

# City of San Diego

CONTRACTOR'S NAME: West Coast General, Corporation

ADDRESS: 13700 Stowe Drive, Suite 100, Poway, CA 92064

TELEPHONE NO.: 619-561-4200

FAX NO.: \_\_\_\_\_

CITY CONTACT: Antoinette Sanfilippo, Contract Specialist, Email: [ASanfilippo@sandiego.gov](mailto:ASanfilippo@sandiego.gov)

Phone No. (619) 533-3439

J. Neff / R. W. Bustamante / cc

## BIDDING DOCUMENTS



FOR

## PALM AVENUE TRANSITIONAL HOUSING

BID NO.: \_\_\_\_\_ **K-18-1746-DBB-3**

SAP NO. (WBS/IO/CC): \_\_\_\_\_ **S-18003**

CLIENT DEPARTMENT: \_\_\_\_\_ **1613**

COUNCIL DISTRICT: \_\_\_\_\_ **8**

PROJECT TYPE: \_\_\_\_\_ **BT**

CDBG #: \_\_\_\_\_ **B-18-MC-06-0542**

### **THIS CONTRACT WILL BE SUBJECT TO THE FOLLOWING:**

- FEDERAL EQUAL OPPORTUNITY CONTRACTING REQUIREMENTS.
- PREVAILING WAGE RATES: STATE  FEDERAL
- APPRENTICESHIP
- THIS IS A CDBG FUNDED CONTRACT THROUGH THE DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

### **BID DUE DATE:**

**2:00 PM**

**MAY 16, 2018**

**CITY OF SAN DIEGO**

**PUBLIC WORKS CONTRACTS**

**525 B STREET, SUITE 750, MS 908A**

**SAN DIEGO, CA 92101**

**ENGINEER OF WORK**

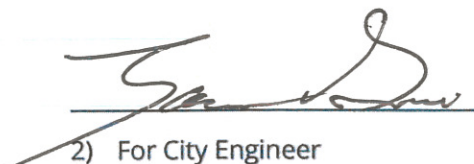
The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Architect and Registered Engineer:

  
\_\_\_\_\_  
1) Registered Architect

  
\_\_\_\_\_  
Date

Seal:



  
\_\_\_\_\_  
2) For City Engineer

  
\_\_\_\_\_  
Date

Seal:



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## NOTICE INVITING BIDS

1. **SUMMARY OF WORK:** This is the City of San Diego's (City) solicitation process to acquire Construction services for **Palm Avenue Transitional Housing**. For additional information refer to Attachment A.
2. **FULL AND OPEN COMPETITION:** This contract is open to full competition and may be bid on by Contractors who are on the City's current Prequalified Contractors' List. For information regarding the Contractors Prequalified list visit the City's web site: <http://www.sandiego.gov>.
3. **ESTIMATED CONSTRUCTION COST:** The City's estimated construction cost for this project is **\$5,590,000**.
4. **BID DUE DATE AND TIME ARE:** **MAY 16, 2018 at 2:00 PM**
5. **PREVAILING WAGE RATES APPLY TO THIS CONTRACT:** Refer to Attachment D.
6. **LICENSE REQUIREMENT:** The City has determined that the following licensing classification is required for this contract: **Class B**
7. **AGENCY FUNDED PROJECT SUBCONTRACTING PARTICIPATION PERCENTAGES:**
  - 7.1. The City affirms that in any contract entered into pursuant to this advertisement, DBE firms will be afforded full opportunity to submit Bids in response to this invitation.
  - 7.2. This Federally assisted project includes subcontracting participation percentages for DBE participation. DBE goal commitments and Good Faith Efforts (GFE) shall be made prior to bidding. DBE commitments and GFE made after the Bid opening will not be considered for the Award of Contract.
  - 7.3. This project is subject to the federal equal opportunity regulations and the following requirements. The City reserves the right to audit the Contractor's compliance with the federal requirements set forth below.
  - 7.4. Following are federally subcontracting participation percentages for this contract. For the purpose of achieving the subcontractor participation percentage, Additive or Deductive, and Type II Allowance Bid Items will not be included in the calculation.
  - 7.5. **Department of Housing and Urban Development (HUD):**

1.	Small Disadvantaged Business (SDB):	5%
2.	Women-Owned Small Business (WoSB):	5%
3.	HUBZone Small Business (HubZone):	3%
4.	Service Disabled Veteran-owned Small Business (SDVoSB):	3%
  - 7.6. Bid shall be **declared non-responsive** if the Bidder fails any of the following conditions:
    1. Submission of GFE documentation, as specified in the Special Provisions.
    2. Attending the Pre-Bid Meeting.

3. Bidder's submission of Good Faith Effort documentation, saved in searchable Portable Document Format (PDF) and stored on Compact Disc (CD) or Digital Video Disc (DVD), demonstrating the Bidder made a good faith effort to outreach to and include DBE Subcontractors shall be submitted within **4 Working Days** of the Bid opening.

**8. AWARD PROCESS:**

- 8.1. The Award of this contract is contingent upon the Contractor's compliance with all conditions of Award as stated within these documents and within the Notice of Intent to Award.
- 8.2. Upon acceptance of bids and determination of the apparent low bidder, the City will prepare the contract documents for execution within approximately 21 days of the date of the bid opening. The City will then award the contract upon receipt of properly signed Contract, bonds, and insurance documents.
- 8.3. This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form by the City Attorney's Office.
- 8.4. The low Bid will be determined by Base Bid plus all Alternates
- 8.5. Once the low bid has been determined, the City may, at its sole discretion, award the contract for the Base bid alone; or for the Base bid plus one or more alternates.

**9. PRE-BID MEETING:**

- 9.1. Prospective Bidders are **required** to attend the Pre-Bid Meeting. The purpose of the meeting is to discuss the scope of the Project, submittal requirements, the pre-qualification process and any Equal Opportunity Contracting Program requirements and reporting procedures. To request a sign language or oral interpreter for this visit, call the Public Works Contracts at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. Failure to attend the Mandatory Pre-Bid Meeting may result in the Bid being deemed non-responsive. The Pre-Bid meeting is scheduled as follows:

**Date:** April 18, 2018  
**Time:** 10:00 AM  
**Location:** 525 B Street, Suite 750, San Diego, CA 92101  
Wada Conference Room

Attendance at the Pre-Bid Meeting will be evidenced by the Bidder's representative's signature on the attendance roster. It is the responsibility of the Bidder's representative to complete and sign the attendance roster.

**Bidders may not be admitted after the specified start time of the mandatory Pre-Bid Meeting.**

- 10. PRE-BID SITE VISIT:** All those wishing to submit a bid are **encouraged** to visit the Work Site with the Engineer. The purpose of the Site visit is to acquaint Bidders with the Site conditions. To request a sign language or oral interpreter for this visit, call the Public Works Contracts at (619) 533-3450 at least 5 Working Days prior to the meeting to ensure availability. The Pre-Bid Site Visit is scheduled as follows:

**Time:** 12:00 PM  
**Date:** April 18, 2018  
**Location:** 1788 Palm Avenue, San Diego, CA 92154

**11. SUBMISSION OF QUESTIONS:**

- 11.1.** The Director (or Designee) of the Public Works Department is responsible for opening, examining, and evaluating the competitive Bids submitted to the City for the acquisition, construction and completion of any public improvement except when otherwise set forth in these documents. Any questions related to this solicitation shall be submitted to:

Public Works Contracts  
525 B Street, Suite 750  
San Diego, California, 92101  
Attention: Antoinette Sanfilippo

OR:

[ASanfilippo@sandiego.gov](mailto:ASanfilippo@sandiego.gov)

- 11.2.** Questions received less than 14 days prior to the date for opening of Bids may not be considered.
- 11.3.** Questions or clarifications deemed by the City to be material shall be answered via issuance of an addendum and posted to the City's online bidding service.
- 11.4.** Only questions answered by formal written addenda shall be binding. Oral and other interpretations or clarifications shall be without legal effect. It is the Bidder's responsibility to be informed of any addenda that have been issued and to include all such information in its Bid.

**12. ADDITIVE/DEDUCTIVE ALTERNATES:**

- 12.1.** The additive/deductive alternates have been established to allow the City to compare the cost of specific portions of the Work with the Project's budget and enable the City to make a decision whether to incorporate these portions prior to award. The award will be established as described in the Bid. The City reserves the right to award the Contract for the Base Bid only or for the Base Bid plus one or more Alternates.
- 12.2.** For water pipeline projects, the Plans typically show all cut and plug and connection work to be performed by City Forces. However, Bidders shall refer to Bidding Documents to see if all or part of this work will be performed by the Contractor.

## INSTRUCTIONS TO BIDDERS

### 1. PREQUALIFICATION OF CONTRACTORS:

- 1.1. Contractors submitting a Bid must be pre-qualified for the total amount proposed, including all alternate items, prior to the date of submittal. Bids from contractors who have not been pre-qualified as applicable and Bids that exceed the maximum dollar amount at which contractors are pre-qualified may be deemed **non-responsive** and ineligible for award. Complete information and links to the on-line prequalification application are available at:

<http://www.sandiego.gov/cip/bidopps/prequalification.shtml>

- 1.2. The completed application must be submitted online no later than 2 weeks prior to the bid opening.
- 1.3. Due to the City's responsibility to protect the confidentiality of the contractors' information, City staff will not be able to provide information regarding contractors' prequalification status over the telephone. Contractors may access real-time information about their prequalification status via their vendor profile on [PlanetBids™](#).

### 2. ELECTRONIC FORMAT RECEIPT AND OPENING OF BIDS: Bids will be received in electronic format (eBids) EXCLUSIVELY at the City of San Diego's electronic bidding (eBidding) site, at: <http://www.sandiego.gov/cip/bidopps/index.shtml> and are due by the date, and time shown on the cover of this solicitation.

- 2.1. **BIDDERS MUST BE PRE-REGISTERED** with the City's bidding system and possess a system-assigned Digital ID in order to submit an electronic bid.
- 2.2. The City's bidding system will automatically track information submitted to the site including IP addresses, browsers being used and the URLs from which information was submitted. In addition, the City's bidding system will keep a history of every login instance including the time of login, and other information about the user's computer configuration such as the operating system, browser type, version, and more. Because of these security features, Contractors who disable their browsers' cookies will not be able to log in and use the City's bidding system.
- 2.3. The City's electronic bidding system is responsible for bid tabulations. Upon the bidder's or proposer's entry of their bid, the system will ensure that all required fields are entered. **The system will not accept a bid for which any required information is missing.** This includes all necessary pricing, subcontractor listing(s) and any other essential documentation and supporting materials and forms requested or contained in these solicitation documents.

- 2.4. BIDS REMAIN SEALED UNTIL BID DEADLINE.** eBids are transmitted into the City's bidding system via hypertext transfer protocol secure (https) mechanism using SSL 128-256 bit security certificates issued from Verisign/Thawte which encrypts data being transferred from client to server. Bids submitted prior to the "Bid Due Date and Time" are not available for review by anyone other than the submitter which has until the "Bid Due Date and Time" to change, rescind or retrieve its proposal should it desire to do so.
- 2.5. BIDS MUST BE SUBMITTED BY BID DUE DATE AND TIME.** Once the bid deadline is reached, no further submissions are accepted into the system. Once the Bid Due Date and Time has lapsed, bidders, proposers, the general public, and City staff are able to immediately see the results on line. City staff may then begin reviewing the submissions for responsiveness, EOCP compliance and other issues. The City may require any Bidder to furnish statement of experience, financial responsibility, technical ability, equipment, and references.
- 2.6. RECAPITULATION OF THE WORK.** Bids shall not contain any recapitulation of the Work. Conditional Bids may be rejected as being non-responsive. Alternative proposals will not be considered unless called for.
- 2.7. BIDS MAY BE WITHDRAWN** by the Bidder only up to the bid due date and time.
- 2.7.1. Important Note:** Submission of the electronic bid into the system may not be instantaneous. Due to the speed and capabilities of the user's internet service provider (ISP), bandwidth, computer hardware and other variables, it may take time for the bidder's submission to upload and be received by the City's eBidding system. It is the bidder's sole responsibility to ensure their bids are received on time by the City's eBidding system. The City of San Diego is not responsible for bids that do not arrive by the required date and time.
- 2.8. ACCESSIBILITY AND AMERICANS WITH DISABILITIES ACT (ADA) COMPLIANCE:** To request a copy of this solicitation in an alternative format, contact the Public Works Contract Specialist listed on the cover of this solicitation at least five (5) working days prior to the Bid/Proposal due date to ensure availability.

### **3. ELECTRONIC BID SUBMISSIONS CARRY FULL FORCE AND EFFECT**

- 3.1.** The bidder, by submitting its electronic bid, acknowledges that doing so carries the same force and full legal effect as a paper submission with a longhand (wet) signature.
- 3.2.** By submitting an electronic bid, the bidder certifies that the bidder has thoroughly examined and understands the entire Contract Documents (which consist of the plans and specifications, drawings, forms, affidavits and the solicitation documents), and that by submitting the eBid as its bid proposal, the bidder acknowledges, agrees to and is bound by the entire Contract Documents, including any addenda issued thereto, and incorporated by reference in the Contract Documents.

