install per manufacturer's specifications.
 - Fittings for Schedule 40 PVC shall be ASTM D2466, fittings for Schedule 80 b. PVC ASTM D2467 PVC molded fittings suitable for solvent weld. Fittings made of other materials are not permitted.
 - Sleeve all main and lateral lines below all walks and paving, sleeves shall C. have glued joints.
 - d. PVC schedule 80 fittings w/ glued joints shall be utilized for Valve and Gate Valve manifolds.
 - e. Cross fittings are not permitted.
 - f. Use male adapters for plastic to metal connections. Hand-tighten male adapters plus one - two turns with a strap wrench as needed for a watertight connection. Utilized approved pipe dope or Teflon tape.
 - 3. Dissimilar Metal Fittings: Shall be dielectric and retard corrosion.
 - Air Release Valves: Provide air release valves at the end of all mains and/or where shown B. on plans.
 - C. Glue Training: The Contractor shall have the glue manufacturer furnish training for landscape contractor and certified all employees to be present during irrigation construction and installation, including owners, supervisors, foreman as well as other laborers. See Quality Assurance.
 - D. Photo ID: Trained employees are required to wear their individual photo ID's visibly while working on site. Employees are required to provide the photo ID's on request by the IOR/CM/PM/LA during irrigation construction/installation. Those not able to provide proof of training shall be required to leave the site while active irrigation installation is in progress. Work installed by untrained individuals shall be removed and replaced at no additional cost to the owner.
 - E. Gate Valves: See Irrigation Legend
 - All Isolation Gate Valves shall be equal to the line size which they are on.
 - All Gate Valves shall be equal the line size to which they are on. If a change in 2. size occurs at the gate valve the gate valve shall match the larger size.

- 3. Each Isolation and gate valves shall have its own locking rectangular valve box. Valve boxes in paving shall be traffic rated to match or exceed the pavements design load as shown on the Civil Engineer plans and specifications.
- 4. Provide the PM/CM with two keys for isolation valves prior to completion

F. Controller Wires:

- Shall be Paige Electric Jacketed Decoder Cables Direct Burial # 14 solid copper 2conductors, 600-volt AC, ASTM specification B-3 or B-8 per Paige Electric P7079D. Overall Jacket shall be high density polyethylene with a thickness of 0.035 ".
 - Wire shall be reviewed and approved by the Controller Manufacture as compatible with the specified controller, decoders and valves. Should the Controller manufacture require a different wire, the Contractor shall provide at no additional cost to the owner.
- 2. Wires shall be placed below irrigation mains wherever practical. Where wires do not parallel pipes, they shall be buried a minimum of 24", marked with utility warning tape and should run along walks or building edges wherever practical. Control wires under walks or paving shall be sleeved in a schedule 40 PVC conduit.
- 3. All Electrical, Irrigation Control wires and Communication cables/wires shall be place in electrical conduit.
 - Conduit shall be glued and directly enter valve boxes a.
 - b. All splices not in valve boxes shall be place in pull boxes. Pull box locations shall be measured and marked on As Built plans. If pull boxes are in driveways the pull boxes shall be traffic rated with locking lids to match or exceed those shown on Civil Engineer plans and specifications
- All Electrical Power, Irrigation Controller Wires and Communication cables that are 4. above ground shall be placed in rigid metal conduit.
 - If to be located on a building or attached to a structure wall/column/post the Contractor shall contact the Architect and Building contractor to confirm the location, and provide a method of attachment that is agreed to by both the
 - If to be located on a building or attached to a structure wall/column/post the b. conduit shall be prepared for painting, and then primed prior to attachment to the building or structure.
 - If attached prior to final painting the conduit may be painted by the painting C. contractor, if not than the Contractor shall be responsible for painting.
 - d. Paint shall exactly match the building color, if the building or structure is preprinted or finished (for example metal surfaces/finishes) the contractor shall match the building/structure color - color to be approved by the PM prior to painting.
 - All conduit shall be attached in a vertical or horizontal manner to match the e. building/structure vertical and/or horizontal lines. Confirm and receive approval from the IOR/CM/PM prior to attachment.
- Flow Sensor, Flow Meter or Hydrometer: Contractor is to connect PE 89 communication G. cable to the Irrigation Controller or other wire as specified by the Irrigation Controller Manufacture that is also compatible with the device. Contractor is to install communication cable in conduit from the flow sensor (or hydrometer if used) to the controller and into pump control panel for communication as required by the controller and pump manufacture for a complete installation.
- Communication Wire from Controller to Building: Н.
 - See Electrical Engineers plans for location of the conduit and Ethernet connection.

- 2. Co-ordinate with the building contractor and Internet/Ethernet sub-contractor to provide a connection between the irrigation controller and campus Ethernet within the building.
- 3. The Contractor shall install an electrical conduit from the controller and connect to a conduit/sleeve within 5' of the building's exterior wall (confirm exact location with the building contractor, electrical engineer and/or COP Ethernet provider/administrator).
- 4. Include a pull string within the electrical conduit; confirm that the string is continuous to its final destination within the building.
- 5. Install warning tape above the conduit per details.
- I. Line Surge Protection: Grounding rod and plates: per manufacture recommendations and requirements. Install at locations shown on plans and per details or as recommended by the manufacture, whichever is greater and most conservative.
- J. Tracer Wire: All water pressure lines to be installed with #12 tracer wire except where control wires are located adjacent to pressure lines.
- K. Utility Marker Tape: Shall be placed over all Mainline and any control wires that do not follow irrigation mainline pipes.
 - 1. The continuous utility marking tape shall be located 12 inches below finish grade.
- L. Solvent: ASTM D2466 recommended by manufacturer of approved pipe.
 - 1. The Weld On Glue & Solvent Manufacture shall provide training to the Contractor and his/her employees in the correct technic for installation of solvent weld glue joints prior to commencing work see Quality Assurance
 - 2. Utilize Primer and Glue that is compatible with the weather conditions anticipated during installation and as recommended by the Glue and Solvent manufacture.
 - For example: slow curing glue during the summer; faster curing glue in the winter; and primers compatible with each type of glue.
 - b. The Contractor shall, at each significant change of weather, inform the IOR of the change in primer and glue the contractor intends to use along with the specific manufacture recommendations supporting the change in products, for approval by the IOR.
- M. Controller and Controller Enclosure: See Irrigation Legend install per manufactures recommendations.
 - 1. Coordinate with the Irrigation Controller representative to provide training to the Contractor in the proper operation of the Controller. See Quality Assurance.
 - 2. Contractor shall include in his price:
 - a. 2 Hand Held Remote Control Operators—specific to the controller
 - b. Preset Start Up program during installation to comply with WELO
 - c. Provide training in correct use to COP Staff (a minimum of one full training sessions)
 - d. Provide to PM/CM all warranties and manuals prior to the start of the Maintenance Period see Quality Assurance
 - 3. Electrical Power Source by others see Electrical Engineers Plans & specifications for locations Contractor shall provide all materials and labor to make connections.
- N. Valve Decoders/Solenoids: Per Irrigation Legend
 - 1. Single station Valve Decoder
 - a. One Decoder per Valve
 - b. Four 3M DBY / R 6/8 splice kits per Decoder, or as needed and recommended by the manufacture
 - c. Decoders to be pre-programed

- 2. Review the controller location, installation and operation: The Contractor shall review the installation and operation with COP M&O staff as well as the site Facility Superintendent/M & O Supervisor. The Contractor shall inform the COP PM/CM in writing of any issues, concerns or the detection of items which will negatively impact the control system, prior to the start of construction.
- Ο. Control Valves: See Irrigation Legend for specific valve manufactures, model, size etc.
 - Use pressure compensating valves for all MP Rotator, drip and bubbler zones.
 - Provide Valve Kits with filters for all drip irrigation zones. 2.
 - Provide designated valves with pressure regulating feature. 3.
 - Provide identification tag attached to valves indicating valve/station number as 4. shown on drawings.
 - 5. Locate valve boxes outside of turf areas directly behind the concrete curbs / walkways in shrub areas whenever possible.
 - When not possible, valve boxes shall be located as far as possible away from the active use/play areas.
 - Do Not provide or install swing joints on control valves. At all irrigation valve 6. installations as shown on the details.
 - Schedule 80 TOE ("threaded one end") nipples are the only acceptable method of 7. attaching threaded inlet/outlet valves to all irrigation piping and/or fittings. At no time shall SCH 40 male adapters be used on any threaded valves to main lines.
 - Nipples shall equal the service line size, utilize reducing bushings if the valve is smaller than the service line.

P. Control Valve Manifolds:

Unless otherwise noted on plans, the manifold service line to a group of 2 or more valves shall be equal to the mainline size servicing the manifold. Single valves shall be connected with a manifold that equals or exceeds the size of the largest lateral line.

Q. Heads:

Deep root watering systems shall be installed for trees and shrubs as shown on the plans and details.

R. Swing Joints:

- For irrigation Heads:
 - ½" to 1" Contractor fabricated Triple Swing Joints.
- 2. For Quick Couplers:
 - Low/Regulated Pressure Areas 1" Rainbird TSJ Series
 - High Pressure Areas 1" TSJ PRS Series. b.

S. Sub Surface Drip Line System:

- See Plan, Legend and Details 1.
- Install per manufactures recommendations & requirements 2.
- Fitting shall be by the same manufacture. 3.
- All in line drip emitters shall face/pint up

Valve boxes:

- Irrigation Valve Boxes in Landscape Areas: Applied Engineering at all irrigation 1. valves, master and gate valves, guick couplers and air release valves.
- 2. Irrigation Vaults and Pull Boxes in Pavement: "Christy" traffic rated for heavy vehicle loads, concrete boxes with lockable steel lids at all irrigation, gate valves, quick couplers, other underground devices and mainline direction changes. Install with concrete footings per manufacture recommendations.

- 3. Irrigation Valves, Large Pressure Regulators & Flow Sensor and quick couplers: Series 1015 1G2G 12"High Standard Rectangle with Solid Cover (lid) w/ Stainless Steel pentagon bolt and socket. Utilize 1015 6" Extension Bodies where necessary to eliminate soil intrusion into valve boxes. Use 1 box per valve.
- Master Valve & Gate Valves: Series 1320 1G2G 12" High Jumbo Rectangle with 4. Solid "T" Cover (lid) w/ Stainless Steel pentagon bolt and socket. Utilize 6" High Jumbo Extension Bodies to full depth to provide clean access to valve. Use 1 box per valve.
- U. Rain Sensor - Automatic Shut Off: The Contractor shall confirm that the Rain Sensor is operating properly prior to the maintenance period starting. See Legend
- V. Valve Tags and Valve Box Stamps
 - Valve Tags: Shall be by Rainbird valve tags model #VID1Y24 or by Christy Enterprises, standard size tags, which shall be irrigation yellow color with controller letter and valve numbers hot stamped in black (ie: A-1 for controller A - Valve #1).
 - Valve Boxes: Shall be branded on the exterior of the valve box lid with the identical 2. number as the Valve Tag.
 - All ID Tags and branding: Shall be installed prior to the start of the Maintenance 3. Period.

W. **Quick Couplers**

- 1" quick couplers: See Irrigation Legend on plans 1.
- Provide rebar stabilizers and stainless steel clamps on each side of the Quick 2. Coupler. Clamps shall be series 1" minimum width screw closing stainless steel.
- Use inline pressure regulator on Quick Couplers. 3.
- Install quick coupling valve as manufactured by Rainbird Corporation. 4.

X. Hose Bibs

- 1. See Legend
- Risers shall be installed per details 2.
- Install with posts and straps per details 3.
 - Remove any burrs, sharp edges, or splinters from all support components
- 4. Provide a 18"x18" gravel filled drain box directly below each hose bib
- Y. Booster Pump - Not Used

2.04 **TRENCHES**

- Α. Trenching:
 - Trenches shall be excavated and cleared prior and during irrigation installation to insure that the minimum amount of cover is provide for all irrigation lines, control wire, trace wire and marking tape.
 - Trenches shall be kept clear to maintain minimum separation and coverage 2. requirements.
- В. Prevent Floating: Installed pipe shall be protected, loaded or weighted as needed to prevent 'floating' due to rain, flushing water and pressure tests, such that soil does not sluff into trenches reducing minimum separation and coverage requirements.
 - Trenches which experience floating or soil sluffing shall be cleared remove pipe and wire if necessary. Insure that the minimum amount of cover remains after clearing.

- 2. Where this occurs Mainlines shall be pressure tested to confirm integrity.
- Where trenches are cleared due to sluffing, wire conductivity tests shall be 3. performed to confirm that wires have not been nicked or cut. Repair per Wiring specifications and manufactures requirements. All splices shall be in pull boxes.
- C. Backfill: Fill to match adjacent grade elevations with approved earth fill material.
 - Trench backfill shall be 100% clear of all construction debris, including remnant pieces of irrigation pipe, fittings, glue cans and brushes, paper, boxes, and all other construction debris, organic material and trash.
 - Place and compact fill in layers not greater than 6" depth. 2.
 - Under Paving: Provide compaction of 95% or as specified by the Civil Engineer plans and specifications, whichever is greater, over main lines where they cross under areas with concrete or AC paving.
 - In Landscape Areas: Compact all other trench backfill to a minimum of 80% b. and a maximum of 85% in landscape areas.
- D. Trench Depths – Minimum Cover: Excavate trenches deep enough to provide:
 - 24" of cover over Mainlines and lines under continuous pressure. 1.
 - 18" of cover over Lateral lines. 2.
 - 24" of cover under paving for all pipes. 3.

E. Separation:

- 12" minimum of horizontal clearance between lines of other trades. 1.
- 2. 6" minimum of horizontal separation between all irrigation lines
 - Unless otherwise approved in writing by COP.

2.05 THRUST BLOCKS

- Thrust Blocks sizes and dimensions shall be based on 2000 lb per square foot. See A. Details
- 2.06 FERTILIZER PROPORTIONING SYSTEMS (FERTIGATION) - NOT USED

PART 3 - EXECUTION

3.01 INSPECTION AND SITE ACCEPTANCE BY THE CONTRACTOR

- Α. Examine final grades and installation conditions.
 - Do not start irrigation system work until all unsatisfactory conditions are corrected.
 - Inform the PM/CM of all unacceptable conditions, such as debris and incorrect rough grade conditions
 - 2. Confirm that all soil preparation has been completed or scheduled and approved by the IOR/CM/PM.
 - Commencement of work by the Contractor, without prior notification to the PM/CM 3. shall indicate the Contractors acceptance of the site.

PREPARATION 3.02

- A. Layout: Layout and stake the location of each pipe run and all sprinkler heads and sprinkler valves. Obtain IOR inspection and approval prior to excavating.
 - Confirm that pipe runs will not conflict with buried utilities or improvements.
- B. Sleeves: Place sleeves as indicated for installation of piping and control wire - confirm depths and locations with the IOR.
 - Install sleeves into street tree wells per COP Standard Tree Well Details and a. requirements.

3.03 INSTALLATION

- General: Provide all needed materials, products, tools, equipment, labor and Α. miscellaneous items needed to provide the Owner with a complete and operational system. Perform all installation in a workmanship manor that equals or exceeds industry standards. If there are specific standards and/or requirements contained within this specification or General/Supplemental Conditions that exceed industry standards than the more stringent standards are required.
- B. Excavating and backfilling:
 - All excavation shall be considered unclassified excavation and include all materials encountered, except for rocks exceeding 3" in diameter and all non-soil or mineral debris, which shall be removed and not included in the backfill.
 - 2. Excavate trenches to depths necessary to provide the minimum required covers and widths necessary to provide minimum separations and to permit proper handling and installation of pipe and fittings.
 - Backfill to match adjacent grade elevations with approved earth fill material. Place 3. and compact fill in layers not greater than 6" depth.
 - Provide compaction of 4.
 - 95% over main lines where they cross under areas with concrete or AC paving - See Civil Engineer plans, details and specifications for requirements for sleeves under walk, drive lanes, roads and fire lanes. Civil Engineer requirements shall take precedence under paving.
 - 85% over all other trench backfill in Landscape Areas to a minimum of 80% b. and a maximum of 85 %.
- C. Backflow Device: See Civil Plans and Specifications
 - If provided by others see Civil Plans and specifications 1.
 - Install per State, City and Water Purveyor Codes and standards. 2.
 - Provide a 4" thick concrete pad sufficient to support the backflow device and cage. 3.
 - Backflow shall be Double Check Lead Free See Irrigation Legend
 - Install per COP standard details and specifications a.
 - Proved all shut off valves and testing petcocks. b.
 - Install with Unions at both inflow and outflow C.
 - Service Line in and Mainline Out shall be full line size directly to the backflow. d. All reductions shall take place at the backflow device utilizing reducing bushings as needed.
 - All plumbing and fittings shall be galvanized. All galvanized pipe and fittings e. shall be wrapped with Scotts 10 mil plumbers wrap (or approved equal).
 - f. Install plumb and level with a minimum of 12" clearance from the concrete pad and device, unless more is required by local codes - confirm with IOR prior to installation.

- g. Flush, Test and Certify prior 98% review.
- 5. Miscellaneous: Install Cage and polar blanket per plans and details.
- D. Ring Tite Plastic Pipe: 6" and larger diameter pipe (May be used for sleeves)
 - 1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
 - 2. Saw cut plastic pipe. Use a square-in sawing vice, to insure a square cut. Remove burrs and shavings at cut ends prior to installation.
 - 3. Do not exceed manufactures recommended angle changes for fittings.
 - 4. Do not exceed manufactures recommended radiuses size dependent.
 - a. The contractor shall receive specific approval from the COP PM/CM in writing prior to rerouting mainlines runs/locations shown on the plans, including the use of radiuses where not shown.
 - 1) Radiuses will not exceed Manufactures recommended deflection.
- E. Glued Plastic Pipe: 4" and smaller diameter pipe (may be used for sleeves)
 - 1. Contractor to provide Glue training for all supervisors and installers.
 - a. All laborers working must be trained, certified by the glue manufacture and wear identification see Quality Control
 - 2. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
 - a. Radiuses will not exceed Manufactures recommended deflection.
 - 3. Saw cut plastic pipe. Use a square-in sawing vice, to insure a square cut for pipes 4" diameter or greater.
 - 4. Remove burrs and shavings at cut ends prior to application of primer, glue and installation.
 - 5. Clean all soil from uncut ends prior to installation.
 - 6. Make plastic to plastic joints with solvent weld joints for slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions.
 - 7. Make plastic to metal joints with plastic male adapters.
 - Make solvent weld joints in accordance with manufacturer's recommendations.
 - 9. Allow joints to set at least 24 hours before either air or water pressure is applied to the system.
 - 10. Maintain pipe interiors free of dirt and debris.
 - Close all open ends of pipe by acceptable methods when pipe installation is not in progress: including breaks, lunch times, delays and at the end of each work day.
- F. Flushing: All lines shall be flushed until clear water and all debris has exited.
 - All mainlines shall be flushed prior to pressure testing and the installation of control valves.
 - 2. All lateral lines shall be flushed prior to installation of irrigation heads/pop ups.
 - 3. All lateral lines shall be flushed again after the installation of popups and risers.
 - 4. All driplines shall be flushed prior to capping any header/footers.
 - 5. All driplines shall be flushed prior to installation of flush valves, air relief valves and operation indicators.
- G. Pressure Tests:
 - 1. All mainlines shall be pressure tested to 120 psi for 48 hours if installed and pressure tested in section, the entire system shall be pressure tested at 100 psi for 24 hours see Quality Control
- H. Sprinklers, fittings, valves, and accessories for Spray Systems:

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- 1. Install fittings, valves sprinkler heads, risers and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
- Set sprinkler heads perpendicular to finished grade and 6" inches from pavement 2. edge, except as otherwise indicated on the plans.
- Nozzle changes and adjustments as needed to provide head to head coverage shall 3. be made at no cost to the Owner.
- Obtain IOR's inspection review and acceptance of height for proposed sprinkler 4. heads and valves prior to backfill installation.
- Locate sprinkler heads to assure proper coverage of indicated areas. 5.
 - Make field adjustments as needed, but Do Not exceed sprinkler head spacing distance indicated - Nozzle changes within 1 -2 sizes of those specified may be made as needed on a case by case basis.
 - Additional field adjustments shall be made at the recommendation of the LA, b. at no additional cost to the Owner.
- 6. Install pop-up gear driven sprinklers with an adjustable triple swing joint riser of at least 3 standards 90 degree elbows. Size to match the size of the rotor or rotator inlet.
 - a. Refer to irrigation drawings. All other nipples of the swing joint riser shall be of length as required for proper installation of the sprinkler head.
 - All sprinkler popups and heads on risers shall be mounted on triple swing b. joints.
 - Do not use Teflon tape on swing joints or at the base of sprinklers.
- 7. Adjust heads and install spares as needed
 - Including but not limited to trenching, adjusting, pipe and irrigation head installation at no additional cost to the Owner.
- Install backflow prevention, isolation valves, valves, fittings, and accessories as 8. shown or required to complete the system.
- 9. Install in-ground control valves in a valve access box as indicated.
- Install valve access boxes on a base of clean gravel with bricks at each corner to provide a level firm foundation at proper grade and to provide drainage of the access box.
 - Valve boxes shall be perpendicular to adjacent walkways, evenly spaced. a.
 - Valve box tops shall be 1" above the adjacent soil level. b.
 - If the site slopes the valve box lids shall slope to match the finished grade. C.
 - Lids shall be able to close completely, clearing valves by a minimum of 1". d.
 - If boxes fill with soil/silt, remove and replace with new gravel. e.
 - All valve boxes shall be locked
- Seal threaded connection on pressure side of control valves with Teflon tape or approved plastic joint type compound.

I. Quick Coupling Valves

- Install quick-coupling valves with an adjustable triple swing joint riser.
- 2. Install in valve boxes with the top flush with the finish grade, 8 inches from the pavement and heads.
- Furnish two (2) valve keys with inverted hose bibs and (2) swivel hose ells to the 3. PM/CM along with the required spare irrigation parts prior to substantial completion.

Controller and Enclosure: J.

- Install the controller per manufactures specifications, requirements and 1. recommendations.
- Install controller and enclosure in COP Right of Way per COP standard details, 2. specifications and requirements.
- Provide enclosures as noted on plans 3.

- Enclosures shall be secured in place and installed per manufactures a. recommendations and requirements.
- Confirm wire conductivity from Valves to the controller 4.
- Provide wire and connection to the Ethernet 5.
- Confirm connection, operation and operational compatibility with the COP central 6. control system.
- 7. Install all above ground wires in rigid metal electrical conduit
- All connections shall be in an orderly, neat workmanship manner 8.
- Provide Start Up and Certification of proper installation and operation by the 9. Controller Manufacture prior to the start of the Maintenance Period.
- 10. Provide COP Staff training, a minimum of 1 training is required.
- Provide COP staff with model seasonal programs that meet WELO Maximum Water Allowances.

K. Control Wiring:

- Install control wire in the piping trenches wherever possible.
 - All wire shall be placed in electrical conduit
 - Place wire in trench adjacent to pipe.
 - Install wire with slack to allow for thermal expansion and contraction. C.
 - d. Expansion loops in wire to be provided at 200-foot intervals by providing 4' of wire as of slack in a valve box.
 - Where necessary to run wire in a separate trench, provide a minimum cover e. of 24" with detectable warning tape 12" below finished grade as detailed.
- 2. Provide sufficient slack at site connections to remote control valve in control boxes and at all wire splices to allow raising the valve bonnet or splice a minimum of one foot (1') above the top of the valve box lid without disconnecting the wires when repair is required.
- 3. Install the Decoder to each valve; connect each remote control valve decoder to the 2-wire system as recommended by the Controller Manufacture. Utilize one controller station per decoder otherwise indicated.
- Make wire connection to remote control electric valves, decoders, surge protectors 4. and splices in the field using wire connectors in accordance with manufacturer's recommendations.
 - The Contractors installation personnel shall be trained by the 2 wire supplier on the proper installation and connection procedures for 2 wire.
- Wire nuts provided with the DBY packages shall be used to tightly twist wires 5. together prior to insertion into the DBY's to the bottom of the receiver such that the sealant completely fills and covers the wire nuts to provide tight joints to prevent leakage of water and corrosion build-up on the wire connection.
- 6. Wire splices shall only be made in accessible valve boxes or wire splice boxes - No wire splices shall be buried directly in the soil.
- 7. Utilize sleeves under paving for all wire runs.
- Any wire jacket that is skinned or cut shall be immediately removed and replaced and a wire splice provided in a splice box at no additional cost to the Owner -
 - All splices place in a box and the location shall be identified on the 'As Build' plans.
- 9. All wire runs shall be tested for conductivity to be within the manufactures recommendations.
 - Tests shall be inspected and verified by the IOR prior to backfill a.
 - If wire is to be backfilled in phases, the wire shall be tested for conductivity at b. each phase prior to backfill.

L. Adjustment:

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- 1. After sprinkler piping and swing joints and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
- Perform system testing upon completion of each section. 2.
- Adjust sprinklers after installation for proper and adequate distribution of the water 3. over the coverage pattern. Adjust for the proper arc of coverage.
- Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting 4. screws as required for proper radius. Interchange nozzles patterns as needed, to give best arc of coverage.
- Adjust all electric remote control valve pressure regulators and flow control stems for 5. system balance and optimum performance.

M. Controller Operation:

- Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required of each season per Service section below.
- Provide Owner with a Irrigation schedule that matches WELO requirements. 2.

N. Service:

- Service equipment regularly and as needed during the Maintenance Period. 1.
- The Contractor shall perform all modifications, repairs and/or adjustments as 2. recommended by the Water Auditor prior to the start of the maintenance period.

3.04 Disposal of Waste Material

- A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.
 - Comply with all Cal Green requirements. a.
- B. Maintain disposal route clear, clean, and free of debris.
- C. The Contractor shall maintain a clean site and shall dispose of debris on a weekly basis, daily if within the Public Right of Way if accessible to the public.

3.05 Water Audit & Backflow Preventer Testing

- Α. Prior to the start of the Maintenance Period, the COP shall select and the Contractor shall pay for an independent 3rd party Certified Water Auditor to perform a Water Audit on the entire irrigation system when completed.
 - The Contractors foreman shall be present, and shall operate the irrigation system and provide all other assistance as needed and directed by the Water Auditor
 - All modifications required by the water auditor must be completed prior to start of the 2. maintenance period.
 - If the project is built in phases, each phase shall be tested prior to the start of the 3. maintenance period.
- B. Prior to the start of the Maintenance Period the COP shall select, and the Contractor shall pay an independent 3rd party Certified to test Backflow Preventers to perform tests and certify the Backflow device, the Contractor shall make any adjustments and corrections as needed.
- C. Contractor shall test and demonstrate to the Owner satisfactory operation of the system free of leaks.

38 84 00 **IRRIGATION** D. Instruct the Owner's designated personnel in the operation of the system, including adjustment of sprinklers, controller(s), valves, pump controls, and moisture sensing controls and any other equipment/components.

3.06 Acceptance

- A. All record documents (As Builds) must be approved and submitted prior to the start of the Maintenance Period.
- B. The Maintenance Period shall not begin until
 - All Record Documents (As Builds) and
 - 2. Spare parts have been provided and approved.
 - 3. Booster Pump, Controller and other Irrigation systems are 100% operational
- C. Payments may be withheld per the General Conditions and contract stipulations for non-compliance.

3.07 Cleaning

- A. Perform cleaning during installation of the work, at minimum once per week,
- B. The site shall be clean and weed free prior to the start of the Maintenance Period, as needed or as directed by the PM during the Maintenance period and immediately prior to final completion of the work. Remove from site and legally dispose of all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

100% 10-22-2020

SECTION 32 93 00 - PLANTING - LANDSCAPE

PART 1 - GENERAL

1.01 DEFINITIONS

- Owner, Client, and City of Porterville (COP): Shall all mean and represent the City of Porterville.
- B. Construction Manager (PM/CM): Shall mean the Person/Firm/Company that the City of Porterville (COP) retains to be responsible to communicate, relay decisions for the COP to the Contractor, manage the schedule, verify performance to plans and specifications and give direction to the Contractor regarding project.
- C. Owners Representative or Project Manager (PM): Shall mean the person(s) from the Public Works Department or other assigned Department within the City of Porterville that has been made responsible to communicate, make and relay decisions for the COP and give direction to the PM and Contractor regarding the project.
- D. Inspector of Record (IOR): Shall be the Inspector that the COP has assigned to inspect the Contractors work and compliance with the plans and specifications. IOR may inform the Contractor of compliance or non-compliance with plans and specifications and issue statements to the CM/PM/LA and Contractor of the same.
- E. COP Staff: Shall mean all employees of the COP that are not the PM which may be requested/directed by the PM to provide direct information to the CM, PM,PA,LA and/or Contractor.
 - Any contact with COP Staff shall only occur with the permission of the PM/CM.
 Meetings and conversations shall only occur in the presence of the PM/CM and
 documented by the Contractor and PM/CM.
- F. Maintenance and Operations Staff (M&O): Shall be the COP staff responsible for maintenance and operation of the COP physical plant. Specific M&O staff will be identified by the PM/CM as the individuals who may provide the Contractor with information.
 - 1. Prior to requesting information from the designated M&O staff the Contractor is required to request, stating the exact purpose, in writing and receive permission from the PM/CM, in writing, to contact the M&O staff.
- G. Contractor: See General Conditions Definitions. Shall mean the General Contractor or Individual Prime Contractor who has contracted directly with the COP.
- H. Contractors Representative: Shall mean an owner, principal and/or managing employee of the Contractor who has been authorized by the Contractor to discuss details of the project with the CM, PM, IOR, Architect and Landscape Architect.
 - 1. The Contractors Representative shall be authorized by the Contractor to receive information from and make binding decisions with the CM and/or PM.
- Sub-Contractor: Shall mean a licensed Contractor who has been sub contracted by the Contractor to perform specialized portions of the work within the Contractors contract requirements.