- 3.3.** The Bidder, by submitting its electronic bid, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certification, forms and affidavits submitted as part of this bid are true and correct.
- 3.4.** The Bidder agrees to the construction of the project as described in Attachment “A – Scope of Work” for the City of San Diego, in accordance with the requirements set forth herein for the electronically submitted prices. The Bidder guarantees the Contract Price for a period of 120 days (90 days for federally funded contracts and contracts valued at \$500,000 or less) from the date of Bid opening. The duration of the Contract Price guarantee shall be extended by the number of days required for the City to obtain all items necessary to fulfill all conditions precedent.
- 4. BIDS ARE PUBLIC RECORDS:** Upon receipt by the City, Bids shall become public records subject to public disclosure. It is the responsibility of the respondent to clearly identify any confidential, proprietary, trade secret or otherwise legally privileged information contained within the Bid. General references to sections of the California Public Records Act (PRA) will not suffice. If the Contractor does not provide applicable case law that clearly establishes that the requested information is exempt from the disclosure requirements of the PRA, the City shall be free to release the information when required in accordance with the PRA, pursuant to any other applicable law, or by order of any court or government agency, and the Contractor will hold the City harmless for release of this information.
- 5. CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM:**
- 5.1.** **Prior** to the Award of the Contract or Task Order, you and your Subcontractors and Suppliers must register with the City’s web-based vendor registration and bid management system. For additional information go to:  
  
<http://www.sandiego.gov/purchasing/bids-contracts/vendorreg.shtml>.
- 5.2.** The City may not award the contract until registration of all subcontractors and suppliers is complete. In the event this requirement is not met within the time frame specified in the Notice of Intent to Award letter, the City reserves the right to rescind the Notice of Award / Intent to Award and to make the award to the next responsive and responsible bidder / proposer.
- 6. JOINT VENTURE CONTRACTORS:** Provide a copy of the Joint Venture agreement and the Joint Venture license to the City within 10 Working Days after receiving the Contract forms. See 7-6, “The Contractors Representative” in The GREENBOOK and 7-6.1 in The WHITEBOOK.
- 7. PREVAILING WAGE RATES WILL APPLY:** Refer to Attachment D.
- 8. SUBCONTRACTING PARTICIPATION PERCENTAGES:** Subcontracting participation percentages apply to this contract. Refer to Attachment E.

**9. INSURANCE REQUIREMENTS:**

- 9.1. All certificates of insurance and endorsements required by the contract are to be provided upon issuance of the City’s Notice of Intent to Award letter.
- 9.2. Refer to sections 7-3, “LIABILITY INSURANCE”, and 7-4, “WORKERS’ COMPENSATION INSURANCE” of the Supplementary Special Provisions (SSP) for the insurance requirements which must be met.

**10. REFERENCE STANDARDS:** Except as otherwise noted or specified, the Work shall be completed in accordance with the following standards:

Title	Edition	Document Number
Standard Specifications for Public Works Construction (“The GREENBOOK”) <a href="http://www.greenbookspecs.org/">http://www.greenbookspecs.org/</a>	2015	PWPI070116-01
City of San Diego Standard Specifications for Public Works Construction (“The WHITEBOOK”)* <a href="https://www.sandiego.gov/publicworks/edocref/greenbook">https://www.sandiego.gov/publicworks/edocref/greenbook</a>	2015	PWPI070116-02
City of San Diego Standard Drawings* <a href="https://www.sandiego.gov/publicworks/edocref/standarddraw">https://www.sandiego.gov/publicworks/edocref/standarddraw</a>	2016	PWPI070116-03
Citywide Computer Aided Design and Drafting (CADD) Standards <a href="https://www.sandiego.gov/publicworks/edocref/drawings">https://www.sandiego.gov/publicworks/edocref/drawings</a>	2016	PWPI092816-04
California Department of Transportation (CALTRANS) Standard Specifications – <a href="http://www.dot.ca.gov/des/oe/construction-contract-standards.html">http://www.dot.ca.gov/des/oe/construction-contract-standards.html</a>	2015	PWPI092816-05
CALTRANS Standard Plans <a href="http://www.dot.ca.gov/des/oe/construction-contract-standards.html">http://www.dot.ca.gov/des/oe/construction-contract-standards.html</a>	2015	PWPI092816-06
California Manual on Uniform Traffic Control Devices Revision 1 (CA MUTCD Rev 1) - <a href="http://www.dot.ca.gov/trafficops/camutcd/">http://www.dot.ca.gov/trafficops/camutcd/</a>	2014	PWPI092816-07
<b>NOTE:</b>	*Available online under Engineering Documents and References at: <a href="http://www.sandiego.gov/publicworks/edocref/index.shtml">http://www.sandiego.gov/publicworks/edocref/index.shtml</a>	

**11. CITY’S RESPONSES AND ADDENDA:** The City, at its discretion, may respond to any or all questions submitted in writing via the City’s eBidding web site in the **form of an addendum**. No other responses to questions, oral or written shall be of any force or effect with respect to this solicitation. The changes to the Contract Documents through addenda are made effective as though originally issued with the Bid. The Bidders shall acknowledge the receipt of Addenda at the time of bid submission.

- 12. CITY'S RIGHTS RESERVED:** The City reserves the right to cancel the Notice Inviting Bids at any time, and further reserves the right to reject submitted Bids, without giving any reason for such action, at its sole discretion and without liability. Costs incurred by the Bidder(s) as a result of preparing Bids under the Notice Inviting Bids shall be the sole responsibility of each bidder. The Notice Inviting Bids creates or imposes no obligation upon the City to enter a contract.
- 13. CONTRACT PRICING:** This solicitation is for a Lump Sum contract with Unit Price provisions as set forth herein. The Bidder agrees to perform construction services for the City of San Diego in accordance with these contract documents for the prices listed below. The Bidder further agrees to guarantee the Contract Price for a period of 120 days from the date of Bid opening. The duration of the Contract Price guarantee may be extended, by mutual consent of the parties, by the number of days required for the City to obtain all items necessary to fulfill all contractual conditions.
- 14. SUBCONTRACTOR INFORMATION:**
- 14.1. LISTING OF SUBCONTRACTORS.** In accordance with the requirements provided in the "Subletting and Subcontracting Fair Practices Act" of the California Public Contract Code, the Bidder shall provide the **NAME** and **ADDRESS** of each Subcontractor who will perform work, labor, render services or who specially fabricates and installs a portion [type] of the work or improvement, in an amount in excess of 0.5% of the Contractor's total Bid. The Bidder shall also state within the description, whether the subcontractor is a **CONSTRUCTOR, CONSULTANT** or **SUPPLIER**. The Bidder shall state the **DIR REGISTRATION NUMBER** for all subcontractors and shall further state within the description, the **PORTION** of the work which will be performed by each subcontractor under this Contract. The Contractor shall list only one Subcontractor for each portion of the Work. The **DOLLAR VALUE** of the total Bid to be performed shall be stated for all subcontractors listed. Failure to comply with this requirement may result in the Bid being rejected as **non-responsive** and ineligible for award. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3, "Subcontracts", which stipulates the percent of the Work to be performed with the Bidders' own forces. The Bidder shall list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which Bidders are seeking recognition towards achieving any mandatory, voluntary (or both) subcontracting participation goals.
- 14.2. LISTING OF SUPPLIERS.** Any Bidder seeking the recognition of Suppliers of equipment, materials, or supplies obtained from third party Suppliers towards achieving any mandatory or voluntary (or both) subcontracting participation goals shall provide, at a minimum, the **NAME, LOCATION (CITY), DIR REGISTRATION NUMBER** and the **DOLLAR VALUE** of each supplier. The Bidder will be credited up to 60% of the amount to be paid to the Suppliers for materials and supplies unless vendor manufactures or substantially alters materials and supplies, in which case, 100% will be credited. The Bidder is to indicate within the description whether the



listed firm is a supplier or manufacturer. If no indication is provided, the listed firm will be credited at 60% of the listed dollar value for purposes of calculating the Subcontractor Participation Percentage.

- 14.3. LISTING OF SUBCONTRACTORS OR SUPPLIERS FOR ALTERNATES.** For subcontractors or suppliers to be used on additive or deductive alternate items, in addition to the above requirements, bidder shall further note "ALTERNATE" and alternate item number within the description.
- 15. SUBMITTAL OF "OR EQUAL" ITEMS:** See Section 4-1.6, "Trade Names or Equals" in The WHITEBOOK and as amended in the SSP.
- 16. AWARD:**
- 16.1.** The Award of this contract is contingent upon the Contractor's compliance with all conditions precedent to Award.
- 16.2.** Upon acceptance of a Bid, the City will prepare contract documents for execution within approximately 21 days of the date of the Bid opening and award the Contract approximately within 7 days of receipt of properly executed Contract, bonds, and insurance documents.
- 16.3.** This contract will be deemed executed and effective only upon the signing of the Contract by the Mayor or his designee and approval as to form the City Attorney's Office.
- 17. SUBCONTRACT LIMITATIONS:** The Bidder's attention is directed to Standard Specifications for Public Works Construction, Section 2-3, "SUBCONTRACTS" in The GREENBOOK and as amended in the SSP which requires the Contractor to self-perform not less than the specified amount. Failure to comply with this requirement shall render the bid **non-responsive** and ineligible for award.
- 18. AVAILABILITY OF PLANS AND SPECIFICATIONS:** Contract Documents may be obtained by visiting the City's website: <http://www.sandiego.gov/cip/>. Plans and Specifications for this contract are also available for review in the office of the City Clerk or Public Works Contracts.
- 19. ONLY ONE BID PER CONTRACTOR SHALL BE ACCEPTED:** No person, firm, or corporation shall be allowed to make, file, or be interested in more than one (1) Bid for the same work unless alternate Bids are called for. A person, firm or corporation who has submitted a sub-proposal to a Bidder, or who has quoted prices on materials to a Bidder, is not hereby disqualified from submitting a sub-proposal or quoting prices to other Bidders or from submitting a Bid in its own behalf. Any Bidder who submits more than one bid will result in the rejection of all bids submitted.

**20. SAN DIEGO BUSINESS TAX CERTIFICATE:** The Contractor and Subcontractors, not already having a City of San Diego Business Tax Certificate for the work contemplated shall secure the appropriate certificate from the City Treasurer, Civic Center Plaza, First floor and submit to the Contract Specialist upon request or as specified in the Contract Documents. Tax Identification numbers for both the Bidder and the listed Subcontractors must be submitted on the City provided forms within these documents.

**21. BIDDER'S GUARANTEE OF GOOD FAITH (BID SECURITY) FOR DESIGN-BID-BUILD CONTRACTS:**

**21.1.** For bids \$250,000 and above, bidders shall submit Bid Security at bid time. Bid Security shall be in one of the following forms: a cashier's check, or a properly certified check upon some responsible bank; or an approved corporate surety bond payable to the City of San Diego for an amount of not less than 10% of the total bid amount.

**21.2.** This check or bond, and the monies represented thereby, will be held by the City as a guarantee that the Bidder, if awarded the contract, will in good faith enter into the contract and furnish the required final performance and payment bonds.

**21.3.** The Bidder agrees that in the event of the Bidder's failure to execute this contract and provide the required final bonds, the money represented by the cashier's or certified check will remain the property of the City; and the Surety agrees that it will pay to the City the damages, not exceeding the sum of 10% of the amount of the Bid, that the City may suffer as a result of such failure.

**21.4.** At the time of bid submission, bidders must upload and submit an electronic PDF copy of the aforementioned bid security. Whether in the form of a cashier's check, a properly certified check or an approved corporate surety bond payable to the City of San Diego, the bid security must be uploaded to the City's eBidding system. Within twenty-four (24) hours after the bid due date and time, the first five (5) apparent low bidders must provide the City with the original bid security.

**21.5.** Failure to submit the electronic version of the bid security at the time of bid submission AND failure to provide the original within twenty-four (24) hours may cause the bid to be rejected and deemed **non-responsive**.

**22. AWARD OF CONTRACT OR REJECTION OF BIDS:**

**22.1.** This contract may be awarded to the lowest responsible and reliable Bidder.

**22.2.** Bidders shall complete ALL eBid forms as required by this solicitation. Incomplete eBids will not be accepted.

**22.3.** The City reserves the right to reject any or all Bids, to waive any informality or technicality in Bids received, and to waive any requirements of these specifications as to bidding procedure.

- 22.4.** Bidders will not be released on account of their errors of judgment. Bidders may be released only upon receipt by the City within 3 Working Days of the bid opening, written notice from the Bidder which shows proof of honest, credible, clerical error of a material nature, free from fraud or fraudulent intent; and of evidence that reasonable care was observed in the preparation of the Bid.
- 22.5.** A bidder who is not selected for contract award may protest the award of a contract to another bidder by submitting a written protest in accordance with the San Diego Municipal Code.
- 22.6.** The City of San Diego will not discriminate in the award of contracts with regard to race, religion creed, color, national origin, ancestry, physical handicap, marital status, sex or age.
- 22.7.** Each Bid package properly signed as required by these specifications shall constitute a firm offer which may be accepted by the City within the time specified herein.
- 22.8.** The City reserves the right to evaluate all Bids and determine the lowest Bidder on the basis of the base bid and any proposed alternates or options as detailed herein.

**23. BID RESULTS:**

- 23.1.** The availability of the bids on the City's eBidding system shall constitute the public announcement of the apparent low bidder. In the event that the apparent low bidder is subsequently deemed non-responsive or non-responsible, a notation of such will be made on the eBidding system. The new ranking and apparent low bidder will be adjusted accordingly.
- 23.2.** To obtain the bid results, view the results on the City's web site, or request the results by U.S. mail and provide a self-addressed, stamped envelope. If requesting by mail, be sure to reference the bid name and number. The bid tabulations will be mailed to you upon their completion. The results will not be given over the telephone.

**24. THE CONTRACT:**

- 24.1.** The Bidder to whom award is made shall execute a written contract with the City of San Diego and furnish good and approved bonds and insurance certificates specified by the City within 14 days after receipt by Bidder of a form of contract for execution unless an extension of time is granted to the Bidder in writing.
- 24.2.** If the Bidder takes longer than 14 days to fulfill these requirements, then the additional time taken shall be added to the Bid guarantee. The Contract shall be made in the form adopted by the City, which includes the provision that no claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.