- J. Architect (PA): Shall mean the Project Architect/Architectural Firm that has been retained directly by the COP to manage the design of the overall project, retain sub-consultants (including the Landscape Architect), review all portions of the project within their scope of services, and make reports and provide recommendations to COP.
 - The Architect may also provide direction to the Landscape Architect as well as other sub-consultants under their master contract with the COP.
- K. Landscape Architect (LA): Shall mean the project Landscape Architect/Landscape Architectural Firm that has been retained directly by the Architect to design, review the project, report and provide recommendations to the COP via the Architect and/or PM as directed by the Architect and COP.
- L. Arborist: Shall mean the COP Arborist or Consulting Arborist selected by the COP. The Arborist shall be notified prior to construction and trenching, and shall be the authority related to tree protection evaluating excavation and trenching within the designated drip zone and aid the IOR in determining compliance or any violations to the Tree Protection Specifications and shall be the authority in determine the extent of any damage and determiner of any monetary damages that the Contractor shall owe to COP should damage occur to existing trees. The COP may choice to assign certain Arborist tasks to the LA.
- M. Sub Consultants: Including but not limited to the Civil Engineer (Civil, CE), Electrical Engineer (EE), Landscape Architect (LA) that are sub consultants to the Architect that have been retained directly by the Architect or COP to design, review specific portions of the project, report and provide recommendations to the COP via the Architect and/or PM as directed by the Architect.
 - 1. The Contractor may be directed through the specifications, references, plan notes, details, legends or PM to refer to the sub consultant documents to coordinate their.
 - 2. Conflicts shall be immediately brought to the attention of the Architect and Landscape Architect in writing and direction requested and received prior to proceeding with any work.

N. Discrepancies:

See Instructions to Bidders - Interpretation of Contract Documents and General Conditions

Discrepancies shall mean any difference in quantity, quality, size, product, method etc. between the specifications, notes, legends, plans or the Architects and sub consultants plans and specifications that the Contractor is directed to. In the case of any discrepancy the Contractor shall:

- 1. Immediately notify the Architect in writing. Specifically noting and including
 - a. The exact nature of the discrepancy
 - b. The exact location(s) of any discrepancy on the plan(s), note(s), legend(s), detail(s). Contractor shall provide a legible and marked up plan or document showing the exact locations. Discrepancy reviews will be return without review until the marked up plans or specs are received from the Contractor.
- 2. The Contractor shall not proceed with construction affecting the discrepancy until the Architect or PM has responded with direction and authorization to proceed.
- 3. The Contractor shall be responsible for all work, materials, equipment and incidentals needed to properly install the work in completely at no additional cost to the Owner.
- 4. In the event of a discrepancy the most stringent, highest quality, largest quantity/volume, etc. shall prevail and the Contractor shall be responsible providing and installing the most stringent requirement(s) at no additional cost to the Owner.

- a. Example #1: If a legend calls for a locking valve box with bolts and another reference calls for valve boxes with stainless steel bolts, the Contractor shall provide stainless steel bolts for all valve boxes at no additional cost to the owner
- b. Example # 2: The planting legend calls for 250 1gal. Plants for plants species XYZ, however the planting plan only shows 225 XYZ plants the Contractor shall provide and install 250 plants, the extra 25 plants at locations indicated/directed by the LA/PM, at no additional cost to the owner, unless specifically directed otherwise by the Architect in writing, in which case a credit will be issued to the COP by the Contractor.
- O. Establishment: Shall be the establishment of plant material, from delivery, storage, planting, throughout the Construction period, into and through the maintenance period.
 - 1. The Contractor shall provide all services needed to maintain plant material in a healthy and actively growing state. This shall include but not limited to, adequate and timely application of water to meet the plant material needs based on hydrozone, corrective pruning (only as recommended by the LA or COP Arborist and as directed by the PM), weeding, pest management or other recommendations approved by the PM.
- P. Field Adjustments: During the course of the construction the contractor shall make any all field adjustments as needed and or recommended by the CM/PM/LA to accommodate minor changes in the project layout adjustments due to relocation/adjustments of utilities, site paving, grading, structures or previously unknown existing conditions. The Contractor shall make these adjustments whether improvements have been installed or not at no additional cost to the owner.
 - 1. Should the Contractor request Field Adjustments for their conveniences, which are approved by the COP, these shall be at no additional cost to the Owner, even if there are additional materials, equipment or labor required by the Contractor to accomplish the field adjustment(s).
- Q. Protect: See General Conditions Protection of Work and Property. To protect from damage.
 - 1. Existing Planting (Turf, Trees, Shrubs): If existing, protect existing trees, shrubs and turf to remain in place, as shown/noted on the plans or further defined in the specifications. See Tree Protection Specifications if existing trees on site.
 - 2. Protection Measures: Protection includes warning fencing, protecting tree root zones during construction; provide sufficient periodic deep watering and fertilizer to maintain remaining trees and shrubs in a healthy state
 - 3. No material storage or parking within the designated protection zone is allowed.
 - 4. Protect Existing Improvements: Protect all existing utilities, paving, plant material (turf, trees and shrubs), structures and all other existing site improvements intended to remain.
- R. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged.
- S. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, protect, clean and store (ready for reuse). Include fasteners or brackets needed for reattachment elsewhere.
- T. Spare Parts and Materials: All materials shown on the plans or required in the notes, legends or specifications shall be considered the property of COP.

- 1. Any that are not used during construction shall be considered spare parts and delivered in clean unused condition to the PM/CM prior to the start of the Maintenance Period, at no additional cost to the owner.
 - a. For Example: if the plans show 200 pop-up spray heads with swing joints and nozzles and due to any reason, only 180 are installed, the remaining 20 shall be considered spare parts and delivered to the PM/CM prior to the start of the maintenance period.
- 2. Any additional spare parts required in these specifications shall be considered the property of COP and shall be available for use in addition to the parts and materials shown on the plans and/or required in the notes, legends or specifications.
 - a. The contractor shall provide all labor, materials, equipment and miscellaneous parts needed to properly install these items as recommended by the LA and/or required by the COP CM/PM/IOR at no additional cost to the Owner.
 - b. These spare parts shall be available to the COP to be used on the site in the event of changes in site/field conditions that might require modifications to the design.
 - c. For Example: Should there be 200 pop-up spray heads with swing joints and nozzles be shown on the plans and all are installed, and due to any reason, an additional number of heads indicated as needed by the Landscape Architect, the Contractor shall install those additional heads (up to the total spares required below in these specifications) at the locations recommended by the LA/PM. The Contractor shall including and provide all trenching, backfill, labor, equipment and materials needed to properly install all spares noted in the specifications at no additional cost to the Owner. Any spares that are not used or installed shall be considered spare parts and delivered to the PM/CM prior to the start of the maintenance period.

U. Submittals:

See General Conditions – Submittals, Shop Drawings and Submittals, and Samples

Shall be the Contractors required, product and materials submittals shown and/or noted in the specifications and on the plans, and soil samples to be submitted in the time and format require:

- 1. Clearly marked manufactures cut sheets for all material and products to be used.
- 2. Physical materials and/or product samples where called for in the specification.
 - Physical Samples shall be accompanied with the Manufactures cut sheet and product information data
- Contractor shall be responsible for the delivery and cost of all submittals, including physical submittal samples to the Architect and from the Architect to the Landscape Architect.
- V. Tree Dripline (Dripline): Shall mean the outer most portions of existing tree(s) canopy, (branches, leaves or stems with or without leaves). Irrigation water delivery tubing shall be noted as 'Drip Line'.
 - 1. Driplines shall be determined by a vertical plumb line from the outermost portions of the canopy in a vertical line.
 - 2. The contractor shall verify the exact location with the IOR prior to any work. In case of discrepancy between the IOR and Contractor the COP arborist or LA shall be the final arbiter.
- W. Maintenance: Shall be the maintenance of all components contained within the Contractors contract. The Contractor shall be required to maintain all improvements:

- 1. During construction.
- Completed phased improvements until the completion of all phases
- 3. For the duration of the Maintenance period, length noted elsewhere
- X. Warranty: Warranty repair and replacement for the workmanship and all products used and installed by the Contractor, including materials and products purchased by the COP and installed by the Contractor. All Warranty repairs and replacements shall be at no additional charge to the Owner.
 - 1. During Construction and Maintenance Period: The Contractor shall Warranty all work during these periods and shall make immediate repairs (within 24 hours) to any and all non-conforming, substandard work and materials.
 - 2. Warranty length: Unless otherwise noted shall be a minimum of 1 calendar year from the date of the project Notice of Completion.
 - 3. Warranty start shall begin at the Notice of Completion
 - 4. Warranty Repairs: Notification to the Contractor of repairs deemed required by the PM/CM or IOR deemed to be:
 - a. Emergency repairs to protect the Public Health Safety and Welfare or to protect eminent continuing damage to major existing conditions shall be control, mitigated and repaired within 24 hours of notice, including weekends and holidays.
 - b. Critical nature to the Public Health Safety and Welfare shall be completed within 48 hours of notice.
 - c. Critical to the survival of plant material or potentially detrimental to any other site improvements shall be completed within 3 business days or 6 calendar days, whichever is shorter.
 - d. Non-critical nature shall be completed within 10 business days.
- Y. Water Efficient Landscape Ordinance (WELO): California State Law 2015 Updated Model Water Efficient Landscape Ordinance for efficient application of water to landscape areas.
 - 1. The Contractor shall confirm to all WELO required irrigation system installation, application of water, performance, scheduling, testing and documentation requirements.
- Z. Contract Grow: Contracting with Nursery suppliers to grow and or secure plant material specifically for this project.
 - 1. See submittal, approvals and time line requirements the Contractor shall comply with to secure plant material.
- AA. Record Documents:

See General Conditions - Contract Close Out

1.02 DESCRIPTION OF WORK

- A. Work Shall Include: All labor, materials, tools, transportation and performance of all the work required as indicated on the Drawings and Specifications and reasonably incidental to:
 - 1. Submittals All products and materials including physical samples
 - 2. Coordination between all phases and with other contractors.
 - Secure of plant material at the start of the contract, including but not limited to Contract Growing
 - 4. Contract Grow Monitoring

- a. Availability confirmation, specifications, and delivery schedules for all plants pre-purchased, tagged or secured by COP
- 5. Secure, purchase, install, maintain and warranty all plant material if not scheduled, secured or previously purchased by COP
- 6. Schedule, Track and coordinate delivery of all plant material pre-purchased by COP, if any. The Contractor shall be informed of any materials pre purchased or provided by the COP.
- 7. Schedule delivery of all materials and plant material purchased by the Contractor
- 8. Storage and maintenance of plant material after delivery and prior to planting
- 9. Early delivery (if needed) of plants needed to be delivered early due to nursery delivery requirements, acclimatization and/or project delays.
- 10. Rough Grading and over excavations as shown on plans and details.
- 11. Layout and installation of curbs, steel edging etc. if shown on plans to be provided by Contractor.
- 12. Continuous Weed Control
- 13. Planter soil fracture, tilling and/or Pulverization
- Import Soil and soil mixes, Gravels, Sand and other fill materials if shown as required
- 15. Soil Amendment placement and incorporation
- 16. Tree Layout, Tree Pit excavation, installation of Root Barriers and Tree Planting
- 17. Street Tree planting vaults per COP standard details, specifications and requirements
- 18. Street Tree grates and tree guards per COP standard details, specifications and requirements.
- 19. Shrub Layout, Shrub, liner, plug, sod and seed planting
- 20. Concrete Curbs and Pads
- 21. Drinking Fountain purchase and installation
- 22. Fine Grade
- 23. Sod purchase, delivery, installation and maintenance
- 24. Organic and mineral mulch delivery and placement
- 25. Herbicide application
- 26. Interim maintenance during construction
- 27. Maintenance
- 28. Clean up and legal disposal of waste and debris
- 29. Warranty/Guaranty
- B. Complete Project: The Contractor shall be responsible to provide all materials, labor, equipment and incidentals, whether mentioned or shown specifically or not, necessary to complete the work and provide completely and operational landscape systems.
 - 1. For Example: if locking valve boxes are required, but if stainless steel locking bolts normally used to lock valve boxes are not specifically called for the Contractor shall provide the locking stainless steel bolts recommended by the manufacture for use with each specific valve box type at no additional cost to the Owner.
 - a. This requirement shall extend to all products providing a similar function, in the example above, vaults containing irrigation components shall also be required to be provided with stainless steel bolts recommended by the vault manufacture.

1.03 RELATED WORK, DOCUMENTS, REFERENCES AND STANDARDS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division O and Division 1 Specification Sections, apply to work of this Section.

- B. Plans and Specifications by the:
 - 1. All Architects, Civil Engineer, Electrical Engineer and other related project consultants Sections including but not limited to:
 - a. Demolition
 - b. Earthwork & Grading
 - c. Storm Water Pollution Prevention Plans (SWPPP)
 - d. Air Quality Control Requirements
 - e. California Products and Materials Preference See General Conditions
 - f. Paving
 - g. Irrigation
- C. Multiple Prime Contractor or General Contractor Specifications for this Project
- D. COP Contractor Contract Requirements
- E. 2015 Updated Model Water Efficient Landscape Ordinance (WELO) State of California
- F. California Products and Materials Preference See General Conditions.
- G. American Standard for Nursery Stock
- H. Storm Water Pollution Prevention Plans (SWPPP)
- I. Air Quality Control Requirements
- J. City of Porterville Standard Details, Specifications and requirements

1.04 SITE CONDITIONS

- A. Traffic Control: Maintain and coordinate access for vehicular and pedestrian traffic as required for all construction activities.
- B. Erosion Control: Maintain in place all Erosion Control measures; Co-ordinate with PM/CM requirements related to temporary removal/adjustment/replacement/removal and abandonment for execution of work within this section.
- C. Air Quality: Review, comply and maintain all measures need or required for Air Quality Control, including covering and protection of stored materials.
- D. Verification of Job Conditions: Contractor shall verify actual conditions and report any discrepancies between the plans and actual conditions immediately to the PM/CM, refraining from doing any work in said areas until given approval to do so.
 - 1. It is the responsibility of the Contractor to coordinate his work with other trades and be familiar with the locations of drain lines, utility lines and other on grade and subsurface improvements that could affect the planting work.
 - 2. Contractor shall call for location of Utilities via USA North 811
- E. Obstruction To Planting Operations: If rock, plaster, concrete, asphalt, or other debris, electrical cables, conduits or utility lines are encountered and cause conflict with irrigation or planting operations, notify the CM/PM/LA to arrange relocation to avoid unmovable buried objects and/or cleanup work which is not the responsibility of the Contractor.

- F. Contamination: If washout areas or equipment emissions by other the Contractor or other Contractors (i.e.: paint, thinners, concrete slurry, cleaning fluids, oils, fuel, hydraulic fluids, etc.) are encountered, Notify the PM/CM verbally and in writing.
 - 1. No planting is to occur until the area has been cleaned and contaminated soil remove and disposed of by others and new clean approved import fill soil has been imported, amended to match the site, placed, compacted and approved for planting by COP.
- G. Utilities: The contractor shall make themselves familiar with all existing and proposed utilities within the Project Work Limit Line.
 - 1. A minimum of 72 hours (3 full business days) prior to commencement of any excavation, trenching, grading or tilling the Contractor shall contact USA North 811 utility location services.
 - 2. Contractor shall also contact the PM/CM for review of plans and confirmation of any utilities which have been installed or that may be in conflict with the Contractors work.
 - 3. The Contractor shall protect all work previously performed by others. Damage by the Contractor of the work of others shall be brought to the attention of the PM/CM immediately. The PM/CM shall direct the repairs and assign costs for the repairs.
- H. Weed Control: Weeds shall be eradicated from the site starting immediately after site rough grading and the construction of the building pads.
 - During building construction weeding shall occur continuously, at minimum monthly.
 Weeds shall not be allowed to set seed. All weed debris shall be removed from the site and disposed of legally.
 - 2. Noxious weeds, such as Nut grass, Nut sedge, Bermuda Grass, Johnson grass, Star or Russian thistle, or others that may be identified as noxious shall be sprayed regularly with herbicide, as recommended by the Contractors Pest Control Advisor and approved by the COP, and eradicated from the site prior to planting.

1.05 QUALITY ASSURANCE

- A. Examine all sections of Specifications and Drawings for Work related to this Section.
- B. Submittals to Be Provided: Shall be provided to the Architect for all materials and products contained within this specification and shown on the plans, including notes and legends.
- C. Submittals: See General Requirements Specifications. Shall be provided to the Architect for all materials and products contained within this specification as shown on the plants within the timelines required in the General Conditions after the award of the contract.
 - 1. Submittals shall be provided within 31 working days after the award of the contract to the General Contractor or Landscape/Irrigation Contractor on Multiple Prime projects or as otherwise required by the General Conditions. Confirm conformance with the General Conditions.
 - a. If a Landscape Contractor has not by the General Contractor, then the General Contractor shall be responsible for all submittals within the Submittal period.
 - 2. Cut Sheets: are required for all materials and products.
 - a. Cut sheets shall be clearly marked with the Manufacture, size and model number of the exact item being submitted that matches the specifications and/or plans.

- b. If there are any variations marked from what is specified, the contractor shall provide a cover sheet stating the Manufacture/size/model number specified and a written explanation as to why the specified item is not shown.
 - For example: If a manufacture has discontinued or modified a product that was specified and replaced it with another product than that change is required to be noted.
 - 2) If the original product exists and the Contractor is requesting/attempting a substitution without written justification noted above the item will be rejected without review.
- 3. An indexed cover sheet shall be included with the submittal package with the contact information for the specific supply house, wholesaler and sales representative contact information for each product to be supplied by the Contractor.
- 4. The COP/PM/CM/PA/LA reserves the right to contact the manufacturers and suppliers directly with any questions they may have regarding the products submitted by the Contractor for use on the project.
- 5. The contractor shall provide complete submittals for all irrigation and planting requirements:
 - a. The 1st Submittals shall be complete and contain all components within each specification section
 - 1) Irrigation
 - 2) Soil Preparation
 - 3) Planting including contractors Pest Control Advisor liscense
 - 4) All other Landscape Construction related sections
 - b. The Contractors 1st submittal shall be reviewed by the LA and/or other design consultant needed specific to the submittal item, which will make recommendations for acceptance, conditional acceptance, or denial requiring resubmittal for incomplete documentation, missing items and/or substitution requests.
 - 1) If, in the opinion of the LA, 5% or more of the submittal items are not clearly identified as to the specific product, incomplete or missing items the Contractor shall be notified that the submittal is considered void. The submittal package will not be returned to the Contractor. The contractor shall be required at their sole expense to provide a new complete submittal package.
 - 2) Substitutions are not allowed within the submittal packages.
 - c. The Contractors 2nd submittal shall contain all items required to be corrected or completed including any previously missing items.
 - If, in the opinion of the LA, 5% or more of the resubmittal items are not clearly identified as to the specific product, incomplete or missing items the Contractor shall be notified that the submittal is considered void. The submittal package will not be returned to the Contractor. The contractor shall be required at their sole expense to provide a new complete submittal package.
- D. Incomplete Submittals: Any conflicts between the General Conditions and these requirements, the General Conditions shall prevail. If, in the opinion of the LA, 5% or more of the submittal items are not clearly identified as to the specific product, incomplete or combined with missing items the Contractor shall be notified that the submittal is considered void and rejected without review.
 - 1. The submittal package will not be returned to the Contractor.
 - 2. The contractor shall be required at their sole expense to provide a complete new submittal package.
 - 3. Substitutions requests are not allowed within the submittal packages.

- 4. The Contractors 2nd re-submittal shall contain all items required to be corrected or completed, including any previously missing items.
 - a. If, in the opinion of the LA, 5% or more of the resubmittal items are not clearly identified as to the specific product, incomplete or missing items the Contractor shall be notified that the submittal is considered void. Incomplete submittal package will not be returned to the Contractor. The contractor shall be required at their sole expense to provide a complete submittal package.
- E. Subsequent Re-Submittals: If additional submittal reviews, beyond the first two (2) due to rejection based on incompleteness, missing items, substitution, omission, error or other any other cause, than
 - 1. The Contractor shall be responsible for the COP, CM, PA and LA costs associated with the review of the Contractors Submittals.
 - a. These costs will be invoiced at the current (date of submittal) billing rates including but not limited to hourly time, reimbursable expenses (including travel and per diem if incurred).
 - b. These items shall be back charged to the Contractor as allowed in the General/Special/Supplemental Conditions of the Contractors contract and deducted from the Contractors next-payment.
- F. Submittals Physical Samples: See General Conditions
 - 1. Physical Samples 3 of the following are required, each accompanied with clearly marked manufactures cut sheets (independent of those required above)—(these samples shall not be considered as part of the spares). After recommended approval one sample shall be retained by the PA, one by the LA and one sample shall be retained by the PM/CM/IOR on the job site for comparison with the materials delivered to the site by the Contractor. The Contractor shall be responsible for all packaging, shipping, and costs of the physical samples to and from each party:
 - a. Gravel (3 1/2 cubic ft.)
 - b. Filter Fabric (3' square)
 - c. Tree Ties (3)
 - d. Fertilizer Packets (3 of each type)
 - e. Soil Organic Amendments (3 1 gallon clear bags)
 - f. Gypsum (3 1 gallon clear bags)
 - g. Mycorrhiza (3 small sample packs)
 - h. Fill Soil (5 1 gallon clear bags)
 - i. Pesticides, Herbicides, Pre & Post Emergent intended for use during the course of the project.
 - These items are to be supplied with the original submittal package and will be reviewed and approved/denied by the COP not the Design Team. If denied by the COP the Contractor shall provide alternative products that are acceptable to the COP.
- G. Use of Pesticides, Herbicides, Pre & Post Emergent: Chlorinated hydrocarbons, (DDT, Chlordane, Lindane, etc...) or organic phosphates (Parathion, etc...) shall not be used in this work. The use of any USDA or California Department of Agriculture restricted material is prohibited.
 - The Contractor shall submit the name, contact information and copy of the current license of the Pest Control Advisor that is directly employed or retained by the Contractor to make recommendations for products, concentration/mixes and application requirements.
 - a. The products intended for use shall be submitted to the COP in writing at the start of the project for prior approval.

- 2. The Contractor shall submit the name, contact information and copy of the current license of the Pest Control Applicator that is directly employed or retained by the Contractor for the application of the products used.
 - a. The licensed Pest Control Applicator shall be present the entire time that any product is being mixed or applied.
 - b. A written copy of the PCA recommended product, mixing and application instructions shall be available on site for review by the IOR/CM/PM on request.
- H. Installation: Install in accordance with all manufactures recommendations/specifications and applicable codes and regulations.
- I. Experience: Installer shall have had a minimum years' experience and a demonstrated ability in the installation, per the General Conditions, of planting of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship.
- J. Confirmation: Contractor shall check and confirm the static pressure at the irrigation point of connection to the water supply before beginning work and notify IOR, Project Manager, Architect and Landscape Architect in writing of the pressure available.
- K. Review of Plant Material, Prior, at or After Delivery: The Contractor shall allow up to 5% of the quantity of plants to be removed from their containers for review by CM/PM/IOR or LA.
 - 1. The Contractor shall provide the labor, equipment and materials for removal and replacement of the plants into their containers that have been selected to be reviewed at a time as directed.
 - Suspected non-conforming plant material may be reviewed by a plant and/or pest specialist chosen by the COP/LA. Costs for plant and/or pest specialist conformance review and any testing shall be paid by the Contractor if any material is found to be infected or not in conformance. Should materials pass conformance review, the costs shall be paid by the COP.
- L. Schedule: Contractor, within the time required in the General Conditions after signing their contract, and prior to commencement of work, shall provide the PM/CM, IOR and Landscape Architect with a complete schedule of work to be performed; the schedule shall include benchmark dates for all phases of the project. The schedule shall be updated as required in the General Conditions or at minimum once per month, schedules shall be provided to the PM/CM and shall include anticipated dates when each work phase is anticipated to be ready to be inspected.
- M. Utilities: The Contractor shall:
 - 1. Contact USA Locate a minimum of 72 hours in advance of any potholing, trenching, digging or any other type of excavation or grading.
 - Prior to any exaction, digging or trenching the Contractor shall contact the PM/CM for verification of where other buried utilities or objects exist. Any markings provided by the PM/CM shall be maintained by the Contractor during the course of the project.
 - 3. Maintain continuous power and water supply to all facilities that are directly or indirectly affected by this construction,
 - 4. Arrangements are to be made with, and approval received from the PM/CM/Owner for temporary shut-offs. Provide at least 2 business days' notice.

N. Protections:

1. Protect the public health, safety and welfare

- 2. Protect all existing and newly installed site improvements during all phases of the
 - a. Contractor shall immediately notify the PM/CM and not cover any buried utilities or improvements that are exposed, nicked, cracked, broken or cut.
 - b. The Contractor shall immediately report to the IOR any damage to any work of others or existing improvements.
 - c. The Contractor shall not patch or attempt repairs to work performed by others without specific approval by the PM/CM.
- O. Communication: All meetings and correspondence with the CM/PM/IOR/PA/LA, including training, shall be conducted in English. The Contractor shall provide an interpreter, at the Contractors expense, to translate for his/her non-English or poor English speaking representative(s) for all trainings and meetings.
- P. Plant Material Reviews: The Landscape Architect and/or COP shall retain the right to inspect the plant material at any time within normal business days and hours prior to delivery to the site at the source nursery(s).
 - For plant material to be purchased and provided by the Contractor, if requested by the COP and/or LA, the Contractor shall co-ordinate 1 or more on nursery site review(s) by the LA and/or COP representative, led by a knowledgeable representative of the nursery.
 - 2. The COP, based on the recommendation of the Landscape Architect may reject any plant material for any of the following, but not limited to, reasons:
 - Poor plant health,
 - b. Insect, wind or sun damage,
 - c. Weeds in containers,
 - d. Undersized/aged for container size,
 - e. Oversized/aged/root bound for container size,
 - f. Poorly formed structure which varies from individual species standards,
 - g. Scared or damaged trunks or branches
 - h. Deformed and/or poor pruning techniques, broken central leaders.
 - i. Indication of prior water, disease, insect or other detrimental stress factors.
 - 3. Rejected Plant Material: If the COP rejects any plant material, it is the Contractors responsibility to find suitable replacement material. First from the same nursery the plants original came from, if not another approved by COP.
 - a. The Contractor shall provide the Landscape Architect with all the same submittal information required above within 5 working days of being notified by the Landscape Architect that material has been rejected. Replacement plant material shall be provided at no additional cost to the COP.
- Q. County Agricultural Inspections: All plant material grown outside of the Project State or County shall be inspected and approved (with certificate delivered to IOR/CM) for shipment and prior to planting by the County Agricultural Inspector from:
 - 1. The State and County of Origin
 - 2. County where the plant material is temporarily stored or transferred. (ie: Contractors facility in a different County)
 - 3. County in which the project is being built.
- R. Inspection & Reviews: Contractor shall notify the IOR as required in the General Conditions, in advance when each work phase is read to be inspected.
 - 1. Submittals within the required time frame
 - 2. Required Inspections, but not limited to shall be:
 - a. Pre-Construction Meeting shall include required participation by the Contractors Owner/Manager, Project Supervisor and Project Foreperson.

- b. Plant Material Pre-Purchase / Contract Grow / Guaranteed secured documentation within 35 days of contract award.
- c. Monthly confirmation of Plant Material condition
- d. Over excavation and placement of gravels, fabrics etc.
- e. Soil Preparation and Rough Grading
- f. Layout of curbs, edging, structures etc.
- g. Tree, Shrub and Groundcover Layout prior to excavation of plant pits
- h. Plant Material Delivery
- i. Proper storage of Plant Material
- j. Interim watering and maintenance of plants prior to planting
- k. Plant pit excavation
- I. Confirmation calculations of volumes and application rates for soil amendments, organics, fertilizers etc. prior to application and incorporation.
- m. Confirmation that materials delivered to the site are identical to the approved submittals.
- n. Provide weight tickets and delivery slips for all materials to confirm delivered items are
- o. Installation of amendments
- p. Soil moisture content prior to planting (moist to very moist planting in dry soil to nearly dry soil is specifically prohibited)
- q. Planting, including backfill amendment, fertilizer installation and immediate and continuous manual watering and plant pit soils settlement and top off.
- r. Staking
- s. Fine Grade
- t. Turf/Sod soil preparation and fine grade.
- u. Sod installation
- v. Submittal of 'As Builds' and Spare Parts prior to Maintenance Period
- w. Maintenance Period Initiation
- x. Pre Final & Final Inspection
- S. Warranty and Guaranty: See General Conditions. Contractor shall provide a one (1) year warranty and guarantee from the filing date of the Notice of Completion and Final Acceptance of the entire project for all project components that the contractor secure, built or installed unless otherwise modified by the COP in writing.
 - 1. The Contractor shall completely restore all damaged planting, paving, or other improvements damaged or anticipated to be damaged by settlement due to irrigation trenching settlement or other installation activities which have damaged other improvements.
 - After the Final Acceptance the Contractor is not responsible for items which have been damaged, removed or plants that have died due to vandalism, theft or other construction or operational activities beyond the Contractors control.