- 24.3.** If the Bidder to whom the award is made fails to enter into the contract as herein provided, the award may be annulled and the Bidder's Guarantee of Good Faith will be subject to forfeiture. An award may be made to the next lowest responsible and reliable Bidder who shall fulfill every stipulation embraced herein as if it were the party to whom the first award was made.
- 24.4.** Pursuant to the San Diego City Charter section 94, the City may only award a public works contract to the lowest responsible and reliable Bidder. The City will require the Apparent Low Bidder to (i) submit information to determine the Bidder's responsibility and reliability, (ii) execute the Contract in form provided by the City, and (iii) furnish good and approved bonds and insurance certificates specified by the City within 14 Days, unless otherwise approved by the City, in writing after the Bidder receives notification from the City, designating the Bidder as the Apparent Low Bidder and formally requesting the above mentioned items.
- 24.5.** The award of the Contract is contingent upon the satisfactory completion of the above-mentioned items and becomes effective upon the signing of the Contract by the Mayor or designee and approval as to form the City Attorney's Office. If the Apparent Low Bidder does not execute the Contract or submit required documents and information, the City may award the Contract to the next lowest responsible and reliable Bidder who shall fulfill every condition precedent to award. A corporation designated as the Apparent Low Bidder shall furnish evidence of its corporate existence and evidence that the officer signing the Contract and bond for the corporation is duly authorized to do so.
- 25. EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK:** The Bidder shall examine carefully the Project Site, the Plans and Specifications, other materials as described in the Special Provisions, Section 2-7, and the proposal forms (e.g., Bidding Documents). 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 scope of Work, the quantities of materials to be furnished, and as to the requirements of the Bidding Documents Proposal, Plans, and Specifications.
- 26. CITY STANDARD PROVISIONS:** This contract is subject to the following standard provisions. See The WHITEBOOK for details.
- 26.1.** The City of San Diego Resolution No. R-277952 adopted on May 20, 1991 for a Drug-Free Workplace.
- 26.2.** The City of San Diego Resolution No. R-282153 adopted on June 14, 1993 related to the Americans with Disabilities Act.
- 26.3.** The City of San Diego Municipal Code §22.3004 for Contractor Standards.
- 26.4.** The City of San Diego's Labor Compliance Program and the State of California Labor Code §§1771.5(b) and 1776.

- 26.5. Sections 1777.5, 1777.6, and 1777.7 of the State of California Labor Code concerning the employment of apprentices by contractors and subcontractors performing public works contracts.
- 26.6. The City's Equal Benefits Ordinance (EBO), Chapter 2, Article 2, Division 43 of The San Diego Municipal Code (SDMC).
- 26.7. The City's Information Security Policy (ISP) as defined in the City's Administrative Regulation 90.63.

**27. PRE-AWARD ACTIVITIES:**

- 27.1. The contractor selected by the City to execute a contract for this Work shall submit the required documentation as specified in the herein and in the Notice of Award. Failure to provide the information as specified may result in the Bid being rejected as **non-responsive**.
- 27.2. The decision that bid is non-responsive for failure to provide the information required within the time specified shall be at the sole discretion of the City.

## PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND

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### FAITHFUL PERFORMANCE BOND AND LABOR AND MATERIALMEN'S BOND:

West Coast General, Corporation, a corporation, as principal, and Fidelity and Deposit Company of Maryland, a corporation authorized to do business in the State of California, as Surety, hereby obligate themselves, their successors and assigns, jointly and severally, to The City of San Diego a municipal corporation in the sum of **Five Million Three Hundred Ninety-Seven Thousand Seventy-Three Dollars and Zero Cents (\$5,397,073.00)** for the faithful performance of the annexed contract, and in the sum of **Five Million Three Hundred Ninety-Seven Thousand Seventy-Three Dollars and Zero Cents (\$5,397,073.00)** for the benefit of laborers and materialmen designated below.

#### Conditions:

If the Principal shall faithfully perform the annexed contract with the City of San Diego, California, then the obligation herein with respect to a faithful performance shall be void; otherwise it shall remain in full force.

If the Principal shall promptly pay all persons, firms and corporations furnishing materials for or performing labor in the execution of this contract, and shall pay all amounts due under the California Unemployment Insurance Act then the obligation herein with respect to laborers and materialmen shall be void; otherwise it shall remain in full force.

The obligation herein with respect to laborers and materialmen shall inure to the benefit of all persons, firms and corporations entitled to file claims under the provisions of Article 2. Claimants, (iii) public works of improvement commencing with Civil Code Section 9100 of the Civil Code of the State of California.

Changes in the terms of the annexed contract or specifications accompanying same or referred to therein shall not affect the Surety's obligation on this bond, and the Surety hereby waives notice of same.

**PERFORMANCE BOND, LABOR AND MATERIALMEN'S BOND (continued)**

The Surety shall pay reasonable attorney's fees should suit be brought to enforce the provisions of this bond.

Dated June 20, 2018

Approved as to Form

West Coast General Corporation

Principal

By 

David E. Davey, President

Printed Name of Person Signing for Principal

Mara W. Elliott, City Attorney

By   
Deputy City Attorney 7/18/18


Fidelity and Deposit Company of Maryland

Surety

By 

Attorney-in-fact

Approved:

By   
Stephen Samara  
Interim Deputy Director  
Public Works Department

777 South Figueroa Street, Suite 3900

Local Address of Surety

Los Angeles, CA 90017

Local Address (City, State) of Surety

(213) 270-0717

Local Telephone No. of Surety

Premium \$ 38,763.00 (Premium is subject to adjustment based on final contract price)

Bond No. 9217776

**CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT** Civil Code § 1189

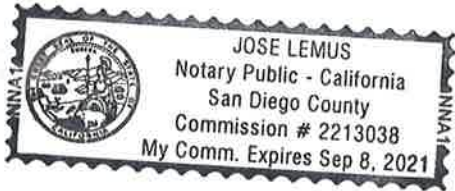
A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document, to which this certificate is attached, and not the truthfulness, accuracy or validity of that document.

STATE OF CALIFORNIA

County of San Diego

On JUN 20 2018 before me, Jose Lemus, Notary Public,  
Date Insert Name of Notary exactly as it appears on the official seal

personally appeared Richard Hallett  
Name(s) of Signer(s)



Place Notary Seal Above

who proved to me on the basis of satisfactory evidence to be the person(~~s~~) whose name(~~s~~) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/~~her/their~~ authorized capacity(~~ies~~), and that by his/~~her/their~~ signature(~~s~~) on the instrument the person(~~s~~), or the entity upon behalf of which the person(~~s~~) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

Witness my hand and official seal.

Signature [Signature]  
Signature of Notary Public Jose Lemus

**OPTIONAL**

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of the form to another document.

**Description of Attached Document**

Title or Type of Document: \_\_\_\_\_

Document Date: \_\_\_\_\_ Number of Pages: \_\_\_\_\_

Signer(s) Other Than Named Above: \_\_\_\_\_

**Capacity(ies) Claimed by Signer(s)**

Signer's Name: \_\_\_\_\_

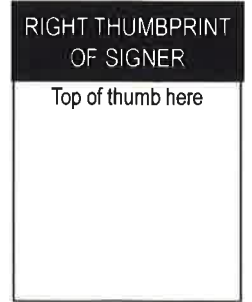
- Individual
- Corporate Officer — Title(s): \_\_\_\_\_
- Partner  Limited  General
- Attorney in Fact
- Trustee
- Guardian or Conservator
- Other: \_\_\_\_\_



Signer is Representing: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signer's Name: \_\_\_\_\_

- Individual
- Corporate Officer — Title(s): \_\_\_\_\_
- Partner  Limited  General
- Attorney in Fact
- Trustee
- Guardian or Conservator
- Other: \_\_\_\_\_



Signer is Representing: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**ZURICH AMERICAN INSURANCE COMPANY  
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY  
FIDELITY AND DEPOSIT COMPANY OF MARYLAND  
POWER OF ATTORNEY**

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Maryland, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Maryland (herein collectively called the "Companies"), by **DAVID MCVICKER, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Richard HALLETT, Aidan SMOCK, Tim MCCLELLAN, Marta COLLETT and Jose LEMUS, all of San Diego, California, EACH** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings**, and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.


IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 3rd day of August, A.D. 2017.

**ATTEST:**

**ZURICH AMERICAN INSURANCE COMPANY  
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY  
FIDELITY AND DEPOSIT COMPANY OF MARYLAND**



By:   
*Assistant Secretary  
Joshua Lecker*

  
*Vice President  
David McVicker*

State of Maryland  
County of Baltimore

On this 3rd day of August, A.D. 2017, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **DAVID MCVICKER, Vice President, and JOSHUA LECKER, Assistant Secretary**, of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, depose and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.



Constance A. Dunn, Notary Public  
My Commission Expires: July 9, 2019



**EXTRACT FROM BY-LAWS OF THE COMPANIES**

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify or revoke any such appointment or authority at any time."

**CERTIFICATE**

I, the undersigned, Vice President of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this \_\_\_ day of JUN 20 2018 20\_\_.



Michael Bond, Vice President

**TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT ALL REQUIRED INFORMATION TO:**

Zurich American Insurance Co.  
Attn: Surety Claims  
1299 Zurich Way  
Schaumburg, IL 60196-1056

## ATTACHMENTS

**ATTACHMENT A**  
**SCOPE OF WORK**

## SCOPE OF WORK

1. **SCOPE OF WORK:** Rehabilitation of an existing hotel for the operation of a transitional housing facility including; fire live and safety upgrades, landscaping, site improvements and roofing.

Alternate Bid item: Photo Voltaic Panels for Parking Lot Trellis and Roof as defined in the Plans.

- 1.1. The Work shall be performed in accordance with:

- 1.1.1. The Notice Inviting Bids and Plans numbered **40498-01-D** through **40498-122-D**, inclusive.

2. **LOCATION OF WORK:** The location of the Work is as follows:

**Refer to Appendix E.**

3. **CONTRACT TIME:** The Contract Time for completion of the Work, including the Plant Establishment Period, shall be **222 Working Days**.

**ATTACHMENT B**  
**INTENTIONALLY LEFT BLANK**

**ATTACHMENT C**  
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**ATTACHMENT D**  
**COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)**  
**HOUSING URBAN DEVELOPMENT (HUD)**  
**FUNDING AGENCY PROVISIONS**



**IN THE EVENT THAT THESE REQUIREMENTS CONFLICT WITH THE CITY'S GENERAL EOC REQUIREMENTS, THE FUNDING AGENCY'S REQUIREMENTS WILL CONTROL.**

**1. NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246).**

1.1. The goal and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, as follows:

	<u>Goal</u>
1. Minority Participation:	16.9%
2. Female Participation:	6.9%

1.2. These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs Work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the Work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both federally involved and non-federally involved Work.

1.3. The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals.

1.4. The hours of minority and female employment and training shall be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

1.5. The Contractor shall provide written notification to the Director the Office of Federal Contract Compliance Programs within 10 Working Days of award of any Subcontract in excess of \$10,000 at any tier for Work under the Contract resulting from this solicitation. The notification shall list the name, address and telephone number of the Subcontractor; employer identification number of the Subcontractor; estimated dollar amount of the Subcontract; estimated starting and completion dates of the Subcontract; and the geographical area in which the subcontract is to be performed. The "covered area" is the City of San Diego.

## **2. EQUAL OPPORTUNITY CLAUSES:**

**2.1.** The following equal opportunity clauses are incorporated by reference herein:

1. The equal opportunity clause located 41 CFR 60.1.4(a), which specifies the obligations imposed under Executive Order 11246.
2. The equal opportunity clause located at 41 CFR 60-741.5, which contains the obligations imposed by Section 503 of the Rehabilitation Act of 1973.
3. The "Equal Opportunity Clause" (Resolution No. 765092) filed on December 4, 1978, in the Office of the City Clerk, San Diego, California and incorporated in the "Standard Federal Employment Opportunity Construction Contract Specifications (Executive Order 11246 - Document No. 769023, filed September 11, 1984, in the Office of the City Clerk, San Diego, California) is applicable to all non-exempt City construction contracts and subcontracts of \$2,000 or more.
4. Age Discrimination Act of 1975, Pub. L. 94-135.
5. Title VI of the Civil Rights Act of 1964, Pub. L. 88-352.
6. Section 13 of the Federal Water Pollution Control Acts Amendments of 1972, Pub. L. 92-5200 (the Clean Water Act).
7. Section 504 of the Rehabilitation Act of 1973, Pub. L. 93-112 (Executive Orders 11914 and 11250).
8. Women's Minority Business Enterprises, Executive Orders 11625, 12138 and 12432.
9. Section 129 of the Small Business Administration Reauthorization and Amendment Act of 1988, Pub. L. 100-590.

## **3. STANDARD FEDERAL EQUAL EMPLOYMENT SPECIFICATIONS:**

**3.1.** The Contractor is required to comply with the 16 "Standard Federal Equal Employment Specifications" located at 41 CFR 60-4.3 for federal and federally-assisted construction contracts in excess of \$10,000, set forth below.

**3.2.** The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative actions steps at least as extensive as the following:

1. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign 2 or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain

such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

2. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
3. Maintain a current file of the names, addresses and telephone numbers of each minority and female walk-in applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.
4. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
5. Develop on-the-job training opportunities, participate in training programs for the area, or both which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under item 2 of section 3.2 above.
6. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreements; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
7. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignments, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as superintendents, foreman, etc., prior to the initiation of Work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and dispositions of the subject matter.

8. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.
9. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.
10. Encourage present minority and female employees to recruit other minority persons and women and where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.
11. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.
12. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.
13. Ensure that seniority practices, job classifications, work assignments and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.
14. Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.
15. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.
16. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

**4. VIOLATION OR BREACH OF REQUIREMENTS:**

- 4.1.** If at any time during the course of the Contract there is a violation of the Affirmative Action or Equal Employment Opportunity requirements by the Contractor, or the Subcontractors, the City will notify the Contractor of the breach. The City may withhold any further progress payments to the Contractor until the City is satisfied that the Contractor and Subcontractors are in full compliance with these requirements.