1.06 SUBMITTALS:

- A. Submittal Due Dates: All Submittals shall be provided within the working days required in the General conditions unless otherwise noted within 31 days of the General Contractors contract award:
 - 1. Pre-Construction Meeting
 - a. Construction Schedule
 - b. Plant Material Delivery Dates based on Construction Schedule
 - 2. 1st Submittal of Products and Materials as Required in the General Conditions
 - Re-Submittal of Products and Materials as required in the General Conditions after return of reviewed 1st Submittal

- 4. Subsequent Submittals of Products and Materials within 5 working days of return of reviewed previous submittal(s)
- 5. 1st Plant Material Availability Submittal within 31 days after award of Contract
- 6. 2nd Plant Material Availability Submittal as Required in the General Conditions after return of 1st Submittal
- 7. Subsequent Plant Material Submittals within 5 days after return of reviewed previous submittals.
- 8. Contract Grow contracts and/or Guaranteed supply confirmations within 5 days after approval and authorization to proceed by COP from Plant Material Availability Submittals 1 and 2 above
 - a. COP reserves the right to approve independent contracts/agreements to secure plant material at each submittal.
 - b. Interim approvals shall be contracted/secured within 5 days provide documentation immediately.
- 9. All other submittals required during the course of the project by the CM/PM/IOR are required within the time required in the General Conditions; including but not limited to: Change Orders, Pricing, Schedules, Confirmations, and Availability etc.
- 10. Soil Samples: Immediately after completion of site rough grading and construction of building pads.
 - a. 3 samples minimum (1 quart each) from locations as directed by the LA
 - b. Contractor shall collect the samples in the presence of the IOR/PM/CM/LA.
 - c. Contractor shall deliver the samples directly to the LA for the LA's delivery to the Soils Testing Lab of the LA's choice. Test results shall be delivered directly to the LA for evaluation.
 - d. Contractor to pay for all shipping/delivery costs.
- B. Substitutions shall not be provided as a Submittal: See General Conditions regarding Substitution requests. Substitutions included in the Submittal package(s) will be rejected without review.
- C. Pre-Construction Meeting: Is required; to be held at a mutually agreed time at the site with the LA/CM/PM/IOR in attendance, as well as including required participation by the Contractors Owner/Manager, Project Supervisor and Project foreperson to review the general and special requirements, site, plans and specifications.
 - 1. The contractor shall provide a schedule for work to be performed including anticipated plant material delivery dates.
- D. Incomplete Submittals: If, in the opinion of the LA, 5% or more of the submittal items are missing, or are not clearly identified as to the specific product, incomplete or any combination of the previous, the Contractor shall be notified that the submittal is considered void and rejected without review.
 - 1. The submittal package will not be returned to the Contractor.
 - 2. The contractor shall be required, at their sole expense, to provide a complete new submittal package.
 - 3. Substitutions requests are not allowed within the submittal packages.
 - 4. The Contractors 2nd submittal shall contain all items required to be corrected or completed, including any previously missing items.
 - 5. Rejected Submittals due to incompleteness, substitutions and missing items shall be considered a delay of project.
- E. Subsequent Submittals and Reimbursement of Costs: If additional submittal reviews, beyond the first two (2) due to rejection based on incompleteness, missing items, substitution, omission, error or other any other cause, than

- 1. The Contractor shall be responsible for the COP, CM, PA and LA costs associated with the review of the Contractors Submittals.
 - a. These costs will be invoiced at the current (date of submittal) billing rates including but not limited to hourly time, reimbursable expenses (including travel and per diem if needed).
 - b. These items shall be charged to the Contractor as allowed in the General/Special/Supplemental Conditions of the Contractors contract and deducted from the Contractors payment(s).
- F. Material Submittals: Via the Architect the Contractor shall provide Submittals for all products and materials to be utilized on site. Submittals shall be the items specified within the plans and specifications. For all Submittals the Contractor shall provide the following:
 - 1. Manufacture Cut Sheets, with all contact information
 - 2. Supplier that the Contractor intends to purchase material from; with all contact information including sales representative familiar with the anticipated order.
 - 3. Exact product identification: Circle, highlight or otherwise mark the specific product to be used including model numbers
- G. Submittals requiring Physical Samples(Accompanied with Cut Sheets): Physical Samples, three (3) each, shall be clearly labeled and accompanied with the corresponding cut sheet (separate from the cut sheets required for the overall submittal package.
 - 1. Each sample shall be clearly labeled, with the label affixed to the material container, with the following information:
 - a. Name of the Material
 - b. Manufacture name
 - c. Supplier: Name, address, contact information
 - d. Sales Representative Name and contact information
 - 2. Soil Samples 3 total at locations directed by the LA.
 - 3. 100% Prilled Gypsum or 98% Ultra-Fine Grind Gypsum (325 mesh)
 - 4. Humic Acid
 - 5. Virgin Redwood Wood Shavings 1" minus
 - 6. Plaster Sand
 - 7. Gravel for tree pit backfill
 - 8. Gravel for Backfill
 - 9. Filter Fabric
 - 10. Decomposed Granite/Rock Mulch 3/8 1/4" minus
 - 11. Wood Chips Mulch
 - 12. Turf Max
 - 13. Nutri Pak Packets (4)
 - 14. Root Barriers (2 full size panels)
 - 15. Edging and Stakes
- H. Submittals Required for All Products including but not limited to (Cut Sheets):
 - 1. Fertilizers for planting
 - 2. Fertilizers for maintenance
 - Turf Max
 - 4. Ground Breaker
 - 5. Nutri Paks
 - 6. Micro Nutrients
 - 7. Mycorrhizae
 - 8. Tree Stakes Tie Downs
 - 9. Central Leader Tree Stakes
 - 10. Green Nursery tape
 - 11. Contractors Pest Control Applicator License and Contact Information

- 12. Plant Material Sources Nursery of Origin Sales Rep Contact Info
- 13. Plant material Photos and Specifications
- 14. State of California Agricultural Inspection Tags/Receipts for Plants on delivery
- 15. Contractors Pest Control Advisor License
- 16. Contractors Pest Control Applicators License
- 17. Proposed Herbicides and pre-emergent intended for use on site for approval by the COP.
- I. COP Pre-Purchased or Secured Plants and Materials: To ensure availability the COP reserves the right to pre-purchase and/or secure contacts and/or pre-tag plant material for use on the project.
 - 1. COP will advise the Contractor of the intent to provide any Pre-Purchased, Secured Contracts or Agreements and/or tagged material at the time of Bidding.
 - 2. Should the COP pre-purchase or otherwise secure any materials the Contractor shall be responsible for securing and purchasing all other materials.
 - 3. If no notice is provided during the bid period than the Contractor shall provide all plant material.
- J. Monitor and Schedule Delivery of COP Pre-Purchased and all Secured Plant Material to be supplied by the Contractor: For COP purchased or secured plants and materials the Contractor is required to:
 - Contact the source nurseries/suppliers and update the COP/LA on the status on a monthly basis.
 - 2. Include in their bid the cost to provide all required co-ordination needed for the delivery from suppliers that have included delivery.
 - 3. Confirm, and make all arrangements needed to provide and pay for delivery for suppliers not providing delivery.
 - 4. COP will provide information, during bidding, of suppliers that have or have not included delivery.
 - 5. After delivery, receiving, unloading, the Contractor shall protect, provide interim maintenance and watering to match the irrigation regime of the source nursery including watering daily as well as on weekends and holidays until planting and the plants are sustained by the irrigation system. If the irrigation system is not operational the contractor shall maintain optimum moisture manually, including multiple daily watering, including weekends and holidays, during hot weather exceeding 80 degrees Fahrenheit.
- K. Plant Material Photos and Specifications: For all plant material items not Pre Purchased by COP or if the plant material is for replacements plants; The Contractor shall provide the PM/CM/Landscape Architect with photos of all trees and shrubs 15 gallon and larger within 31 days of the award of contract; for replacements within 5 days of notification by COP.
 - 1. Photos shall be accompanied with nursery of origin, (including specific block and yard site), and plant specifications: box size, height, canopy spread width, trunk diameter, and plant type (standard trunk, high head trunk, multi trunk, natural branching, low branching column or espalier.
 - Stock photos are not acceptable
 - 2. Photos shall be digital and may be e-mailed directly to the Architect & Landscape Architect within the allocated time frame. Photos shall be of medium to high digital quality and shall clearly show a typical tree/plant for each species.
 - a. If photo quality is poor or individual trees/plants cannot be identified (photographed in a block where the individual tree/plant cannot be discerned or clearly seen as an individual), the Landscape Architect, at his/her discretion, may require additional photos be taken and delivered. These additional photos shall be provided within 3 working days.

- 3. Photos shall include the date that the photo was taken, nursery of origin & location of yard/site in which trees are located and specs.
- L. State of California Agricultural Inspection Tags: For all Plant material delivered to the site including items Pre-Purchased by COP. The Contractor shall provide the IOR/PM/CM with legible and chronologically ordered copies of all plant material inspections. At the source nursery, storage/transfer and point of delivery. The tags shall be specific to itemized delivery sheets verifying that the plant material has been inspected by the State and County Ag inspector at each inspection point and certified to be free from all restricted pests and pathogens including but not limited to: Mediterranean fruit fly, glassy wing sharpshooter, sudden oak decline, fire ants and other restricted pests/pathogens/invasive species.
 - 1. Should any items fail inspection, the Contractor shall be required to immediately perform any and all requirements imposed by the Agricultural Inspector; including but not limited to spraying in place, quarantine, removal, destruction and replacement at no additional cost to the Owner.
- M. Materials Receipts: The Contractor shall submit materials and delivery receipts to the PM/CM/IOR. Submit immediately at the time of delivery. The project name, material and quantity shall be indicated on all receipts.
 - A copy of all receipts shall be legible, in chronological order, punched and bound in a binder. A summary cover sheet shall be provided with each submittal indicating previous shipments versus new.
- N. Confirmation of Quantities: Prior to delivery, the Contractor shall have previously provided to the PM/CM the calculations for the quantities to be delivered in a clear, organized format. The quantities to be ordered must be approved by the PM/CM prior to delivery.
 - The culmination of all material weight tickets and/or receipts shall equal the previously approved quantities.
- O. Delivered Materials: Shall be from the supplier and the materials exactly matching those previously approved in the Submittals.
 - Substitution of suppliers or materials may be rejected by the COP without review.
 - 2. Should substitution of suppliers or materials be considered, for whatever reason, the Contractor shall reimburse the COP for all costs associated with the review by the COP PM/CM/PA/LA at their billing rates at the time of the review, including travel and per diem if needed.
 - a. Review does not guarantee approval. If rejected, reimbursement shall still be required
 - b. Review costs shall be deducted from the Contractors subsequent payments.
- P. 'As Built' Record Plans: 'As Built' original plans shall be provided as required in the General Conditions. Dimensions shall be marked on the plans:
 - 1. Major Tree, shrub, paving or other significant relocations
 - 2. Discovered buried objects to remain.
 - 3. All notations shall be clearly legible.
 - Field marked 'As Builds' shall be converted into a digital AutoCAD format:
 The following shall be on separate AutoCAD layers and distinguished by different colors.
 - b. Dimensions shall be in bright Red
 - c. All notes shall be in dark Yellow
 - 4. Provide 'As Built plans per General Conditions and/or as follows whichever is greater:
 - a. As a digital file PM/CM will provide file name

- b. Full size PDFs
- c. 4 full size plans (in color) shall be provided to the IOR along with the original Field marked plans prior to the Start of the Maintenance Period for the IOR's inspection
- d. 4 copies shall be reduced in size, laminated with vinyl film, (1) copy shall be installed in the controller and the remaining (3) copies and shall be provided to the PM/CM prior to the commencement of the maintenance period.
- e. For Phased Projects; As Built plans shall be updated as required in the General Conditions
- 5. Contractor shall provide <u>all</u> completed "As-Built "plans prior to the start of the Maintenance period.

1.07 INSPECTIONS AND REVIEWS:

- A. Contractor shall notify the IOR as required in the General Conditions in advance of when each work phase is ready to be inspected or reviewed.
- B. Required Inspections and reviews, but not limited to, shall be:
 - 1. Pre-Construction Site Review
 - 2. Rough Grading
 - 3. Soil Fracturing, ripping, tilling, and planter over excavation or Pulverizing
 - 4. Gravel installation
 - 5. Amended soil backfill all materials and components
 - Amendment and Fertilizers deliveries provide IOR with weight tickets and/or delivery receipts
 - 7. Plant material review before/at/after delivery including at source nurseries
 - 8. Plant material layout
 - 9. Planting pit over excavation
 - 10. Clearing of over excavation loose soil and scarification in planting pits prior to planting
 - 11. Plant pit drainage
 - 12. COP Street Tree vault and grate and tree guard installation
 - 13. Placement of gravel for tree plant pits
 - 14. Soil moisture content prior to planting
 - 15. Planting, including elevation of plant stems above finished grade, amendments and backfill compaction
 - 16. Flushing irrigation lines and driplines prior to planting
 - 17. Sprinkler sprays, bubblers and drip line operation prior to planting
 - 18. Fine Grading and Steel Edging Installation
 - 19. Herbicide application
 - 20. Installation of Rock and Wood mulches
 - 21. Weekly 'As Built' plan updates
 - 22. Substantial Completion when 98% + of all work is completed
 - 23. COP Staff Punch List Review Site review with IOR and COP Maintenance & Operations Staff review of all work to confirm compliance with plans and specification and proper operation of all systems and that all M&O staff trainings by the Contractor have been completed.
 - 24. Final Completion Shall only occur only all Substantial and COP Staff punch list items have been addressed and completed.
 - 25. Schedules per General Conditions

- C. No site review by the Landscape Architect and/or COP's representative shall commence without all items noted in previous site review reports being completed or remedied (unless compliance has been waived by COP in advance).
 - 1. Failure to accomplish punch list items or prepare adequately for inspections or reviews or not providing project supervisor capable of making and binding decisions such that addition inspections, reviews or meetings are required shall be considered a Project Delay and shall make the Contractor responsible for reimbursing the COP for the PM/CM/PA/LA costs at their his/her current billing rates per hour including transportation costs and per diem if needed. The reimbursement shall be deducted from subsequent payments.
 - No further inspections or reviews shall be scheduled until the Contractor has
 completed prior punch list items. No time extension on the contract will be allowed for
 these delays caused by the Contractor.
- D. The Contractor shall provide their in house construction supervisor and/or foreman in charge of the project for all standard required meetings, all payment request meetings and all special meetings deemed necessary by the COP's PM/CM/PA/LA. The Contractors construction supervisor shall be capable of:
 - 1. Informing the COP's representative(s) of all pertinent information regarding the project, including schedules and deliveries,
 - 2. Shall have the authority to make binding decisions regarding the work in progress.
 - 3. Be able to read English sufficient to understand plans and specifications.
 - a. All meetings are to be in English. The Contractor shall provide an interpreter, at the Contractor's expense, to translate for his non-English or poor English speaking representatives.
- E. Soil amendments shall be applied to planting areas during normal business hours at specified rates and inspected, approved, and materials and quantities shall certified by COP IOR prior to spreading, covering or tilling in.

1.08 DELIVERY AND HANDLING:

A. Delivery: Deliver seed, amendments, fertilizer and other packaged materials in original unopened containers, showing weight, analysis and name of manufacturers; Store in a dry location per manufactures recommendations, including temperature control if required to prevent deterioration.

Amended backfill soil shall be approved prior to installation.

- B. Contacts: The Contractor shall be provided with the contact information for the source nurseries of items that have or will be pre-purchased by the COP. Sources that include or do not include delivery in the COP will also be noted.
 - 1. The Contractor shall be totally responsible for coordinating with the source nurseries for deliveries; including split deliveries due to phasing, construction schedules or contractors convenience.
 - For Material Pre-purchased by the COP, where the supplier included delivery in the purchase price, COP has included 1 full load delivery for the project, including multiple full trucks for large projects.
 - a. Should the contractor desire/request/require multiple deliveries split into smaller than truck full deliveries within a project phase the Contractor shall be solely responsible for the cost of each additional delivery cost after the first delivery and shall pay for that delivery, prior to delivery at no additional cost to the COP.

- 3. For Material Pre-purchased by the COP, where the supplier does not provide delivery in the purchase price, the Contractor shall arrange for, provide and pay for delivery to the site.
- 4. The Contractor shall be 100% responsible for scheduling, coordinating and/or providing delivery for all plants and materials, including those provided by the COP.
- 5. The Contractor shall be responsible for all equipment, labor, materials and costs to unload the plant material, and shall be responsible for coordinating the delivery with the Nursery or supplier.
- 6. The Contractor shall coordinate the time and location for the County Agricultural Inspection prior to planting.
- C. Ownership of Plant Material or other Materials Purchased by COP: Once COP Pre-Purchased plants or other materials is delivered to the site the Ownership of the plant material shall become that of the Contractor until the completion of the maintenance period and final acceptance/Notice of Completion – whichever is longer.
 - 1. The contractor shall be 100% responsible for maintaining the heath of the plant material and integrity of other materials.
 - 2. Any material that is lost/stolen/damaged/destroyed or plant material that dies, is damaged, lost/stolen or stressed due to planting stress, insect/disease/rodent or mechanical damage, vandalism or loss for whatever cause shall be required to be purchased and replaced by the Contractor (from the original nursery source at the identical size & quality) at no additional cost to the Owner.
 - 3. The Contractor shall inspect the plant material on the truck prior to unloading and immediately inform the IOR of any damage or concerns prior to unloading. Any damage during unloading shall be the sole responsibility of the Contractor and shall be remedied at the direction of the Landscape Architect, if possible. If the damage is severe in the opinion of the Landscape Architect the Contractor shall be required to replace the damaged items at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS, SUPPLIERS AND MATERIALS

- A. All materials shall be as indicated on the plans, legends, notes, details, and as specified herein.
- B. Other manufactures maybe requested by the Contractor and considered by COP See General Conditions.
 - 1. Only one requested substitution per item/product will be reviewed.
 - 2. All other substitution review costs for the COP/CM/PM/PA/LA shall be reimbursed to the COP by the Contractor at their current billing rates including travel and per diem if needed, and shall be deducted from the Contractors subsequent payments.

2.02 PLANT MATERIAL

- A. Ownership: For plant material purchased by COP the ownership of the plant material shall transfer from COP to the Contractor once the plant material has been delivered and unloaded at the project site or interim storage site. For plant material secured and purchased by the Contractor the Contractor will retain continuous ownership.
 - 1. The Contractor shall be 100% responsible for the care and maintenance of the delivered plant material until the project is completed, final acceptance, completion of maintenance period or Notice of Completion is file, whichever is last.

- 2. Plant material that is damaged during off loading, storage, planting or during the maintenance period shall be replaced immediately by the Contractor at no additional cost to the Owner.
- B. Grade: Quality and size shall conform to the American Standard for Nursery Stock. Only nursery grown stock shall be used unless previously recommended for approval by the LA to the COP.
- C. Unacceptable Material: All plant material overgrown and root bound, too recently canned with insufficient roots, or damaged rootballs, diseased, unhealthy or badly shaped, heat or freeze stress/damage, scars or with poor bud/branching unions are considered unacceptable and shall be removed from the site and replaced with acceptable material at no additional cost to COP.
- D. True to Species, Variety, and Clone: Plants shall be the species, varieties and specific clones as indicated and sizes shown on the plan. At least one plant per 25 plants of each variety/clone delivered shall be identified with nursery tag showing complete botanical name.
 - 1. Plants of the same species, but different variety/clone shall be separated at the time of delivery to verify identity.
- E. Plant Material Substitutions: Substitution of plant material species and varieties are not allowed.
- F. Availability: Local unavailability shall not be acceptable cause for substitution.
- G. Reviews: Contractor provided plant materials shall be reviewed and recommend approval or rejection prior to installation.
- H. Plant Acclimatization: All plants shall be nursery grown under climatic conditions similar to this project site.
 - 1. If grown in Cool weather areas, Coastal areas within 50 miles of the coast or a mild climate, the plant material shall be acclimatized prior to installation. This may include but is not limited to delivering to the site or similar site climate in advance of the anticipated planting time.
 - 2. Should the Contractor chose to accept delivery to a holding yard or site other than the project site the Contactor shall be 100% responsible for all additional transportation costs and/or damage to the plant material.
- I. Care of Plants: Contractor shall adequately protect the plants on site from damage.
 - The Contractor shall be 100% responsible for the care of the plants from the time of delivery until the final acceptance, including but not limited to watering, insect and disease treatments, protection from rodents and other animals, mechanical damage, heat/cold stress, transplant shock, vandalism and any other cause of damage or loss.
 - Contractor shall provide care similar to that which the plants were grown under in the source nursery, including, but not limited to, multiple daily watering, including weekends and holidays.
 - 3. During spring, summer and fall, plants shall be thoroughly watered immediately after delivery.
 - 4. Precautions shall be taken to protect frost tender plants newly installed or stored on site from frost damage.
 - 5. Plants shall <u>NOT</u> be stored on concrete or asphalt surfaces or within 100' of west or south facing building walls when temperature exceeds 80 degrees.

6. After delivery, any plant material damaged or lost shall be the sole responsibility of the Contractor to replace, from the original source nursery at the original size and quality at no additional cost to the COP.

2.03 SOIL AMENDMENTS

b.

For the convenience, potential sources for manufactures and suppliers known to be able to provide the specified products are listed in the plans and specifications. See General Conditions and Requirements for potential substitution requests requirements. The Contractor may provide identical or equal products from other sources; see General Conditions for Guarantees required for substitution purposes.

A. Fertilizers

- Backfill plant pits: Add slow release fertilizer Packets:
 - a. NutraPacs

1 GAL.	1 each
2 GAL	2 each
5 GAL.	3 each
15 GAL.	4 each
24" Box	8 each
36" Box	16 each
48" Box	24 each

Existing Trees 24 each

Available from: Green as it Gets

300 Morning Drive

Bakersfield, CA 93306

Contact: Jere White 661-366-3200

B. Specifically Prohibited Materials

- 1. Human, horse, cow, chicken or other waste is specifically prohibited from all products
- 2. Shall be 100% free of any non-organic contaminants: glass, masonry, plastics etc.
- 3. Recycled material specifically prohibited (wood pallets, etc.)
- 4. Organic products containing Eucalyptus and related species, Walnut, Oleander, Yew, Podocarpus, California Pepper, grass, weeds, Castor Bean and others known to have allotropic and/or poisonous properties.
- C. Organic Material to be used in Over Excavated Planters at Building, Turf area backfill and Ground Cover Areas:
 - Virgin Redwood Planner Milled Wood Shavings 1" minus. (0" 1")
 - a. 100% Derived from Virgin Redwood Wood (no bark)
 - 1) ph 4.6 4.8
 - 2) 100% organic material by dry weight
 - b. Mill direct generated and delivery
 - c. Shall be free from all other materials.
 - d. Available from:

Sequoia Horticultural Products Contact: Garrett Worrell 559-591-1177 garrett@seqhort.com or

32 93 00

Anelus Soil Products
Contact: Eric Carlstom
949-616-2047
anelussoilproducts@gmail.com
or
Central Valley Bulk Materials
Contact: Bruce Chastain
559-909-3172
brucecvbm@yahoo.com

D. Amendments

1. 95% - 98% Ultra Fine Grind Solution Grade Gypsum (Gypsum)

By Western Mining Ultra Fine x 95 or approved equal

- a. Shall be minimum 95% Ultra Fine Grind Gypsum containing 95% pure calcitic limestone CaS04 (2H2O) 97.1%, Calcium (Ca) 22.3%, Sulfur (S) 17.7%
- b. Provide in bulk for or prepackaged bags (contractors choice)
 - 1) Cover and Protect bulk material from wind and rain
- c. Application methods (contractors choice)
 - 1) Prilled (pelletized) direct ground application
 - 2) Powder form direct ground application which shall be covered and protect from wind and rain until spread.
 - 3) Water Soluble Spray application May be water suspended in an agitating tank and evenly spray applied
- d. As Manufactured by Western Mining and
 - 1) Available from:

Crop Production Services; Site One Landscape; Simplot; Imperial Sprinkler, Helena chemical, Wilbur-Ellis, American Ag (661) 635-0778 Phil or Jimmy Superior Soil Supplements (559) 584-7695 Andrea Fike sales@superiorsoil.com

- 2. Hydra-Hume DG "Coated" Turf and Ornamental (Humic)
 - Shall be Helena Chemical Company Fine Grind Turf and Ornamental Hydra-Hume 70% Humic Acids (derived from leonardite)
 - b. Available from:

Superior Soil Supplements - Hanford, CA Andrea Fike 559-584-7695 Helena Chemicals – Santa Maria, Ca. (805) 928-7000

- 3. Mycorrhizal Inoculants (Mycorrhiza) by Mycorrhizal Applications
 - a. Turf Areas Ultafine Endo (2 lbs. /5000 sq.ft.)
 - b. Planting Areas MicroApply All Purpose Granular (80 lbs./acre)
 - c. Available from:

Mycorrhizal Applications 541-476-7800 inquiries@mycorrhizae.com

- 4. TurfMax
 - a. Available from:

Green as it Gets 300 Morning Drive Bakersfield, CA 93306 Contact: Jere White 661-366-3200

- 5. Ground Breaker
 - a. Available from:

Green as it Gets 300 Morning Drive Bakersfield, CA 93306 Contact: Jere White 661-366-3200

- 6. Soil Sulfur as determined by soils test
- 7. Ironite as determined by soils test
- 8. Fertilizers and Micronutrients as determined by soils test
- 2.04 AMENDMENTS APPLICATION RATES (for bid purposes, adjustments after soils tests)
 - A. For Trail Only Applied Immediately Prior to 1st Tilling/Ripping/Fracturing or Pulverizing All Areas 18"-20" depth
 - 1. Gypsum 100 lbs/1000 sq. ft. (2.2 tons/acre)
 - 2. Soil Sulfur 32 lbs/1000 sq. ft. (870 lbs/acre)
 - 3. Ironite –5 lbs/1000 sq.ft. (220 lbs/acre)
 - 4. Endo Mycorrhizal Inoculants 2 lb/1000 sq. ft. (88 lbs/acre)
 - 5. Humic 20 lbs./1000 sq. ft. (440 lbs/acre)
 - 6. Ground Breaker 1 gallon/1000 sq.ft. (4.3 gal/acre)
 - Micro Nutrients To Be Determined by soils tests after rough grading
 - B. For Trail Only Applied Immediately Prior to 2nd Tilling or Pulverizing Turf and Turf Substitute (Kurapia) Only (8" Depth Tilling) (Pulverizing 18" satisfies this requirement)
 - 1. Virgin Redwood Shavings 12.0 cu.yds./1000sq.ft.(4" Layer) (523 cu.yds./acre)
 - 2. Ultra Fine Grade Gypsum 100 lbs/1000 sq. ft. (2.2 tons/acre)
 - 3. Humic 10 lbs/1000 sq. ft. (440 lbs/acre)
 - C. For Trail Only Applied to All Planters Non Turf Shrub Areas Prior to Tilling (6" Depth Tilling.
 - 1. Ultra Fine Grade Gypsum 100 lbs/1000 sq. ft. (2.2 tons/acre)
 - 2. Humic 4 lbs/1000 sq. ft. (220 lbs/acre)
 - D. For Trail Only Pulverized Areas (Contractors option in Lieu of Ripping and Tilling)
 - For areas to be pulverized apply all amendments required above to be spread in one pass
 - 2. Pulverizing requires only one pass
 - E. Turf Area Tested Native or previously tested and approved Import Amended Fill Soil
 - 1. Site Soil (75% Soil) blended with (amendments maybe modified based on required soils tests modifications in amendments shall be made by the Contractor at no additional cost to the Owner.
 - a. 25% by Volume Virgin Redwood Shavings
 - b. Endo/Ecto Mycorrhizal Inoculant ¼ lb. per cubic yard
 - c. Humic 2 lb. per cubic yard
 - d. Gypsum 2 lbs per cubic vard
 - e. Soil Sulfur 2 lbs per cubic yard
 - f. 12-6-6 1 lb. per cubic yard
 - g. TurfMax 2 cubic foot per 1 cubic yard of backfill
 - . Micro Nutrients to be determined by Landscape Architect
 - 2. Import Topsoil must be from COP approved source
 - 3 Soils Tests
 - a. Provide 1 gal. Soil sample for testing to LA
 - b. Contractor to pay for all tests
 - c. Test results to be provided directly to LA
 - d. LA will provide amendment recommendations.
 - F. Turf and Sod TurfMax
 - TurfMax 2 Cubic Yard per 500 square feet for Sod areas (grass and ground cover)

- 2. After the Fine Grade has been approved and immediately prior to laying the sod, the Contractor shall evenly apply the following directly onto the finished grade:
- 3. Raised and contained planters 1 cubic foot per 1 cubic yard of backfill.
- G. All Planters including those not receiving Amendments Ground Breaker
 - 1. Ground Breaker 1 Gallon per 5000 square feet
 - a. After the Fine Grade has been approved and immediately prior to laying the sod or planting, the Contractor shall evenly apply the following:
- H. All 15 gallon, 24", 36" and larger plant pits Ground Breaker and Gypsum and Mycorrhizal Inoculants.
 - After excavation, scarifying and clearing spray the sides and bottoms of plant pits with Ground Breaker, thoroughly wetting all surfaces and then dust sides and bottoms with Gypsum.
 - 2. MycroApply Soluable MAXX per manufactures application rates

2.05 MISCELLANEOUS MATERIALS

- A. Tree Grates & Tree Planting Vault: Per City of Porterville Standards. See Details & COP standards.
- B. Herbicides for Post Planting and Maintenance: All shall be applied by a licensed Pest Control Applicator (PCA):
 - Pre-Emergent: Shall be as recommended by the PCA, and previously approved by the COP, shall be applied at the manufacturer's recommendations and requirements for the heaviest application rates. Conform to all national, state, County Department of Agriculture and City requirements, including reporting. Assuming a RonStar or approved equal (to be adjusted per PCA recommendations and approved by COP)
 - a. Granular Application Rate: 4.5 lbs per 1000 sq.ft. (200 lbs/acre) per application
 - Wettable Rate: 2.8 oz. per 3.5 gallons of water/1000 sg.ft. per application
 - Post-Emergent: Shall be as recommended and approved by the Contractors PCA and approved by the COP and shall be applied per manufacturer's recommendations. Conform to all national, state, county and city reporting requirements.

C. Gravel:

- 1. Gravel for plant pit backfill shall be clean non-reactive ¾" crushed gravel gravel generated or containing Serpentine is specifically prohibited. Application rate
 - a. Depth per details under turf in Dog Park
 - b. As needed below 15 gallon plants to eliminate over excavation of plant pits
 - c. 3" minimum under 24" boxes
 - d. 4" minimum under 36" boxes
- D. Metal Edging and Stakes: See Plans and Details
- E. Deep Root Barriers See Plans and Details
- F. Street Tree Planting Vaults, Tree Grates, Tree Guards and all related and needed materials needed to install Street Trees per COP standard details, specifications, and recommendations.