**5. MONTHLY EMPLOYMENT UTILIZATION REPORTS:**

- 5.1.** Refer to GENERAL EQUAL OPPORTUNITY CONTRACTING PROGRAM REQUIREMENTS, CONSTRUCTION CONTRACTOR REQUIREMENTS in The WHITEBOOK and the following:
1. Federal and Non-Federal Work in San Diego County. Submit an updated list only if work is complete or new contracts have been awarded during the span of this project.

**6. RECORDS OF PAYMENTS TO DBEs:**

- 6.1.** The Contractor shall maintain records and documents of payments to DBEs for 5 years following the NOC. These records shall be made available for inspection upon request by any authorized representative of the City, funding agency, or both. The reporting requirement shall be extended to any certified DBE Subcontractor.

**7. FEDERAL WAGE REQUIREMENTS FOR FEDERALLY FUNDED PROJECTS:**

- 7.1.** The successful Bidder's work shall be required to comply with Executive Order 11246, entitled "Equal Employment Opportunity," as amended by Executive Order 11375, and as supplemented in Department of Labor regulations (41 CFR chapter 60).
- 7.2.** This Executive Order pertains to Equal Employment Opportunity regulations and contains significant changes to the regulations including new goals and timetables for women in construction and revised goals and time-tables for minorities in construction.
- 7.3.** Minimum wage rates for this project have been predetermined by the Secretary of Labor and are set forth in the Decision of the Secretary and bound into the specifications book. Should there be any difference between the state or federal wage rates, including health and welfare funds for any given craft, mechanic, or similar classifications needed to execute the Work, it shall be mandatory upon the Contractor or subcontractor to pay the higher of the two rates.
- 7.4.** The minimum wage rate to be paid by the Contractor and the Subcontractors shall be in accordance with the Federal Labor Standards Provisions (see below) and Federal Wage Rates (see Wage Rates below) and General Prevailing Wage Determination made by the State of California, Director of Industrial Relations pursuant to California Labor Code Part 7, Chapter 1, Article 2, Sections 1770, 1773 and 1773.1, whichever is higher.

- 7.5. A Contractor having 50 or more employees and its Subcontractors having 50 or more employees and who may be awarded a contract of \$50,000 or more will be required to maintain an affirmative action program, the standards for which are contained in the specifications.
- 7.6. To be eligible for award, each Bidder shall comply with the affirmative action requirements which are contained in the specifications.
- 7.7. Women will be afforded equal opportunity in all areas of employment. However, the employment of women shall not diminish the standards of requirements for the employment of minorities.
8. **PREVAILING WAGE RATES:** Pursuant to San Diego Municipal Code section 22.3019, construction, alteration, demolition, repair and maintenance work performed under this Contract is subject to State prevailing wage laws. For construction work performed under this Contract cumulatively exceeding \$25,000 and for alteration, demolition, repair and maintenance work performed under this Contract cumulatively exceeding \$15,000, the Contractor and its subcontractors shall comply with State prevailing wage laws including, but not limited to, the requirements listed below.
- 8.1. **Compliance with Prevailing Wage Requirements.** Pursuant to sections 1720 through 1861 of the California Labor Code, the Contractor and its subcontractors shall ensure that all workers who perform work under this Contract are paid not less than the prevailing rate of per diem wages as determined by the Director of the California Department of Industrial Relations (DIR). This includes work performed during the design and preconstruction phases of construction including, but not limited to, inspection and land surveying work.
- 8.1.1. Copies of such prevailing rate of per diem wages are on file at the City and are available for inspection to any interested party on request. Copies of the prevailing rate of per diem wages also may be found at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>. Contractor and its subcontractors shall post a copy of the prevailing rate of per diem wages determination at each job site and shall make them available to any interested party upon request.
- 8.1.2. The wage rates determined by the DIR refer to expiration dates. If the published wage rate does not refer to a predetermined wage rate to be paid after the expiration date, then the published rate of wage shall be in effect for the life of this Contract. If the published wage rate refers to a predetermined wage rate to become effective upon expiration of the published wage rate and the predetermined wage rate is on file with the DIR, such predetermined wage rate shall become effective on the date following the expiration date and shall apply to this Contract in the same manner as if it had been published in said publication. If the predetermined wage rate refers to one or more additional expiration dates with additional predetermined wage rates, which expiration dates occur during the life of this Contract, each successive predetermined wage rate shall apply to this Contract on the date following the expiration date

of the previous wage rate. If the last of such predetermined wage rates expires during the life of this Contract, such wage rate shall apply to the balance of the Contract.

- 8.2. Penalties for Violations.** Contractor and its subcontractors shall comply with California Labor Code section 1775 in the event a worker is paid less than the prevailing wage rate for the work or craft in which the worker is employed. This shall be in addition to any other applicable penalties allowed under Labor Code sections 1720 – 1861.
- 8.3. Payroll Records.** Contractor and its subcontractors shall comply with California Labor Code section 1776, which generally requires keeping accurate payroll records, verifying and certifying payroll records, and making them available for inspection. Contractor shall require its subcontractors to also comply with section 1776. Contractor and its subcontractors shall submit weekly certified payroll records online via the City's web-based Labor Compliance Program. Contractor is responsible for ensuring its subcontractors submit certified payroll records to the City.
- 8.3.1.** Contractor and their subcontractors shall **also** furnish records specified in Labor Code section 1776 directly to the Labor Commissioner in the manner required by Labor Code section 1771.4.
- 8.4. Apprentices.** Contractor and its subcontractors shall comply with California Labor Code sections 1777.5, 1777.6 and 1777.7 concerning the employment and wages of apprentices. Contractor is held responsible for the compliance of their subcontractors with sections 1777.5, 1777.6 and 1777.7.
- 8.5. Working Hours.** Contractor and their subcontractors shall comply with California Labor Code sections 1810 through 1815, including but not limited to: (i) restrict working hours on public works contracts to eight hours a day and forty hours a week, unless all hours worked in excess of 8 hours per day are compensated at not less than 1½ times the basic rate of pay; and (ii) specify penalties to be imposed on contractors and subcontractors of \$25 per worker per day for each day the worker works more than 8 hours per day and 40 hours per week in violation of California Labor Code sections 1810 through 1815.
- 8.6. Required Provisions for Subcontracts.** Contractor shall include at a minimum a copy of the following provisions in any contract they enter into with a subcontractor: California Labor Code sections 1771, 1771.1, 1775, 1776, 1777.5, 1810, 1813, 1815, 1860 and 1861.

- 8.7. Labor Code Section 1861 Certification.** Contractor in accordance with California Labor Code section 3700 is required to secure the payment of compensation of its employees and by signing this Contract, Contractor certifies that “I am aware of the provisions of Section 3700 of the California Labor Code which require every employer to be insured against liability for workers’ compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.”
- 8.8. Labor Compliance Program.** The City has its own Labor Compliance Program authorized in August 2011 by the DIR. The City will withhold contract payments when payroll records are delinquent or deemed inadequate by the City or other governmental entity, or it has been established after an investigation by the City or other governmental entity that underpayment(s) have occurred. For questions or assistance, please contact the City of San Diego’s Equal Opportunity Contracting Department at 619-236-6000.
- 8.9. Contractor and Subcontractor Registration Requirements.** This project is subject to compliance monitoring and enforcement by the DIR. A contractor or subcontractor shall not be qualified to bid on, be listed in a bid or proposal, subject to the requirements of section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, unless currently registered and qualified to perform public work pursuant to Labor Code section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.
- 8.9.1.** A Contractor’s inadvertent error in listing a subcontractor who is not registered pursuant to Labor Code section 1725.5 in response to a solicitation shall not be grounds for filing a bid protest or grounds for considering the bid non-responsive provided that any of the following apply: (1) the subcontractor is registered prior to bid opening; (2) within twenty-four hours after the bid opening, the subcontractor is registered and has paid the penalty registration fee specified in Labor Code section 1725.5; or (3) the subcontractor is replaced by another registered subcontractor pursuant to Public Contract Code section 4107.
- 8.9.2.** By submitting a bid or proposal to the City, Contractor is certifying that he or she has verified that all subcontractors used on this public work project are registered with the DIR in compliance with Labor Code sections 1771.1 and 1725.5, and Contractor shall provide proof of registration for themselves and all listed subcontractors to the City at the time of bid or proposal due date or upon request.
- 8.10. Stop Order.** For Contractor or its subcontractors engaging in the performance of any public work contract without having been registered in violation of Labor Code sections 1725.5 or 1771.1, the Labor Commissioner shall issue and serve a stop order prohibiting the use of the unregistered contractors or unregistered subcontractor(s)



on ALL public works until the unregistered contractor or unregistered subcontractor(s) is registered. Failure to observe a stop order is a misdemeanor.

**8.11. List of all Subcontractors.** The City may ask Contractor for the most current list of subcontractors (regardless of tier), along with their DIR registration numbers, utilized on this Agreement at any time during performance of this contract, and Contractor shall provide the list within ten (10) working days of the City's request. Additionally, Contractor shall provide the City with a complete list of all subcontractors utilized on this contract (regardless of tier), within ten working days of the completion of the contract, along with their DIR registration numbers. The City shall withhold final payment to Contractor until at least 30 days after this information is provided to the City.

**8.12. Exemptions for Small Projects.** There are limited exemptions for installation, alteration, demolition, or repair work done on projects of \$25,000 or less. The Contractor shall still comply with Labor Code sections 1720 et. seq. The only recognized exemptions are listed below:

**8.12.1. Registration.** The Contractor will not be required to register with the DIR for small projects. (Labor Code section 1771.1)

**8.12.2. Certified Payroll Records.** The records required in Labor Code section 1776 shall be required to be kept and submitted to the City of San Diego, but will not be required to be submitted online with the DIR directly. The Contractor will need to keep those records for at least three years following the completion of the Contract. (Labor Code section 1771.4).

**8.12.3. List of all Subcontractors.** The Contractor shall not be required to hire only registered subcontractors and is exempt from submitting the list of all subcontractors that is required in section 4.20.11 above. (Labor code section 1773.3).

**9. WAGE RATES:** This contract shall be subject to the following Davis-Bacon Wage Decisions:

General Decision Number: CA180001 03/02/2018 CA1

Superseded General Decision Number: CA20170001

State: California

Construction Types: Building, Heavy (Heavy and Dredging),  
Highway and Residential

County: San Diego County in California.

BUILDING CONSTRUCTION PROJECTS; DREDGING PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); HIGHWAY CONSTRUCTION PROJECTS; RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family homes and apartments up to and including 4 stories)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Modification Number	Publication Date
0	01/05/2018
1	01/12/2018
2	01/19/2018
3	02/09/2018
4	03/02/2018

ASBE0005-002 07/03/2017

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, protective coverings, coatings, and finishes to all types of mechanical systems).....	\$ 39.72	20.81
Fire Stop Technician (Application of Firestopping Materials for wall openings and penetrations in walls, floors, ceilings and curtain walls).....	\$ 26.96	17.81

ASBE0005-004 07/03/2017

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials from mechanical systems, whether they contain asbestos or not)....	\$ 19.26	11.27

BOIL0092-003 10/01/2012

	Rates	Fringes
BOILERMAKER.....	\$ 41.17	28.27

BRCA0004-008 11/01/2017

	Rates	Fringes
BRICKLAYER; MARBLE SETTER.....	\$ 37.46	16.69

BRCA0018-004 07/01/2017

	Rates	Fringes
MARBLE FINISHER.....	\$ 30.93	12.95
TILE FINISHER.....	\$ 25.98	11.23
TILE LAYER.....	\$ 37.76	16.37

BRCA0018-010 09/01/2017

	Rates	Fringes
TERRAZZO FINISHER.....	\$ 29.75	12.91
TERRAZZO WORKER/SETTER.....	\$ 36.75	13.82

CARP0409-002 07/01/2016

	Rates	Fringes
Diver		
(1) Wet.....	\$ 712.48	17.03
(2) Standby.....	\$ 356.24	17.03
(3) Tender.....	\$ 348.24	17.03
(4) Assistant Tender.....	\$ 324.24	17.03

Amounts in "Rates" column are per day

CARP0409-008 08/01/2010

	Rates	Fringes
Modular Furniture Installer.....	\$ 17.00	7.41

CARP0547-001 07/01/2016

	Rates	Fringes
CARPENTER		
(1) Bridge.....	\$ 40.33	17.03
(2) Commercial Building....	\$ 35.10	17.03
(3) Heavy & Highway.....	\$ 40.20	17.03
(4) Residential Carpenter..	\$ 28.08	17.03
(5) Residential		
Insulation Installer.....	\$ 18.00	8.16
MILLWRIGHT.....	\$ 46.70	17.03
PILEDRIVERMAN.....	\$ 40.33	17.03

\* CARP0547-002 07/01/2017

	Rates	Fringes
Drywall		
(1) Work on wood framed construction of single family residences, apartments or condominiums under four stories		
Drywall Installer/Lather...\$ 22.95		18.85
Drywall Stocker/Scrapper...\$ 12.50		12.27
(2) All other work		
Drywall Installer/Lather...\$ 32.00		17.63
Drywall Stocker/Scrapper...\$ 12.50		12.27

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ELEC0569-001 06/05/2017

	Rates	Fringes
Electricians (Tunnel Work)		
Cable Splicer.....\$ 49.41		3%+12.63
Electrician.....\$ 46.97		3%+12.63
Electricians: (All Other Work, Including 4 Stories Residential)		
Cable Splicer.....\$ 44.00		3%+12.63
Electrician.....\$ 43.25		3%+12.63

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ELEC0569-004 06/05/2017

	Rates	Fringes
ELECTRICIAN (Sound & Communications Sound Technician).....\$ 31.00		3%+11.53
SCOPE OF WORK Assembly, installation, operation, service and maintenance of components or systems as used in closed circuit television, amplified master television distribution, CATV on private property, intercommunication, burglar alarm, fire alarm, life support and all security alarms, private and public telephone and related telephone interconnect, public address, paging, audio, language, electronic, background music system less than line voltage or any system acceptable for class two wiring for private, commercial, or industrial use furnished by leased wire, frequency modulation or other recording devices, electrical apparatus by means of which		

electricity is applied to the amplification, transmission, transference, recording or reproduction of voice, music, sound, impulses and video. Excluded from this Scope of Work - transmission, service and maintenance of background music. All of the above shall include the installation and transmission over fiber optics.

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 ELEC0569-005 06/05/2017

Rates Fringes

Sound & Communications

Sound Technician.....\$ 31.00 3%+11.53

SCOPE OF WORK Assembly, installation, operation, service and maintenance of components or systems as used in closed circuit television, amplified master television distribution, CATV on private property, intercommunication, burglar alarm, fire alarm, life support and all security alarms, private and public telephone and related telephone interconnect, public address, paging, audio, language, electronic, background music system less than line voltage or any system acceptable for class two wiring for private, commercial, or industrial use furnished by leased wire, frequency modulation or other recording devices, electrical apparatus by means of which electricity is applied to the amplification, transmission, transference, recording or reproduction of voice, music, sound, impulses and video. Excluded from this Scope of Work - transmission, service and maintenance of background music. All of the above shall include the installation and transmission over fiber optics.

SOUND TECHNICIAN: Terminating, operating and performing final check-out

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 ELEC0569-006 02/27/2017

Work on street lighting; traffic signals; and underground systems and/or established easements outside of buildings

Rates Fringes

Traffic signal, street light and underground work

Utility Technician #1.....\$ 30.48 3%+7.70

Utility Technician #2.....\$ 25.45 3%+7.70

STREET LIGHT & TRAFFIC SIGNAL WORK:

UTILITY TECHNICIAN #1: Installation of street lights and traffic signals, including electrical circuitry, programmable controller, pedestal-mounted electrical meter enclosures and laying of pre-assembled cable in ducts. The layout of electrical systems and communication installation including proper position of trench depths, and radius at duct banks, location for manholes, street lights and traffic signals.

UTILITY TECHNICIAN #2: Distribution of material at jobsite, installation of underground ducts for electrical, telephone, cable TV land communication systems. The setting, leveling, grounding and racking of precast manholes, handholes and transformer pads.

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 ELEC0569-008 06/05/2017

	Rates	Fringes
ELECTRICIAN (Residential, 1-3 Stories).....	\$ 32.81	3%+6.61

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 ELEC1245-001 06/01/2017

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer..	\$ 55.49	16.62
(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment).....	\$ 44.32	3%+17.65
(3) Groundman.....	\$ 33.89	3%+17.65
(4) Powderman.....	\$ 49.55	3%+17.65

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ELEV0018-001 01/01/2018

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 53.85	32.645

FOOTNOTE:

PAID VACATION: Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.  
PAID HOLIDAYS: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

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ENGI0012-003 07/01/2017

	Rates	Fringes
OPERATOR: Power Equipment (All Other Work)		
GROUP 1.....	\$ 44.00	24.25
GROUP 2.....	\$ 44.78	24.25
GROUP 3.....	\$ 45.07	24.25
GROUP 4.....	\$ 46.56	24.25
GROUP 5.....	\$ 47.66	24.25
GROUP 6.....	\$ 46.78	24.25
GROUP 8.....	\$ 46.89	24.25
GROUP 9.....	\$ 47.99	24.25
GROUP 10.....	\$ 48.01	24.25
GROUP 11.....	\$ 48.11	24.25
GROUP 12.....	\$ 47.18	24.25
GROUP 13.....	\$ 47.28	24.25
GROUP 14.....	\$ 47.31	24.25
GROUP 15.....	\$ 47.39	24.25
GROUP 16.....	\$ 47.51	24.25
GROUP 17.....	\$ 47.68	24.25
GROUP 18.....	\$ 47.78	24.25
GROUP 19.....	\$ 47.89	24.25
GROUP 20.....	\$ 48.01	24.25
GROUP 21.....	\$ 48.18	24.25
GROUP 22.....	\$ 48.28	24.25
GROUP 23.....	\$ 48.39	24.25
GROUP 24.....	\$ 48.51	24.25
GROUP 25.....	\$ 48.68	24.25



OPERATOR: Power Equipment  
(Cranes, Piledriving &  
Hoisting)

GROUP 1.....	\$ 45.35	24.25
GROUP 2.....	\$ 46.13	24.25
GROUP 3.....	\$ 46.42	24.25
GROUP 4.....	\$ 46.56	24.25
GROUP 5.....	\$ 46.78	24.25
GROUP 6.....	\$ 46.89	24.25
GROUP 7.....	\$ 47.01	24.25
GROUP 8.....	\$ 47.18	24.25
GROUP 9.....	\$ 47.35	24.25
GROUP 10.....	\$ 48.35	24.25
GROUP 11.....	\$ 49.35	24.25
GROUP 12.....	\$ 50.35	24.25
GROUP 13.....	\$ 51.35	24.25

OPERATOR: Power Equipment  
(Tunnel Work)

GROUP 1.....	\$ 41.80	23.35
GROUP 2.....	\$ 42.58	23.35
GROUP 3.....	\$ 42.87	23.35
GROUP 4.....	\$ 43.01	23.35
GROUP 5.....	\$ 43.23	23.35
GROUP 6.....	\$ 43.34	23.35
GROUP 7.....	\$ 43.46	23.35

PREMIUM PAY:

\$3.75 per hour shall be paid on all Power Equipment Operator work on the following Military Bases: China Lake Naval Reserve, Vandenberg AFB, Point Arguello, Seely Naval Base, Fort Irwin, Nebo Annex Marine Base, Marine Corp Logistics Base Yermo, Edwards AFB, 29 Palms Marine Base and Camp Pendleton

Workers required to suit up and work in a hazardous material environment: \$2.00 per hour additional. Combination mixer and compressor operator on gunite work shall be classified as a concrete mobile mixer operator.

SEE ZONE DEFINITIONS AFTER CLASSIFICATIONS

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Bargeman; Brakeman; Compressor operator; Ditch Witch, with seat or similar type equipment; Elevator operator-inside; Engineer Oiler; Forklift operator (includes loed, lull or similar types under 5 tons;

Generator operator; Generator, pump or compressor plant operator; Pump operator; Signalman; Switchman

GROUP 2: Asphalt-rubber plant operator (nurse tank operator); Concrete mixer operator-skip type; Conveyor operator; Fireman; Forklift operator (includes loed, lull or similar types over 5 tons; Hydrostatic pump operator; oiler crusher (asphalt or concrete plant); Petromat laydown machine; PJU side dum jack; Screening and conveyor machine operator (or similar types); Skiploader (wheel type up to 3/4 yd. without attachment); Tar pot fireman; Temporary heating plant operator; Trenching machine oiler

GROUP 3: Asphalt-rubber blend operator; Bobcat or similar type (Skid steer); Equipment greaser (rack); Ford Ferguson (with dragtype attachments); Helicopter radioman (ground); Stationary pipe wrapping and cleaning machine operator

GROUP 4: Asphalt plant fireman; Backhoe operator (mini-max or similar type); Boring machine operator; Boxman or mixerman (asphalt or concrete); Chip spreading machine operator; Concrete cleaning decontamination machine operator; Concrete Pump Operator (small portable); Drilling machine operator, small auger types (Texoma super economatic or similar types - Hughes 100 or 200 or similar types - drilling depth of 30' maximum); Equipment greaser (grease truck); Guard rail post driver operator; Highline cableway signalman; Hydra-hammer-aero stomper; Micro Tunneling (above ground tunnel); Power concrete curing machine operator; Power concrete saw operator; Power-driven jumbo form setter operator; Power sweeper operator; Rock Wheel Saw/Trencher; Roller operator (compacting); Screed operator (asphalt or concrete); Trenching machine operator (up to 6 ft.); Vacuum or much truck

GROUP 5: Equipment Greaser (Grease Truck/Multi Shift).

GROUP 6: Articulating material hauler; Asphalt plant engineer; Batch plant operator; Bit sharpener; Concrete joint machine operator (canal and similar type); Concrete planer operator; Dandy digger; Deck engine operator; Derrickman (oilfield type); Drilling machine operator, bucket or auger types (Calweld 100 bucket or similar types - Watson 1000 auger or similar types - Texoma 330, 500 or 600 auger or similar types - drilling depth of 45' maximum); Drilling machine operator; Hydrographic seeder machine operator (straw, pulp or seed), Jackson track

maintainer, or similar type; Kalamazoo Switch tamper, or similar type; Machine tool operator; Maginnis internal full slab vibrator, Mechanical berm, curb or gutter (concrete or asphalt); Mechanical finisher operator (concrete, Clary-Johnson-Bidwell or similar); Micro tunnel system (below ground); Pavement breaker operator (truck mounted); Road oil mixing machine operator; Roller operator (asphalt or finish), rubber-tired earth moving equipment (single engine, up to and including 25 yds. struck); Self-propelled tar pipelining machine operator; Skiploader operator (crawler and wheel type, over 3/4 yd. and up to and including 1-1/2 yds.); Slip form pump operator (power driven hydraulic lifting device for concrete forms); Tractor operator-bulldozer, tamper-scraper (single engine, up to 100 h.p. flywheel and similar types, up to and including D-5 and similar types); Tugger hoist operator (1 drum); Ultra high pressure waterjet cutting tool system operator; Vacuum blasting machine operator

GROUP 8: Asphalt or concrete spreading operator (tamping or finishing); Asphalt paving machine operator (Barber Greene or similar type); Asphalt-rubber distribution operator; Backhoe operator (up to and including 3/4 yd.), small ford, Case or similar; Cast-in-place pipe laying machine operator; Combination mixer and compressor operator (gunite work); Compactor operator (self-propelled); Concrete mixer operator (paving); Crushing plant operator; Drill Doctor; Drilling machine operator, Bucket or auger types (Calweld 150 bucket or similar types - Watson 1500, 2000 2500 auger or similar types - Texoma 700, 800 auger or similar types - drilling depth of 60' maximum); Elevating grader operator; Grade checker; Gradall operator; Grouting machine operator; Heavy-duty repairman; Heavy equipment robotics operator; Kalamazoo balliste regulator or similar type; Kolman belt loader and similar type; Le Tourneau blob compactor or similar type; Loader operator (Athey, Euclid, Sierra and similar types); Mobark Chipper or similar; Ozzie padder or similar types; P.C. slot saw; Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pumpcrete gun operator; Rock Drill or similar types; Rotary drill operator (excluding caisson type); Rubber-tired earth-moving equipment operator (single engine, caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator (multiple engine up to and including 25 yds. struck); Rubber-tired scraper operator (self-loading paddle wheel

type-John Deere, 1040 and similar single unit); Self-propelled curb and gutter machine operator; Shuttle buggy; Skiploader operator (crawler and wheel type over 1-1/2 yds. up to and including 6-1/2 yds.); Soil remediation plant operator; Surface heaters and planer operator; Tractor compressor drill combination operator; Tractor operator (any type larger than D-5 - 100 flywheel h.p. and over, or similar-bulldozer, tamper, scraper and push tractor single engine); Tractor operator (boom attachments), Traveling pipe wrapping, cleaning and bending machine operator; Trenching machine operator (over 6 ft. depth capacity, manufacturer's rating); trenching Machine with Road Miner attachment (over 6 ft depth capacity); Ultra high pressure waterjet cutting tool system mechanic; Water pull (compaction) operator

#### GROUP 9: Heavy Duty Repairman

GROUP 10: Drilling machine operator, Bucket or auger types (Calweld 200 B bucket or similar types-Watson 3000 or 5000 auger or similar types-Texoma 900 auger or similar types-drilling depth of 105' maximum); Dual drum mixer, dynamic compactor LDC350 (or similar types); Monorail locomotive operator (diesel, gas or electric); Motor patrol-blade operator (single engine); Multiple engine tractor operator (Euclid and similar type-except Quad 9 cat.); Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Pneumatic pipe ramming tool and similar types; Prestressed wrapping machine operator; Rubber-tired earth-moving equipment operator (single engine, over 50 yds. struck); Rubber tired earth moving equipment operator (multiple engine, Euclid, caterpillar and similar over 25 yds. and up to 50 yds. struck), Tower crane repairman; Tractor loader operator (crawler and wheel type over 6-1/2 yds.); Woods mixer operator (and similar Pugmill equipment)

GROUP 11: Heavy Duty Repairman - Welder Combination, Welder - Certified.

GROUP 12: Auto grader operator; Automatic slip form operator; Drilling machine operator, bucket or auger types (Calweld, auger 200 CA or similar types - Watson, auger 6000 or similar types - Hughes Super Duty, auger 200 or similar types - drilling depth of 175' maximum); Hoe ram or similar with compressor; Mass excavator operator less tha 750 cu. yards; Mechanical finishing machine operator; Mobile form

traveler operator; Motor patrol operator (multi-engine);  
Pipe mobile machine operator; Rubber-tired earth- moving  
equipment operator (multiple engine, Euclid, Caterpillar  
and similar type, over 50 cu. yds. struck); Rubber-tired  
self- loading scraper operator (paddle-wheel-auger type  
self-loading - two (2) or more units)

GROUP 13: Rubber-tired earth-moving equipment operator  
operating equipment with push-pull system (single engine,  
up to and including 25 yds. struck)

GROUP 14: Canal liner operator; Canal trimmer operator;  
Remote- control earth-moving equipment operator (operating  
a second piece of equipment: \$1.00 per hour additional);  
Wheel excavator operator (over 750 cu. yds.)