2.06 TOP DRESS MULCHES

- A. Double Grind Shredded Redwood or Cedar Bark;
 - Shall be from Virgin Redwood or Cedar bark. Size shall be 2"-5" average size/length, shreds longer than 6" shall be rejected.
- B. Specifically Prohibited Materials for Virgin Tree Wood Grindings and Double Grind Shredded Bark:
 - Wood from Eucalyptus, California Pepper, Walnut, Yew, Podocarpus, Oleander and other species with allotropic and/or poisonous affects/attributes. Shall be free of all foreign materials not derived from Virgin Redwood tree grindings
 - 2. Any non-organic material glass, masonry, metals etc.
 - 3. Soils
 - 4. Grass, shrubs and non-orchard derived organic material
 - 5. Manures and Human waste of any kind.
- C. For Trail Only Stone Mulch and Rip Rap: Shall be from rock and stone with no soil, glass, metals, plastics organic material or any other contaminates.
 - 1. Rip Rap Rock Rubble: Shall be fractured stone Apache Gold Rock
 - a. See Planting Plan for specific products and colors
 - b. Application Rate 1 cubic yard/15 sq.ft. minimum application rate
 - c. Available from:

Earth Stone Rock 800 215-7372

- 2. Decomposed Granite/Crushed Stone: Shall be crushed rock 3/8" to 1 /4" diameter
 - a. See Planting Plan for specific products and colors
 - b. 3" thick layer after settlement. 1 cubic yard per 100 sq.ft. Minimum application rate.
 - c. Available from:

Earth Stone Rock 800 215-7372

2.07 TURF SOD

- A. "Celebration" propagated Bermuda grass sod
- B. Sod shall be delivered and installed within 24 hours of harvest anytime of the year. Sod not installed within this period shall be rejected.
- C. Sod strength shall be such that the sod rolls or slabs may be handled, lifted and moved without substantial breaking or tearing.
- D. The sod shall be freshly harvested grown from high quality propagated material on fumigated soil with appropriate State and Federal regulatory agency approved pesticides and herbicides for control of diseases, insects, and weeds. Sod shall meet or exceed the standards of the "State of California Regulations for Nursery Inspection".
- E. Sod shall be weed and fungus free at delivery.

PART 3 - EXECUTION

3.01 ROUGH AND FINISH GRADING

A. Work by Others: Rough Grades shall be established under work of other Sections to within 0.1 foot of required finish grades.

B. Import Topsoil:

- 1. See Civil plans regarding the requirements and placement of import topsoil under paving
- 2. Import Topsoil for planting shall be classified as sandy loam free of contaminants and debris.
 - a. Provide 2 1-quart samples with the Landscape submittals during the first submittal (within 31 days of the General Contract award) to the Landscape Architect for testing.
- C. Verify Existing Grades: Rough grades shall conform to the site grading plan and verified by a Licensed Surveyor that the rough grades are within 0.1 foot of finished grades before performing finish grading, soil preparation and planting.
 - 1. Positive drainage away from buildings and structures, along swale flow lines and to catch basins shall be confirmed prior to finish grading.
 - 2. The Landscape Contractor shall not fine grade or plant any landscape areas that do not meet this specification and shall bring these areas to the attention of the IOR and PM/CM. The PM/CM shall be responsible for arranging that the correct rough grades, if the responsibility of others is achieved.

D. Finish Grades:

- 1. All turf areas shall be smooth, even, and level; undulations, ridges and depressions shall be removed prior to planting. The site will be reviewed by the IOR and Landscape Architect prior to planting for approval.
 - a. If required by the IOR or Landscape Architect the Contractor shall place string lines at intervals as directed to determine areas to be corrected prior to planting.
- E. Finish Grading Approval: Grades shall be uniform and smooth and free of depressions and ridges and mounding high points/areas.
 - 1. Finished grade shall be certified by a licensed surveyor.
 - a. Contractor shall make all needed adjustments to conform to finished grades.
 - 2. If required by the COP the contractor shall provide multiple crossing string lines across areas that
 - 3. PM/CM/LA shall observe the final grades for conformance to the design intent communicated on the drawings and give approval prior to any planting operations.

F. Control Growth of Weeds:

- 1. Products as recommend by the Contractors PCA, and previously approved by the COP.
- 2. Products shall be applied by or under the continuous supervision of the Contractors Pest Control Applicator.
- 3. When using herbicides, apply in accordance with manufacturer's recommendations, COP requirements and all Federal, State & County codes, laws and requirements.
- 4. Remedy damage resulting from negligent or improper use of herbicides, including the replacement of plants damaged at no additional cost to the owners.

- G. Grade at Pavement Edges: All finished grades shall feather, a minimum of 10' back from pavement edges no abrupt grade breaks are allowed.
 - 1. Turf Sod: Grade shall be 2" below top of pavements
 - 2. Ground Cover Sod: Grade shall be 1 ½" below top of pavements
 - 3. Mineral Mulches: Grade shall be 3" below top of pavements
 - 4. Rip Rap: Grade shall be 6" below top of pavements

3.02 SOIL PREPARATION

- A. Application and Spreading of Soil Amendments
 - 1. Soil amendments shall be evenly applied to planting areas during normal business hours at specified rates, inspected, approved and certified by COP IOR <u>prior</u> to covering or tilling in.
 - 2. Apply powder, fine grind amendments and any products with a significant approved amount of fines under ¼" immediately prior to tilling of soils. Care shall be taken to not allow powdered amendments to be spread during windy conditions; at no time shall powdered or fine grind amendments be allowed to be blown beyond the project work limit lines.
 - a. Should powdered or fine grind amendments be blown off the site the IOR and/or the PM/CM shall make an estimate of how much material was lost. The Contractor shall be required to acquire and place the identical material estimated to be lost, including a second tilling/incorporation into the soil at no additional cost to the Owner.
- B. Compaction Tests: Coordinate performance of compaction tests with the PM/CM at locations selected by the Landscape Architect.
 - Compaction Tests shall be done at the depths of 12", 18" and 24" in each location shown on the plans plus two additional at locations indicated by the LA after building and paving construction.
 - 2. Prior to fracturing confirm the exact locations of all buried utilities, other improvements and buried objects.
- C. Trail Only Fracturing: Shall be required for all planting areas if Pulverizing is not selected by the Contractor. Should the Contract select Pulverizing for the majority of the site, the Contractor shall Fracture only those planting areas not reached by Pulverizing.
 - 1. Fracture all planting area soils that exceed 85% compaction for any portion of the top 24" of planter soils.
 - 2. Apply required amendments on soil surfaces at the rates required to be inspected and approved by the IOR prior to fracturing.
 - 3. Fracturing shall be to a minimum depth of 20", unless otherwise indicated.
 - 4. See Details.
 - 5. Utilize tractors with ripping tines, backhoes, mini excavators and other equipment, labor and other means as necessary to rip, turn and fracture over compacted soils and coarsely incorporate amendments. Fracturing shall come within 12" of paving and structures.
 - 6. Remove and legally disposed of all debris exposed during the work.
 - 7. The Contractor shall take all needed care to not damage any existing paving, structures or improvements. The Contractor shall be responsible for cost of repair of all damage to known buried utilities and existing improvements at no additional cost to the Owner.
- D. Over Excavation: Shall be performed for all planters adjacent to buildings and/or planters contained (surrounded) by paving including parking lot tree wells.

- Utilize backhoes, mini excavator and hand labor as needed to depths shown in the Details
- 2. Thoroughly incorporate all amendments into excavated soil or import topsoil
- 3. In planting areas indicated to receive Acid Plant Amendments incorporate and thoroughly incorporate amendments.
- E. Trail Only Pulverizing: Contractors Option in Lieu of Ripping and Tilling.
 - 1. The contractor may choose to pulverize all planting areas which can be reached by an Asphalt Pulverizing machine.
 - a. Contractor shall locate and identify all utilities prior to commencement and protect in place. Contractor shall be responsible for reimbursement for all damage and repairs
 - b. Protect all pavements, curbs and other improvements. Contractor shall be responsible for reimbursement for all damage and repairs
 - 2. Areas to receive planting not reached by the pulverizer shall be required to be ripped and tilled.
 - 3. Prior to Pulverization apply all amendments required for both Ripping and Tilling operations noted above.
 - 4. Pulverization shall blend amendments and soils into a friable state adjust speed as needed to achieve a uniform blending.
 - 5. Pulverization shall be to a minimum depth of 18" and a maximum of 20".
 - a. Pulverizing available from:

Pavement Recycling Systems, Inc. 2280 S. Union – Bakersfield, Ca. Contact Mike Akins 661-833-2280 Makins@pavementrecycling.com

- b. Or Previously Approved Equal Equipment and Operator supplier capable of providing identical results.
- F. Tilling: Shall be to the depths noted above in the Materials sections. Tilling shall continue until all organic material and amendments have been thoroughly blended into the soil and the planter soil does not contain clods exceeding 1" in diameter. All areas that have been fractured are required to be tilled until the soil is friable and free of clods over 1" diameter.
- G. Weed, Debris, Clod, and Rock Removal: All areas to be planted shall be cleared of all weeds and debris prior to soil preparation and finish grading.
 - Nutgrass, purple or white nutsedge, Bermuda and Johnson grass, star and Russian
 Thistle and all other noxious weeds shall be chemically killed throughout the building
 and paving construction period and the site it to be kept weed free of noxious weeds
 during the entire construction period and weed free of all weeds prior to planting.
 - 2. Dispose of weeds and debris legally off-site.
 - 3. Remove all clods or rocks over 1 inch in diameter.
- H. Herbicide Application Shrub Areas:
 - 1. Apply pre-emergent after planting of trees and shrubs and after trees and shrubs have been thoroughly watered in a minimum of 3 times and all planting pit settlement has been backfill and water settled.
 - 2. In Wood mulch areas: Pre-emergent shall be placed and watered in per the manufactures recommendations prior to applying the Wood Mulch Top Dress soil with wood mulch after pre-emergent has been applied.
 - 3. In Stone mulch (DG or Rip Rap)
 - a. Apply 1 layer of pre-emergent immediately prior to application of mulch

- b. After DG has been compacted/rolled and smoothed apply a 2nd application. Hand moisten entire surface to activate pre-emergent.
- 4. Take extreme care not to apply pre-emergent over top of or onto moist foliage.
- 5. Plants that experience foliage burn from application of pre-emergent to the foliage shall be replaced immediately by the CONTRACTOR at no additional cost to the OWNER.
- Backfill soil contaminated with herbicide shall be tested and treated with activated charcoal and other remedies recommended in the soils analysis (including removal). Removed soil shall be legally disposed of off-site and replaced at no additional cost to OWNER.
- I. Contaminated Soil: Do not perform any soil preparation work in areas where soil is contaminated. See Quality Control above.

3.03 CONCRETE CURBS, STEEL EDGER AND CONCRETE PAD INSTALLATION

- A. Install edging in locations shown on plans.
 - 1. All locations radiuses shall be layout per plan dimensions reviewed and approved by the IOR prior to installation.
 - a. Peaks, points or indents at joints shall not be allowed. All transitions shall be smooth and continuous lines.
 - b. Provide as many stakes as needed to secure joints
 - 2. Top of steel edging shall be flush with finished grade.
 - See details
 - 3. Concrete curbs and pads shall be installed to COP Standard Details and specifications or per Civil plans and specifications, whichever is most stringent.

3.04 TREE AND SHRUB PLANTING

- A. General: Do not plant until the irrigation system is operative from the irrigation valves and all lines have been flushed.
- B. Location: Locate trees and shrubs in the field as shown on the plans.
 - The LA reserves the right to approve the locations of trees and shrubs prior to planting unless waived in writing. Any alterations to locations shown on the plan must be reviewed and recommended for approval by the LA.
 - 2. Do not plant large trees over water, utilities or sewer mains Coordinate relocation with the L A.
- C. Tree Planting Holes: Excavate holes of circular outline with vertical sides, per the planting details. Holes shall be per details, confirm dimensions with IOR prior to planting.
 - 1. Scarify sides of holes in clay or tight soils, scarification shall be by hand or mechanically over a minimum of 50% of the hole sidewalls.
 - 2. All planting holes excavated by drilling, boring or auger shall be scarified regardless of soil type.
 - 3. Spray the sides and bottom of plant pits with Ground Breaker and dust with Gypsum for all containers 15 gallon or larger.
 - 4. Contractor shall test to determine if water will drain out of planting holes within an 8 hour period, by filling the plant pits a minimum of 1/2 full. If water does not drain out in that time, Contractor shall auger holes and fill with gravel
 - a. 36" Box 3 holes 36" deep
 - b. 24" Box 2 holes 24" deep

- c. 15 Gal. 1 hole 18" deep
- 5. After installing drain holes, spray holes with Ground Breaker and then refill the plant hole with water ¼ full.
 - a. If water does not drain out 8 hours, inform the CM/PM/IOR that impervious soils may have been encountered. Do not plant trees until the site has been reviewed and directions received from the COP as to any remedies they will require.
- D. Tree Planting: Tree planting pits shall be over excavated to the depths and widths, as shown on the details.
 - After excavation remove all loose soil created by scarification, drain hole auguring and over excavation. The bottom of the planting hole shall be undisturbed native soil.
 - a. See Planting Holes above regarding additional requirements.
 - 2. Place an even layer of gravel at the bottom of the planting hole and tamp firm to eliminate sifting when the tree is placed see details.
 - 3. Prior to breaking box bindings insert tree box into place, confirm that
 - a. Standard tree trunks are vertical and plumb in all directions, that
 - b. Multi stemmed trees centered and the center of the tree is vertical.
 - 4. Confirm that the tree trunk /soil interface will be 2"- 2 ½" above finished grade.
 - 5. If the tree is not plumb or too low or too high remove the tree, add/deduct/adjust the gravel as needed and reset the tree.
 - 6. Remove the box side panels and binding ties.
 - 7. Wood bottoms may remain in place.
 - 8. Tease out and/or cut off any circling roots such that roots are able to expand outward to eliminate any circling.
 - 9. If backfill soil is dry, back fill must be accompanied with simultaneous watering
 - 10. Backfill plant pits in lifts no greater than one foot (1') with amended soil before watering in. Watering must accompany planting at each tree/shrub/plant during the spring/summer/fall.
 - 11. Flood Water settle/compact the amended backfill to 85% compaction.
 - a. Add amended soil as needed to fill any voids or settlement within 24 hours.
 - 12. Any trees which shift or settle, such that they are no longer vertical or settle shall have the backfill soil removed the tree reset and backfilled again.
 - 13. Prune plants only as directed by Landscape Architect to correct damage or awkward forms only.
 - 14. For trees whose central leader is not straight provide a 3' long bamboo straightening stake. Attached with 1/2" green nursery tape with 1' secured to the trunk and the leader attached to the upper part.
 - 15. For trees which have lost their leaders, notify the LA to determine if the tree will need to be rejected and replaced. If not the Contractor will be instructed to perform corrective pruning to generate a new central lead and stake as noted above.
- E. Tree Stakes, Ties and Restraints
 - 1. Install tree stakes with ties and Restraints as shown on plans in details.
 - 2. Tree stakes shall be installed as soon as possible after planting, any shifting of the tree due to wind or settlement shall be corrected by the Contractor immediately.
 - 3. Central leader tree stakes shall be installed at the time of staking or before.
 - 4. Remove nursery stakes during the staking process, except central leader stakes.
 - 5. Street trees shall be installed per COP details and specifications

F. Root Barriers:

1. Install root barriers where shown on plans and details and per manufactures recommendations.

2. All root barriers shall be reviewed and approved by the IOR prior to covering.

G. Shrub Placement, Planting and Backfill:

- Cans, pots and boxes shall be removed carefully to avoid damaging the rootball.
- 2. Plant holes shall be per details and not over-excavated
 - a. Planting holes which are over excavated shall be cleared of all loose soil and backfilled with gravel such that the rootball is 1 inch above finished grade.
- 3. Holes dug with a drill or auger shall have the sides scarified manually.
- 4. Set shrubs and trees upright and plumb in the center of holes so that the top of root ball is 1 to 1 1/2 inches higher than grade.
- Backfill with amended native topsoil. Backfill shall feather over the top of the rootball.
 - a. Water in backfill in lifts and thoroughly flood the backfill to eliminate any voids or air pockets.
 - b. Any settlement shall be backfilled with amended site soil within 24 hours.
- 6. Plants with severe circling or crossing roots shall be rejected.
- 7. Plants with slightly circling roots shall have the roots teased and/or cut and spread prior to planting. Review technique with Landscape Architect and/or I.O.R. prior to planting.
- 8. Prune plants only as directed by Landscape Architect to correct damage or awkward forms only.
- 9. Pre-wet planting holes if soil is dry. Add sufficient water to holes such that the soil is moist at least 18 inches in all directions prior to planting.
- 10. Water thoroughly after planting, multiple times the first day and multiple times during week if surrounding soil is dry.
- 11. Water turf, shrubs and trees, by hand or other methods, as needed where the irrigation system is sub surface drip until the plant material can be sustained by the drip system alone.
 - a. The contractor shall not allow plants, trees and turf to stress from lack of water nor over watering.
 - b. The contractor shall not flood the planters with drip such that water freely flows over the soil surface and into curbs and gutters or onto pavements.
 - c. The contractor shall monitor the water application to induce proper plant growth.

3.05 LINERS, PLUGS, FLATS AND SEED PLANTING

A. Liners, Plugs and Flats Planting:

- 1. Liners and Plugs shall be scheduled for delivery by the Contractor and the Contractor shall receive them on site. They shall be immediately inventoried confirm with the PM/CM or IOR to verify species and quantities.
- 2. Immediately water trays of liners/plugs and maintain in a healthy growing condition until plants do not allow them to dry out or stress.
- 3. Kurapia plug areas shall receive the same soil preparation required for sod.
- 4. Fine Grade: The areas to receive liners and plugs will have been fine graded and grade reviewed and approved by the IOR prior to planting
- 5. Moist Planting Soil: The soil shall be moisten prior to planting, if dry, remoisten immediately prior to planting.
- 6. Planting: Excavate planting holes slightly larger than the liners/plugs and immediately install, press soil around the root balls, rootball tops shall be flush with finished grade. Immediately water in, do not allow liners or plugs to dry or stress.
- 7. Replacement of Stressed or Dead: The contractor shall immediately replace any liners/plugs which stress or die at no additional cost to the owner.

- 8. Irrigate Plugs similar to turf, maintain soil in a moist but not saturated condition, including multiple short watering's per day in the Summer. Maintain in plug areas in a continuously weed free condition.
- 9. After Kurapia has filled in to 100% coverage begin bi weekly mowing's at 3/4 inch height with a walk behind reel mower. Take care to allow soil to dry sufficiently to not allow rutting with mowers.

3.06 PRE-EMERGENT:

- A. Do NOT apply pre-emergent until after the plants have been installed and plant wells have been watered at least 3 times and all settlement has been topped off with soil.
- B. Do not apply pre-emergent to any turf or areas to be planted with spreading ground covers until fully established and all bare ground is covered and well rooted.
- C. Rake and smooth the entire bed
- D. Cover Deep Root Watering Grates to insure that NO pre-emergent enters them.
- E. Evenly apply Pre-emergent to the soil surface. Take care that no pre-emergent lands on soil to receive sod, spreading ground cover or on new laid sod.
- F. Take Care that no pre-emergent lands on plants. Should any land on plants, shake and vacuum all material from plants that trap the material inside leaf joints, voids unions. Rinse off broadleaf plants per manufactures recommendations.
- G. Rock mulch areas require 2 applications during installation of the Rock Mulch: 1st prior to applying rock mulch, 2nd application after rock mulch has been smooth and compacted.
 - 1. Water in by hand or by turf sprinkler over throw or other means to activate and spread.
- H. Apply additional applications over all rock mulch areas every 4 months during the Construction and Maintenance periods.

3.07 SODDING TURF

- A. The sod area shall have been completely fractured, tilled, amended, or filled per details irrigated and settled, fine graded and inspected by the IOR and reviewed by the LA.
- B. Compaction shall be a minimum of 80% and shall not exceed 85%
 - 1. Compaction tests required for confirmation
- C. The area to receive sod shall have a smooth even surface,
 - 1. Finished grade shall be certified by a licensed surveyor prior to planting
 - 2. The Contractor is required to remove all depressions, ridges, rills and other imperfections from the finished surface prior to planting.
- D. The ground surfaces shall be inspected prior to installation of the sod to determine suitability of grading and soil preparation for planting. The Contractor shall obtain such approval prior to sod installation.

- E. After approval of grade spray the entire turf area with Ground Breaker, at the manufactures recommended rate, then evenly spread Turf Max at the rate noted in the Materials section immediately prior to laying sod.
- F. Lay sod as soon as possible after delivery to prevent deterioration. All sod must be installed within 8 hours of delivery to the site.
- G. Lay sod closely knit together with no open joints visible and pieces not overlapped. Lay smooth and flush with adjoining paving, curbing, or other sod strips.
- H. Sand any joints or voids that exceed ½" in width during the sod laying process.
- I. Immediately water sodded areas during installation at 1,000 square feet intervals.
- J. Roll sodded areas to insure a good bond between sod and soil and to remove minor depressions and irregularities. Insure rolling equipment weight to be approximately 150 lbs. and of standard commercial width.
- K. After sod has been completely laid, water in sufficient amounts to saturate sod and upper 6 inches of soil.
- L. Maintain sodded areas immediately after placement until the project is accepted by the COP
- M. Mow grass at regular intervals, with a reel mower weekly, or as required maintaining at a maximum height of 3/4 to 1 inch.
- N. First mowing shall occur when grass is 1 ½ inches high. Do not cut more than 1/3 of grass blade at any one mowing. Neatly trim edges and hand clip where necessary. Immediately remove all clippings after mowing and trimming.
- O. Water when required and in sufficient quantities to prevent grass and underlying soil from drying out.
- P. Roll when required to remove depressions or irregularities.
- Q. Control growth of weeds. When using herbicides, apply in accordance with manufacturer's recommendations. Remedy damage resulting from negligent or improper use of herbicides.
- R. Immediately repair or replace any areas which show deterioration or bare spots.
- S. Protect sodded areas with warning signs and warning tape immediately after laying and during the entire maintenance period.
- T. After the first mowing, or at 30 days, fertilize turf with 2 lbs./1000 square feet of Sulfate of Ammonia and thereafter, every 3-4 weeks May through October, depending on color of turf, until turf receives Final Acceptance by DISTRICT.
- U. At 60 days after installation, Contractor shall obtain soils sample and deliver it to a soils lab selected by the LA. The Contractor shall pay for the analysis. The Soils Lab analysis results and recommendations will be forwarded directly to the LA.

V. Before the 20th day after installation, all depressions, high spots and gaps shall be removed or filled. Gaps and low spots shall be sanded to make surface uniform and consistent. All high spots shall be removed and the surface repaired to be uniform with adjacent sodded areas.

3.08 MULCH

A. Organic Mulch:

- 1. In Shrub Planter areas, after the pre-emergent has been properly applied and watered in, apply specified mulch, 4 inches deep, evenly spread over the entire area of the planter.
- 2. The 4" depth shall be determined after mulch has settled.

B. Trail Only - Stone Mulch / Rip Rap

- 1. Prior to installation of Organic Mulch install Stone/Rock Rip Rap at the locations shown on the plans.
- 2. No portion of the stone shall overlap the edge of adjoining paving.
- 3. Place at the volumes per sq. ft. noted in Materials.
- 4. Remove and loose fragments from paving and adjacent planting areas.
- 5. Apply 2nd application of pre-emergent after stone mulch has been installed
- 6. Water thoroughly to wash pre-emergent off of stones.
- 7. Rinse off as need during maintenance to clean off dirt and dust off of stones.

C. Stone Mulch – Decomposed Granite (DG)

- 1. Prior to application of DG
 - a. All plants shall have been thoroughly water in at least 3 times and all plant pit settlement has been backfilled with soil.
 - b. Irrigation bubblers have been flushed and confirmed to be operating properly
 - c. All deep watering grates have been covered to prevent DG from entering the deep well.
 - d. Clean all deep watering grates that are contaminated with DG.
- Smooth all grades remove any clods, organic material and other debris.
- 3. Apply a uniform layer of Pre-emergent per manufactures heaviest application rate
 - Take care to not apply pre-emergent onto plants, wet surfaces of plants or into leave cavities or nodes.
 - b. Any plants stress or damaged shall be immediately replaced by the Contractor at no additional cost to the Owner.
- 4. Evenly spread and smooth DG
- 5. Compact and smooth with a water filled roller
- 6. Water in to settle to a 3" thick layer
- 7. Spread a 2nd layer of Pre-emergent at the heaviest recommended manufactures rate
 - a. Take care to not apply pre-emergent onto plants, wet surfaces of plants or into leave cavities or nodes.
 - b. Any plants stress or damaged shall be immediately replaced by the Contractor at no additional cost to the Owner.
- 8. Evenly water pre-emergent per manufactures recommendations to activate.
- 9. Any areas disturbed by construction activity shall have pre-emergent reapplied.

3.09 98% COMPLETION AND START OF MAINTENANCE PERIOD

- A. At 98 % completion of all work within the Contractors Contract, all areas included in the Contract shall be clean and free of debris and weeds. All plant materials shall be alive, healthy, and free of infestations.
- B. Items to be completed reviewed and approved prior to 98% Completion review
 - 1. Street Tree, tree grates and tree guards installation
 - 2. As Builds have been provided digitally
 - 3. Irrigation system is 100% automated
 - 4. Irrigation Controller is tied into COP Ethernet and operational on same
 - 5. Irrigation rain sensor and other water conserving equipment are fully operational
 - 6. Irrigation schedules provided
 - 7. All dead and stress plants have been replaced.
 - 8. Water Audit performed and Certified
 - 9. Contractor has signed WELO statements
 - 10. Site is weed free
 - 11. All debris has been removed
 - 12. Site is clean
- C. When 98%+ of all work within the Contractors contract has been completed, the Contractor shall schedule
 - A punch list walk/review with the CM and COP Maintenance and Operations staff to review the entire site and work completed. The IOR will generate a punch list based on COP review of all grading, irrigation systems, controller operation planting and other contract items.
 - 2. The contractor shall complete all items on the punch list prior to calling for a review by the LA/IOR/CM/PM.
 - The contractor shall have in attendance their Project supervisor and Project foreman for this review.
 - 3. 100% of any remaining work and punch list items must be completed, inspected and approved by the IOR prior to the start of the Maintenance Period.
- D. Commencement of Maintenance Period: The Maintenance Period shall begin after all work has been satisfactorily completed and granted final completion notice by the COP.
- E. The Maintenance Period shall be 120 days.

3.10 MAINTENANCE

- A. Maintenance during Construction until Final Acceptance:
 - 1. Maintain areas, including the irrigation system, plants, watering, weeding, applications of herbicides, fungicides, insecticides, rodent control at all times.
 - a. Contractor shall notify PM/CM and receive approval from the CPSDU Maintenance Supervisor approval to apply pesticides.
 - 2. Water as needed (including multiple daily applications) to establish turf areas.
 - 3. Provide adequate soil moisture for proper plant establishment and growth. Monitor the various hydrozones and modify the irrigation system programing as needed to provide the correct amount of water.
 - 4. The contactor shall be responsible for setting:
 - a. A start up watering schedule.
 - b. An interim establishment watering schedule.
 - c. A yearly watering schedule that based on hydrozones such that the Maximum Yearly Water Allowance is not exceeded.

- 5. Any day the Contractor fails to adequately water, replace unsuitable plants, weed, provide timely rodent control and other work determined to be necessary by the IOR/PM/CM, shall NOT be credited as part of the Maintenance Period.
- 6. Constant diligence shall be maintained to prevent disease, insects and/or rodent infestations, algae growth in the drip line irrigation with proper preventative and control measures.
- 7. Any erosion, settling or slippage of soil caused by watering shall be repaired by the Contractor at his expense.
- 8. All walks, curbs, and gutters shall be kept clear of debris, mud, dust, and standing water by sweeping, mopping, or hosing down as required to maintain cleanliness throughout.
- B. Phasing: Due to any Phasing requirements, and potential scheduling modifications due to construction schedules and or use requirements by the COP, the contractor shall plan to maintain and establish the project for the 120 day maintenance/establishment period.
 - Should that period by shorten or lengthened the contract amount for maintenance shall be reduced or lengthened by change order in either 15 day or 30 day increments. In the case of a shortened maintenance period the contractor shall provide a credit change order in equal increments based on the total for that line item, and if increase a change order extra in the same equal increments.
- C. Responsibility of Contractor: During the Maintenance Period, the Contractor shall maintain all planting areas in a weed free condition, performing pest control, pruning, fertilizing and replacement of dead or unhealthy plants as necessary to establish a healthy, vigorous and attractive planting.
- D. Removal of Debris: Remove all cans, surplus material and other debris from the site daily. Flush or sweep all paved areas of soil, leaves or other material. Neatly rake and dress all planting areas immediately after planting on a daily basis.
- E. Dust Removal: Rinse foliage of plant materials as often as needed to remove dust generated by work.
- F. End of the Maintenance Period, the IOR/CM/PM/LA shall inspect the site to determine if the site is acceptable. Site must be weed free at the end of the Maintenance Period. If the site is not acceptable the Contractor will be notified, in writing, of the deficiencies and shall immediately correct those items. Then a new inspection will be arranged. The Maintenance Period will continue for as long as it takes to get an acceptable healthy tree, shrub and turf planting
- G. Replacement of Dead Plants: All plants that may die during the Establishment Period shall be replanted immediately. Waiting to replant until the end of the Maintenance Period is not acceptable and shall be cause to extend the Maintenance Period an equal number of days as the delay in replanting, plus 7 days. All costs for the replacement of dead plans shall be that of the Contractor at no additional cost to COP.
- H. Replacement of Vandalized or Stolen Plants During Construction Period:
- I. Loss of plant material during construction for any cause is the responsibility of the Contractor.
- J. Replacement of Vandalized or Stolen Plants during Maintenance Period: It shall be the Contractors responsibility to immediately notify the I.O.R. and have verified by the I.O.R., plants that are stolen or vandalized. These shall be brought to the attention of the I.O.R.

/CM/PM. The CONTRACTOR shall provide a change order request for review and approval by COP to replace vandalized or stolen plants. Do not remove damaged plants until reviewed and removal is approved by the COP.

3.11 GUARANTEE

- A. All shrubs shall be guaranteed by the CONTRACTOR as to species-variety-clone-form, growth and health for a period of 1 year after Final Notice of Completion. Vandalism and damage by others shall be excluded and are not the responsibility of the CONTRACTOR.
- B. The CONTRACTOR, within 14 days of written notification by the KSHD, shall remove and replace all guaranteed plant materials which for any reason fail to meet the requirements of the guarantee. All plant material replaced shall be guaranteed for the original period, starting from the date of replacement. If the CONTRACTOR fails to remove and replace these plants, the KSHD shall contract the work and charge all associated costs to the CONTRACTOR.

100% CD's 10-22-2020

END OF DOCUMENT