GROUP 15: Rubber-tired earth-moving equipment operator,  
operating equipment with push-pull system (single engine,  
Caterpillar, Euclid, Athey Wagon and similar types with any  
and all attachments over 25 yds. and up to and including 50  
yds. struck); Rubber-tired earth-moving equipment operator,  
operating equipment with push-pull system (multiple  
engine-up to and including 25 yds. struck)

GROUP 16: Rubber-tired earth-moving equipment operator,  
operating equipment with push-pull system (single engine,  
over 50 yds. struck); Rubber-tired earth-moving equipment  
operator, operating equipment with push-pull system  
(multiple engine, Euclid, Caterpillar and similar, over 25  
yds. and up to 50 yds. struck)

GROUP 17: Rubber-tired earth-moving equipment operator,  
operating equipment with push-pull system (multiple engine,  
Euclid, Caterpillar and similar, over 50 cu. yds. struck);  
Tandem tractor operator (operating crawler type tractors in  
tandem - Quad 9 and similar type)

GROUP 18: Rubber-tired earth-moving equipment operator,  
operating in tandem (scrapers, belly dumps and similar  
types in any combination, excluding compaction units -  
single engine, up to and including 25 yds. struck)

GROUP 19: Rotex concrete belt operator (or similar types);  
Rubber-tired earth-moving equipment operator, operating in  
tandem (scrapers, belly dumps and similar types in any  
combination, excluding compaction units - single engine,  
Caterpillar, Euclid, Athey Wagon and similar types with any

and all attachments over 25 yds. and up to and including 50 cu. yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, up to and including 25 yds. struck)

GROUP 20: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps, and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 21: Rubber-tired earth-moving equipment operator, operating in tandem (scrapers, belly dumps and similar types in any combination, excluding compaction units - multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

GROUP 22: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, up to and including 25 yds. struck)

GROUP 23: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, Caterpillar, Euclid, Athey Wagon and similar types with any and all attachments over 25 yds. and up to and including 50 yds. struck); Rubber-tired earth-moving equipment operator, operating with the tandem push-pull system (multiple engine, up to and including 25 yds. struck)

GROUP 24: Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (single engine, over 50 yds. struck); Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar, over 25 yds. and up to 50 yds. struck)

GROUP 25: Concrete pump operator-truck mounted; Rubber-tired earth-moving equipment operator, operating equipment with the tandem push-pull system (multiple engine, Euclid, Caterpillar and similar type, over 50 cu. yds. struck)

## CRANES, PILEDRIVING AND HOISTING EQUIPMENT CLASSIFICATIONS

GROUP 1: Engineer oiler; Fork lift operator (includes loed, lull or similar types)

GROUP 2: Truck crane oiler

GROUP 3: A-frame or winch truck operator; Ross carrier operator (jobsite)

GROUP 4: Bridge-type unloader and turntable operator; Helicopter hoist operator

GROUP 5: Hydraulic boom truck; Stinger crane (Austin-Western or similar type); Tugger hoist operator (1 drum)

GROUP 6: Bridge crane operator; Cretor crane operator; Hoist operator (Chicago boom and similar type); Lift mobile operator; Lift slab machine operator (Vagtborg and similar types); Material hoist and/or manlift operator; Polar gantry crane operator; Self Climbing scaffold (or similar type); Shovel, backhoe, dragline, clamshell operator (over 3/4 yd. and up to 5 cu. yds. mrc); Tugger hoist operator

GROUP 7: Pedestal crane operator; Shovel, backhoe, dragline, clamshell operator (over 5 cu. yds. mrc); Tower crane repair; Tugger hoist operator (3 drum)

GROUP 8: Crane operator (up to and including 25 ton capacity); Crawler transporter operator; Derrick barge operator (up to and including 25 ton capacity); Hoist operator, stiff legs, Guy derrick or similar type (up to and including 25 ton capacity); Shovel, backhoe, dragline, clamshell operator (over 7 cu. yds., M.R.C.)

GROUP 9: Crane operator (over 25 tons and up to and including 50 tons mrc); Derrick barge operator (over 25 tons up to and including 50 tons mrc); Highline cableway operator; Hoist operator, stiff legs, Guy derrick or similar type (over 25 tons up to and including 50 tons mrc); K-crane operator; Polar crane operator; Self erecting tower crane operator maximum lifting capacity ten tons

GROUP 10: Crane operator (over 50 tons and up to and including 100 tons mrc); Derrick barge operator (over 50 tons up to and including 100 tons mrc); Hoist operator,

stiff legs, Guy derrick or similar type (over 50 tons up to and including 100 tons mrc), Mobile tower crane operator (over 50 tons, up to and including 100 tons M.R.C.); Tower crane operator and tower gantry

GROUP 11: Crane operator (over 100 tons and up to and including 200 tons mrc); Derrick barge operator (over 100 tons up to and including 200 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 100 tons up to and including 200 tons mrc); Mobile tower crane operator (over 100 tons up to and including 200 tons mrc)

GROUP 12: Crane operator (over 200 tons up to and including 300 tons mrc); Derrick barge operator (over 200 tons up to and including 300 tons mrc); Hoist operator, stiff legs, Guy derrick or similar type (over 200 tons, up to and including 300 tons mrc); Mobile tower crane operator (over 200 tons, up to and including 300 tons mrc)

GROUP 13: Crane operator (over 300 tons); Derrick barge operator (over 300 tons); Helicopter pilot; Hoist operator, stiff legs, Guy derrick or similar type (over 300 tons); Mobile tower crane operator (over 300 tons)

#### TUNNEL CLASSIFICATIONS

GROUP 1: Skid loader (wheel type up to 3/4 yd. without attachment)

GROUP 2: Power-driven jumbo form setter operator

GROUP 3: Dinkey locomotive or motorperson (up to and including 10 tons)

GROUP 4: Bit sharpener; Equipment greaser (grease truck); Slip form pump operator (power-driven hydraulic lifting device for concrete forms); Tugger hoist operator (1 drum); Tunnel locomotive operator (over 10 and up to and including 30 tons)

GROUP 5: Backhoe operator (up to and including 3/4 yd.); Small Ford, Case or similar; Drill doctor; Grouting machine operator; Heading shield operator; Heavy-duty repairperson; Loader operator (Athey, Euclid, Sierra and similar types); Mucking machine operator (1/4 yd., rubber-tired, rail or track type); Pneumatic concrete placing machine operator (Hackley-Presswell or similar type); Pneumatic heading



shield (tunnel); Pumpcrete gun operator; Tractor compressor drill combination operator; Tugger hoist operator (2 drum); Tunnel locomotive operator (over 30 tons)

GROUP 6: Heavy Duty Repairman

GROUP 7: Tunnel mole boring machine operator

#### ENGINEERS ZONES

\$1.00 additional per hour for all of IMPERIAL County and the portions of KERN, RIVERSIDE & SAN BERNARDINO Counties as defined below:

That area within the following Boundary: Begin in San Bernardino County, approximately 3 miles NE of the intersection of I-15 and the California State line at that point which is the NW corner of Section 1, T17N,m R14E, San Bernardino Meridian. Continue W in a straight line to that point which is the SW corner of the northwest quarter of Section 6, T27S, R42E, Mt. Diablo Meridian. Continue North to the intersection with the Inyo County Boundary at that point which is the NE corner of the western half of the northern quarter of Section 6, T25S, R42E, MDM. Continue W along the Inyo and San Bernardino County boundary until the intersection with Kern County, as that point which is the SE corner of Section 34, T24S, R40E, MDM. Continue W along the Inyo and Kern County boundary until the intersection with Tulare County, at that point which is the SW corner of the SE quarter of Section 32, T24S, R37E, MDM. Continue W along the Kern and Tulare County boundary, until that point which is the NW corner of T25S, R32E, MDM. Continue S following R32E lines to the NW corner of T31S, R32E, MDM. Continue W to the NW corner of T31S, R31E, MDM. Continue S to the SW corner of T32S, R31E, MDM. Continue W to SW corner of SE quarter of Section 34, T32S, R30E, MDM. Continue S to SW corner of T11N, R17W, SBM. Continue E along south boundary of T11N, SBM to SW corner of T11N, R7W, SBM. Continue S to SW corner of T9N, R7W, SBM. Continue E along south boundary of T9N, SBM to SW corner of T9N, R1E, SBM. Continue S along west boundary of R1E, SMB to Riverside County line at the SW corner of T1S, R1E, SBM. Continue E along south boundary of T1s, SBM (Riverside County Line) to SW corner of T1S, R10E, SBM. Continue S along west boundary of R10E, SBM to Imperial County line at the SW corner of T8S, R10E, SBM. Continue W along Imperial and Riverside county line to NW corner of T9S, R9E, SBM. Continue S along the boundary between Imperial and San Diego Counties, along the west edge of R9E,

SBM to the south boundary of Imperial County/California state line. Follow the California state line west to Arizona state line, then north to Nevada state line, then continuing NW back to start at the point which is the NW corner of Section 1, T17N, R14E, SBM

\$1.00 additional per hour for portions of SAN LUIS OBISPO, KERN, SANTA BARBARA & VENTURA as defined below:

That area within the following Boundary: Begin approximately 5 miles north of the community of Cholame, on the Monterey County and San Luis Obispo County boundary at the NW corner of T25S, R16E, Mt. Diablo Meridian. Continue south along the west side of R16E to the SW corner of T30S, R16E, MDM. Continue E to SW corner of T30S, R17E, MDM. Continue S to SW corner of T31S, R17E, MDM. Continue E to SW corner of T31S, R18E, MDM. Continue S along West side of R18E, MDM as it crosses into San Bernardino Meridian numbering area and becomes R30W. Follow the west side of R30W, SBM to the SW corner of T9N, R30W, SBM. Continue E along the south edge of T9N, SBM to the Santa Barbara County and Ventura County boundary at that point which is the SW corner of Section 34. T9N, R24W, SBM, continue S along the Ventura County line to that point which is the SW corner of the SE quarter of Section 32, T7N, R24W, SBM. Continue E along the south edge of T7N, SBM to the SE corner to T7N, R21W, SBM. Continue N along East side of R21W, SBM to Ventura County and Kern County boundary at the NE corner of T8N, R21W. Continue W along the Ventura County and Kern County boundary to the SE corner of T9N, R21W. Continue North along the East edge of R21W, SBM to the NE corner of T12N, R21W, SBM. Continue West along the north edge of T12N, SBM to the SE corner of T32S, R21E, MDM. [T12N SBM is a thin strip between T11N SBM and T32S MDM]. Continue North along the East side of R21E, MDM to the Kings County and Kern County border at the NE corner of T25S, R21E, MDM, continue West along the Kings County and Kern County Boundary until the intersection of San Luis Obispo County. Continue west along the Kings County and San Luis Obispo County boundary until the intersection with Monterey County. Continue West along the Monterey County and San Luis Obispo County boundary to the beginning point at the NW corner of T25S, R16E, MDM.

\$2.00 additional per hour for INYO and MONO Counties and the Northern portion of SAN BERNARDINO County as defined below:

That area within the following Boundary: Begin at the intersection of the northern boundary of Mono County and the California state line at the point which is the center of Section 17, T10N, R22E, Mt. Diablo Meridian. Continue S then SE along the entire western boundary of Mono County, until it reaches Inyo County at the point which is the NE corner of the Western half of the NW quarter of Section 2, T8S, R29E, MDM. Continue SSE along the entire western boundary of Inyo County, until the intersection with Kern County at the point which is the SW corner of the SE 1/4 of Section 32, T24S, R37E, MDM. Continue E along the Inyo and Kern County boundary until the intersection with San Bernardino County at that point which is the SE corner of section 34, T24S, R40E, MDM. Continue E along the Inyo and San Bernardino County boundary until the point which is the NE corner of the Western half of the NW quarter of Section 6, T25S, R42E, MDM. Continue S to that point which is the SW corner of the NW quarter of Section 6, T27S, R42E, MDM. Continue E in a straight line to the California and Nevada state border at the point which is the NW corner of Section 1, T17N, R14E, San Bernardino Meridian. Then continue NW along the state line to the starting point, which is the center of Section 18, T10N, R22E, MDM.

REMAINING AREA NOT DEFINED ABOVE RECIEVES BASE RATE

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 ENGI0012-004 08/01/2015

Rates      Fringes

OPERATOR: Power Equipment  
 (DREDGING)

(1) Leverman.....	\$ 49.50	23.60
(2) Dredge dozer.....	\$ 43.53	23.60
(3) Deckmate.....	\$ 43.42	23.60
(4) Winch operator (stern winch on dredge).....	\$ 42.87	23.60
(5) Fireman-Oiler, Deckhand, Bargeman, Leveehand.....	\$ 42.33	23.60
(6) Barge Mate.....	\$ 42.94	23.60

IRON0377-002 01/01/2017

Rates Fringes

Ironworkers:

Fence Erector.....	\$ 29.58	21.59
Ornamental, Reinforcing and Structural.....	\$ 36.00	30.15

PREMIUM PAY:

\$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval Reserve-Niland, Edwards AFB, Fort Irwin Military Station, Fort Irwin Training Center-Goldstone, San Clemente Island, San Nicholas Island, Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine Base - Barstow, U.S. Naval Air Facility - Sealey, Vandenberg AFB

\$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base, Naval Post Graduate School - Monterey, Yermo Marine Corps Logistics Center

\$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

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LABO0089-001 07/18/2016

Rates Fringes

LABORER (BUILDING and all other Residential Construction)

Group 1.....	\$ 29.42	19.78
Group 2.....	\$ 30.10	19.78
Group 3.....	\$ 30.81	19.78
Group 4.....	\$ 31.61	19.78
Group 5.....	\$ 33.54	19.78

LABORER (RESIDENTIAL  
CONSTRUCTION - See definition  
below)

(1) Laborer.....	\$ 27.32	18.11
(2) Cleanup, Landscape, Fencing (Chain Link & Wood).	\$ 26.03	18.11

RESIDENTIAL DEFINITION: Wood or metal frame construction of single family residences, apartments and condominiums - excluding (a) projects that exceed three stories over a garage level, (b) any utility work such as telephone, gas, water, sewer and other utilities and (c) any fine grading work, utility work or paving work in the future street and public right-of-way; but including all rough grading work at the job site behind the existing right of way

#### LABORER CLASSIFICATIONS

GROUP 1: Cleaning and handling of panel forms; Concrete Screeding for Rought Strike-off; Concrete, water curing; Demolition laborer; Flagman; Gas, oil and/or water pipeline laborer; General Laborer; General clean-up laborer; Landscape laborer; Jetting laborer; Temporary water and air lines laborer; Material hoseman (walls, slabs, floors and decks); Plugging, filling of Shee-bolt holes; Dry packing of concrete; Railroad maintenance, Repair Trackman and road beds, Streetcar and railroad construction trac laborers; Slip form raisers; Slurry seal crews (mixer operator, applicator operator, squeegee man, Shuttle man, top man), filling of cracks by any method on any surface; Tarman and mortar man; Tool crib or tool house laborer; Window cleaner; Wire Mesh puling-all concrete pouring operations

GROUP 2: Asphalt Shoveler; Cement Dumper (on 1 yard or larger mixer and handling bulk cement); Cesspool digger and installer; Chucktender; Chute man, pouring concrete, the handling of the cute from ready mix trucks, such as walls, slabs, decks, floors, foundations, footings, curbs, gutters and sidewalks; Concrete curer-impervious membrane and form oiler; Cutting torch operator (demoliton); Guinea chaser; Headboard man-asphlt; Laborer, packing rod steel and pans; membrane vapor barrier installer; Power broom sweepers (small); Riiprap, stonepaver, placing stone or wet sacked concrete; Roto scraper and tiller; Tank sealer and cleaner; Tree climber, faller, chain saw

operator, Pittsburgh Chipper and similar type brush shredders; Underground laborers, including caisson bellow

GROUP 3: Buggymobile; Concrete cutting torch; Concrete cutting torch; Concrete pile cutter; Driller, jackhammer, 2 1/2 feet drill steel or longer; Dri Pak-it machine; High sealer (including drilling of same); Hydro seeder and similar type; Impact wrench, multi-plate; Kettlemen, potmen and men applying asphalt, lay-kold, creosote, line caustic and similar type materials (applying means applying, dipping, brushing or handling of such materials for pipe wrapping and waterproofing); Operators of pneumatic, gas, electric tools, vibrating machines, pavement breakers, air blasting, come-along, and similar mechanical tools not separately classified herein; Pipelayers back up man coating, grouting, making of joints, sealing, caulking, diapering and including rubber gasket joints, pointing and any and all other services; Rotary Scarifier or multiple head concrete chipping scarifier; Steel header board man and guideline setter; Tampers, Barko, Wacker and similar type; Trenching machine, handpropelled

GROUP 4: Asphalt raker, luterman, ironer, asphalt dumpman and asphalt spreader boxes (all types); Concrete core cutter (walls, floors or ceilings), Grinder or sander; Concrete saw man; cutting walls or flat work, scoring old or new concrete; Cribber, shorer, lagging, sheeting and trench bracing, hand-guided lagging hammer; Laser beam in connection with laborer's work; Oversize concrete vibrator operator 70 pounds and over; Pipelayer performing all services in the laying, installation and all forms of connection of pipe from the point of receiving pipe in the ditch until completion of operation, including any and all forms of tubular material, whether pipe, metallic or non-metallic, conduit, and any other stationary type of tubular device used for the conveying of any substance or element, whether water, sewage, solid, gas, air or other product whatsoever and without regard to the nature of material from which the tubular material is fabricated; No joint pipe and stripping of same; Prefabricated manhole installer; Sandblaster (nozzleman), Porta shot-blast, water blasting

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all powder and explosives of whatever type, regardless of method used for such loading and placing; Driller-all power drills, excluding

jackhammer, whether core, diamond, wagon, track, multiple unit, and any and all other types of mechanical drills without regard to the form of motive power.

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LABO0089-002 11/01/2017

	Rates	Fringes
LABORER (MASON TENDER).....	\$ 30.00	16.47

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LABO0089-004 07/01/2017

HEAVY AND HIGHWAY CONSTRUCTION

	Rates	Fringes
Laborers:		
Group 1.....	\$ 31.63	18.58
Group 2.....	\$ 32.09	18.58
Group 3.....	\$ 32.50	18.58
Group 4.....	\$ 33.34	18.58
Group 5.....	\$ 37.46	18.58

LABORER CLASSIFICATIONS

GROUP 1: Laborer: General or Construction Laborer, Landscape Laborer. Asphalt Rubber Material Loader. Boring Machine Tender (outside), Carpenter Laborer (cleaning, handling, oiling & blowing of panel forms and lumber), Concrete Laborer, Concrete Screeding for rough strike-off, Concrete water curing. Concrete Curb & Gutter laborer, Certified Confined Space Laborer, Demolition laborer & Cleaning of Brick and lumber, Expansion Joint Caulking; Environmental Remediation, Monitoring Well, Toxic waste and Geotechnical Drill tender, Fine Grader, Fire Watcher, Limbers, Brush Loader, Pilers and Debris Handlers. flagman. Gas Oil and Water Pipeline Laborer. Material Hoseman (slabs, walls, floors, decks); Plugging, filling of shee bolt holes; Dry packing of concrete and patching; Post Holer Digger (manual); Railroad maintenance, repair trackman, road beds; Rigging & signaling; Scaler, Slip-Form Raisers, Filling cracks on any surface, tool Crib or Tool House Laborer, Traffic control (signs, barriers, barricades, delineator, cones etc.), Window Cleaner

GROUP 2: Asphalt abatement; Buggymobile; Cement dumper (on 1 yd. or larger mixers and handling bulk cement); Concrete curer, impervious membrane and form oiler; Chute man, pouring concrete; Concrete cutting torch; Concrete pile cutter; driller/Jackhammer, with drill steel 2 1/2 feet or longer; Dry pak-it machine; Fence erector; Pipeline wrapper, gas, oil, water, pot tender & form man; Grout man; Installation of all asphalt overlay fabric and materials used for reinforcing asphalt; Irrigation laborer; Kettleman-Potman hot mop, includes applying asphalt, lay-klold, creosote, lime caustic and similar tyhpes of materials (dipping, brushing, handling) and waterproofing; Membrane vapor barrier installer; Pipelayer backup man (coating, grouting, making of joints, sealing caulkiing, diapering including rubber basket joints, pointing); Rotary scarifier, multiple head concrete chipper; Rock slinger; Roto scraper & tiller; Sandblaster pot tender; Septic tank digger/installer; Tamper/wacker operator; Tank scaler & cleaner; Tar man & mortar man; Tree climber/faller, chainb saw operator, Pittsburgh chipper & similar type brush shredders.

GROUP 3: Asphalt, installation of all frabricks; Buggy Mobile Man, Bushing hammer; Compactor (all types), Concrete Curer - Impervious membrane, Form Oiler, Concrete Cutting Torch, Concrete Pile Cutter,Driller/Jackhammer with drill steel 2 1/2 ft or longer, Dry Pak-it machine, Fence erector including manual post hole digging, Gas oil or water Pipeline Wrapper - 6 ft pipe and over, Guradrail erector, Hydro seeder, Impact Wrench man (multi plate), kettleman-Potman Hot Mop includes applying Asphalt, Lay-Kold, Creosote, lime caustic and similar types of materials (dipping, brushing or handling) and waterproofing. Laser Beam in connection with Laborer work. High Scaler, Operators of Pneumatic Gas or Electric Tools, Vibrating Machines, Pavement Breakers, Air Blasting, Come-Alongs and similar mechanical tools, Remote-Controlled Robotic Tools in connection with Laborers work. Pipelayer Backup Man (Coating, grouting,m makeing of joints, sealing, caulking, diapering including rubber gasket joints, pointing and other services). Power Post Hole Digger, Rotary Scarifier (multiple head concrete chipper scarifier), Rock Slinger, Shot Blast equipment (8 to 48 inches), Steel Headerboard Man and Guideline Setter, Tamper/Wacker operator and similar types, Trenching Machine hand propelled.



GROUP 4: Any worker exposed to raw sewage. Asphalt Raker, Luteman, Asphalt Dumpman, Asphalt Spreader Boxes, Concrete Core Cutter, Concrete Saw Man, Cribber, Shorer, Head Rock Slinger. Installation of subsurface instrumentation, monitoring wells or points, remediation system installer; Laborer, asphalt-rubber distributor bootman; Oversize concrete vibrator operators, 70 pounds or over. Pipelayer, Prefabricated Manhole Installer, Sandblast Nozzleman (Water Blasting-Porta Shot Blast), Traffic Lane Closure.

GROUP 5: Blasters Powderman-All work of loading holes, placing and blasting of all powder and explosives of whatever type, regardless of method used for such loading and placing; Horizontal directional driller, Boring system, Electronic tracking, Driller: all power drills excluding jackhammer, whether core, diamond, wagon, track, multiple unit, and all other types of mechanical drills without regard to form of motive power. Environmental remediation, Monitoring well, Toxic waste and Geotechnical driller, Toxic waste removal. Welding in connection with Laborer's work.

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LABO0300-005 01/01/2018

	Rates	Fringes
Asbestos Removal Laborer.....	\$ 33.19	17.78

SCOPE OF WORK: Includes site mobilization, initial site cleanup, site preparation, removal of asbestos-containing material and toxic waste, encapsulation, enclosure and disposal of asbestos- containing materials and toxic waste by hand or with equipment or machinery; scaffolding, fabrication of temporary wooden barriers and assembly of decontamination stations.

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LABO1184-001 07/01/2017

	Rates	Fringes
Laborers: (HORIZONTAL DIRECTIONAL DRILLING)		
(1) Drilling Crew Laborer...	\$ 34.65	13.20
(2) Vehicle Operator/Hauler.	\$ 34.82	13.20
(3) Horizontal Directional		

Drill Operator.....	\$ 36.67	13.20
(4) Electronic Tracking Locator.....	\$ 38.67	13.20
Laborers: (STRIPING/SLURRY SEAL)		
GROUP 1.....	\$ 35.86	16.21
GROUP 2.....	\$ 37.16	16.21
GROUP 3.....	\$ 39.17	16.21
GROUP 4.....	\$ 40.91	16.21

LABORERS - STRIPING CLASSIFICATIONS

GROUP 1: Protective coating, pavement sealing, including repair and filling of cracks by any method on any surface in parking lots, game courts and playgrounds; carstops; operation of all related machinery and equipment; equipment repair technician

GROUP 2: Traffic surface abrasive blaster; pot tender - removal of all traffic lines and markings by any method (sandblasting, waterblasting, grinding, etc.) and preparation of surface for coatings. Traffic control person: controlling and directing traffic through both conventional and moving lane closures; operation of all related machinery and equipment

GROUP 3: Traffic delineating device applicator: Layout and application of pavement markers, delineating signs, rumble and traffic bars, adhesives, guide markers, other traffic delineating devices including traffic control. This category includes all traffic related surface preparation (sandblasting, waterblasting, grinding) as part of the application process. Traffic protective delineating system installer: removes, relocates, installs, permanently affixed roadside and parking delineation barricades, fencing, cable anchor, guard rail, reference signs, monument markers; operation of all related machinery and equipment; power broom sweeper

GROUP 4: Striper: layout and application of traffic stripes and markings; hot thermo plastic; tape traffic stripes and markings, including traffic control; operation of all related machinery and equipment

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LABO1414-003 08/02/2017

Rates Fringes

LABORER

PLASTER CLEAN-UP LABORER....	\$ 35.50	18.29
PLASTER TENDER.....	\$ 38.05	18.29

Work on a swing stage scaffold: \$1.00 per hour additional.

Work at Military Bases - \$3.00 additional per hour:

Coronado Naval Amphibious Base, Fort Irwin, Marine Corps Air Station-29 Palms, Imperial Beach Naval Air Station, Marine Corps Logistics Supply Base, Marine Corps Pickle Meadows, Mountain Warfare Training Center, Naval Air Facility-Seeley, North Island Naval Air Station, Vandenberg AFB.

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PAIN0036-001 01/01/2018

Rates Fringes

Painters: (Including Lead Abatement)

(1) Repaint (excludes San Diego County).....	\$ 27.59	14.14
(2) All Other Work.....	\$ 31.12	14.14

REPAINT of any previously painted structure. Exceptions: work involving the aerospace industry, breweries, commercial recreational facilities, hotels which operate commercial establishments as part of hotel service, and sports facilities.

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PAIN0036-010 10/01/2017

Rates Fringes

DRYWALL FINISHER/TAPER

(1) Building & Heavy Construction.....	\$ 30.24	16.95
(2) Residential Construction (Wood frame apartments, single family homes and multi-duplexes		

up to and including four stories).....\$ 23.50      15.96

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\* PAIN0036-012 10/01/2017

Rates      Fringes

GLAZIER.....\$ 42.55      18.57

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PAIN0036-019 01/01/2018

Rates      Fringes

SOFT FLOOR LAYER.....\$ 30.02      13.68

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PLAS0200-005 08/02/2017

Rates      Fringes

PLASTERER.....\$ 41.26      14.46

NORTH ISLAND NAVAL AIR STATION, COLORADO NAVAL AMPHIBIOUS BASE, IMPERIAL BEACH NAVAL AIR STATION: \$3.00 additional per hour.

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PLAS0500-001 07/01/2017

Rates      Fringes

CEMENT MASON/CONCRETE FINISHER

GROUP 1.....\$ 26.34      19.77  
GROUP 2.....\$ 27.99      19.77  
GROUP 3.....\$ 29.57      19.77

CEMENT MASONS - work inside the building line, meeting the following criteria:

GROUP 1: Residential wood frame project of any size; work classified as Type III, IV or Type V construction; interior tenant improvement work regardless the size of the project; any wood frame project of four stories or less.

GROUP 2: Work classified as type I and II construction

GROUP 3: All other work

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PLUM0016-006 07/01/2017

	Rates	Fringes
PLUMBER, PIPEFITTER, STEAMFITTER		
Camp Pendleton.....	\$ 53.78	21.61
Plumber and Pipefitter All other work except work on new additions and remodeling of bars, restaurant, stores and commercial buildings not to exceed 5,000 sq. ft. of floor space and work on strip malls, light commercial, tenant improvement and remodel work.....	\$ 49.28	21.61
Work ONLY on new additions and remodeling of commercial buildings, bars, restaurants, and stores not to exceed 5,000 sq. ft. of floor space.....	\$ 47.76	20.63
Work ONLY on strip malls, light commercial, tenant improvement and remodel work.....	\$ 36.91	18.96

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PLUM0016-011 07/01/2017

	Rates	Fringes
PLUMBER/PIPEFITTER		
Residential.....	\$ 39.91	17.53

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PLUM0078-001 07/01/2016

	Rates	Fringes
PLUMBER		
Landscape/Irrigation Fitter..	\$ 44.16	25.19
Sewer & Storm Drain Work....	\$ 44.16	25.19

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ROOF0045-001 07/01/2017

	Rates	Fringes
ROOFER.....	\$ 30.73	8.43

SFCA0669-001 04/01/2017

	Rates	Fringes
SPRINKLER FITTER.....	\$ 39.17	15.84

SHEE0206-001 07/01/2017

	Rates	Fringes
SHEET METAL WORKER		
Camp Pendleton.....	\$ 38.88	26.52
Except Camp Pendleton.....	\$ 36.88	26.52
Sheet Metal Technician.....	\$ 27.70	8.43

SHEET METAL TECHNICIAN - SCOPE:

- a. Existing residential buildings, both single and multi-family, where each unit is heated and/or cooled by a separate system
- b. New single family residential buildings including tracts.
- c. New multi-family residential buildings, not exceeding five stories of living space in height, provided each unit is heated or cooled by a separate system. Hotels and motels are excluded.
- d. LIGHT COMMERCIAL WORK: Any sheet metal, heating and air conditioning work performed on a project where the total construction cost, excluding land, is under \$1,000,000
- e. TENANT IMPROVEMENT WORK: Any work necessary to finish interior spaces to conform to the occupants of commercial buildings, after completion of the building shell

TEAM0166-001 07/03/2017

	Rates	Fringes
Truck drivers:		
GROUP 1.....	\$ 15.90	32.69
GROUP 2.....	\$ 23.49	32.69
GROUP 3.....	\$ 23.69	32.69
GROUP 4.....	\$ 23.89	32.69
GROUP 5.....	\$ 24.09	32.69

GROUP 6.....	\$ 24.59	32.69
GROUP 7.....	\$ 26.09	32.69

FOOTNOTE: HAZMAT PAY: Work on a hazmat job, where hazmat certification is required, shall be paid, in addition to the classification working in, as follows: Levels A, B and C - +\$1.00 per hour. Workers shall be paid hazmat pay in increments of four (4) and eight (8) hours.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Fuel Man, Swamper

GROUP 2: 2-axle Dump Truck, 2-axle Flat Bed, Concrete Pumping Truck, Industrial Lift Truck, Motorized Traffic Control, Pickup Truck on Jobsite

GROUP 3: 2-axle Water Truck, 3-axle Dump Truck, 3-axle Flat Bed, Erosion Control Nozzleman, Dump Crete Truck under 6.5 yd, Forklift 15,000 lbs and over, Prell Truck, Pipeline Work Truck Driver, Road Oil Spreader, Cement Distributor or Slurry Driver, Bootman, Ross Carrier

GROUP 4: Off-road Dump Truck under 35 tons 4-axles but less than 7-axles, Low-Bed Truck & Trailer, Transit Mix Trucks under 8 yd, 3-axle Water Truck, Erosion Control Driver, Grout Mixer Truck, Dump Crete 6.5yd and over, Dumpster Trucks, DW 10, DW 20 and over, Fuel Truck and Dynamite, Truck Greaser, Truck Mounted Mobile Sweeper 2-axle Winch Truck

GROUP 5: Off-road Dump Truck 35 tons and over, 7-axles or more, Transit Mix Trucks 8 yd and over, A-Frame Truck, Swedish Cranes

GROUP 6: Off-Road Special Equipment (including but not limited to Water Pull Tankers, Athey Wagons, DJB, B70 Wuclids or like Equipment)

GROUP 7: Repairman

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

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The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

#### Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198



indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

### Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

### Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

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## WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage

payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U.S. Department of Labor  
200 Constitution Avenue, N.W.  
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

**10. SECTION 3 OF THE HOUSING AND URBAN DEVELOPMENT ACT OF 1968:**

- 10.1.** The work to be performed under this contract is on a project assisted under a program providing direct Federal financial assistance from the Department of Housing and Urban Development and is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u. Section 3 requires that to the greatest extent feasible opportunities for training and employment be given lower income residents of the project area and contracts for work in connection with the project be awarded to business concerns which are located in or owned in substantial part by persons residing in the area of the project.
- 10.2.** The parties to this contract will comply with the provisions of said Section 3 and the regulations issued pursuant thereto by the Secretary of Housing and Urban Development set forth in 24 CFR Part 135, and all applicable rules and orders of the Department issued thereunder prior to the execution of this contract. The parties to this contract certify and agree that they are under no contractual or other disability which would prevent them from complying with these requirements.
- 10.3.** The Contractor will send to each labor organization or representative of workers with which he has a collective bargaining agreement or other contract or understanding, if any, a notice advising the said labor organization or workers' representative of his commitments under this Section 3 clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment or training.
- 10.4.** The Contractor will include this Section 3 clause in every subcontract for work in connection with the project and will, at the direction of the applicant for or recipient of Federal financial assistance, take appropriate action pursuant to the subcontract upon a finding that the Subcontractor is in violation of regulations issued by the Secretary of Housing and Urban Development, 24 CFR Part 135. The Contractor will not subcontract with any Subcontractor where it has notice or knowledge that the latter has been found in violation of regulations under 24 CFR Part 135 and will not let any subcontract unless the Subcontractor has first provided it with a preliminary statement of ability to comply with the requirements of these regulations.
- 10.5.** Compliance with the provisions of Section 3, the regulations set forth in 24 CFR Part 135, and all applicable rules and orders of the Department issued thereunder prior to the execution of the contract, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors and assigns. Failure to fulfill these requirements shall subject the applicant or recipient, its Contractors and Subcontractors, its successors, and assigns to those sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided, and to such sanctions as are specified by 24 CFR Part 135.

**11. FEDERAL LABOR STANDARDS PROVISIONS:**

**APPLICABILITY:** The Project or Program to which the construction work covered by this contract pertains is being assisted by the United States of America and the following Federal Labor Standards Provisions

(Office of the Secretary of Labor 29 CFR 5) are included in this Contract pursuant to the provisions applicable to such Federal assistance.

## **SECTION A.**

### **1. Minimum Wages.**

- (i)** All laborers and mechanics employed or working upon the site of the work, (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project) will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible, place where it can be easily seen by the workers.

- (ii)** **(a)** Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Federal Agency or its designee shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
  - (1)** The work to be performed by the classification requested is not performed by a classification in the wage determination; and
  - (2)** The classification is utilized in the area by the construction industry; and
  - (3)** The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination

**(b)** If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, D.C. 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

**(c)** In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

**(d)** The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (1)(ii)(b) or (c) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

**(iii)** Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

**(iv)** If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

## **2. Withholding.**

The Federal Agency or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of

1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the Federal Agency or its designee may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

### **3. Payrolls and Basic Records.**

- (i)** Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section I(b)(2)(B) of the Davis-bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5 (a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section I(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.
- (ii)** **(a)** The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Federal Agency or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the case may be, for transmission to the Federal Agency or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i) except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired.

Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <https://www.dol.gov/whd/forms/wh347.pdf> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors.

Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Federal Agency or its designee if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant sponsor, or owner, as the

case may be, for transmission to the Federal Agency, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or, owner).

**(b)** Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

- (1)** That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5 (a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete;
- (2)** That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;
- (3)** That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

**(c)** The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph A.3.(ii)(b) of this section.

**(d)** The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 231 of Title 31 of the United States Code.

- (iii)** The contractor or subcontractor shall make the records required under subparagraph A.3.(i) of this section available for inspection, copying, or transcription by authorized representatives of the Federal Agency or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, Federal agency or its designee may, after written notice to the contractor, sponsor, applicant or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.



#### 4. Apprentices and Trainees.

- (i) **Apprentices.** Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination.

Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

- (ii) **Trainees.** Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in

accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

**(iii) Equal Employment Opportunity.** The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

**5. Compliance With Copeland Act Requirements.**

The contractor shall comply with the requirements of 29 CFR Part 3 which are incorporated by reference in this contract.

**6. Subcontracts.**

The contractor or subcontractor will insert in any subcontracts the clauses contained in 29 CFR 5.59(a)(1) through (10 and such other clauses as the Federal Agency may by appropriate instructions require, and a copy of the applicable prevailing wage decision, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

**7. Contract Termination; Debarment.**

A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

**8. Compliance with Davis-Bacon and Related Act Requirements.**

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

**9. Disputes Concerning Labor Standards.**

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the

procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

#### **10. Certification of Eligibility.**

- (i) Certification of Eligibility. By entering into this contract the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- (ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1)..
- (iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

**SECTION B.** The provisions of this section B are applicable where the amount of the prime contract exceeds \$100,000. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

#### **1. Contract Work Hours and Safety Standards Act.**

- (i) **Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.
- (ii) **Violation; Liability For Unpaid Wages; Liquidated Damages.** In the event of any violation of the clause set forth in subparagraph (B)(1)(i) of this section, the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subparagraph (B)(1)(i) of this paragraph, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by the clause set forth in sub paragraph (B)(1)(i) of this section.
- (iii) **Withholding For Unpaid Wages And Liquidated Damages.** The Federal Agency or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contract, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the

same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph (B)(1)(ii) of this section.

**(iv) Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraphs (B)(1)(i) through (B)(1)(iv) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in subparagraphs (B)(1)(i) through (B)(1)(iv) of this section.

**2.** In addition to the clauses contained in Section B, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

## **SECTION C.**

### **1. Compliance Verification.**

**(i)** The Recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. Use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from the funding agency upon request.

**(ii)** The Recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the Recipient should conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. The Recipient must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. The Recipient shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

- (iii) The Recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The Recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable the Recipient shall spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. The Recipient must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the Recipient shall verify evidence of fringe benefit plans and payments thereunder by contractors and subcontractors who claim credit for fringe benefit contributions.
- (iv) The Recipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in subsection (ii) and (iii) above.
- (v) The Recipient must immediately report potential violations of the DB prevailing wage requirements to the funding agency DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/whd/america2.htm>.

## 12. AGENCY SPECIFIC PROVISIONS:

Note: Failure to comply with these specifications e.g., taking the specified steps prior to Bid opening and submitting the forms with the Bid, will lead to the Bid being declared **non-responsive** and, therefore, shall be rejected.

### 12.1. CDBG HUD Requirements:

**12.1.1.** Affirmative Good Faith Effort Steps shall include the steps listed at 24 CFR 85.36(e)(2), set forth below:

1. Placing qualified DBE business enterprises on solicitation lists;
2. Assuring that DBE business enterprises are solicited whenever they are potential sources;
3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBE business enterprises;
4. Establishing delivery schedules, where the requirement permits, which encourage participation by DBE business enterprises;

5. Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and
6. Requiring the Subcontractors to take the affirmative steps listed in this section.
7. See "DBE Potential Resources Centers" Section in these specifications. Include a completed copy of the form AA61, "List of Work Made Available" with the GFE documentation.

**13. DBE POTENTIAL RESOURCES CENTERS:**

- 13.1.** Utilization of US Small Business Administration and Minority Business Development Agency (MBDA) resources is required at no cost. These agencies offer several services, including Internet access to databases of DBEs.
- 13.2.** For additional assistance, the recipient or contractor can telephone the local offices of both agencies in their area (SBA Minority Enterprise Development Offices and DOC MBDA Regional Centers). The Internet web sites also include names, addresses, and phone or fax numbers of local SBA and MBDA centers. Do not write to these sources.
- 13.3.** The Contractor shall provide documentation that the local SBA/MBDA offices or web sites were notified of the contracting bid opportunity at least 15 Working Days prior to Bid opening and solicitation to DBE subcontractors at least 10 Working Days prior to Bid opening. Documentation shall not only include the efforts to contact the information sources and list the Contract opportunity, but also the solicitation and response to the bid request.
- 13.4.** Include qualified DBEs on solicitation lists and record the information on Form AA63. Solicitation shall be as broad as possible.
- 13.5.** If DBE sources are not located, explain why and describe the efforts made.
- 13.6.** The Contractor shall send invitations to at least 3 (or all, if less than 3) DBE vendors for each item of work referred by sources contacted. The invitations shall adequately specify the items for which bids are requested. The record of "good faith" efforts shall indicate a real desire for a positive response, such as a certified mail receipt or a documented telephone conversation.
- 13.7.** A regular letter or an unanswered telephone call is not an adequate "good faith" effort. A list of all sub-bidders, including the bidders not selected and non DBE Subcontractors, and bid amount for each item of the Work shall be submitted on Form AA62. If a low bid was not accepted, an explanation shall be provided.

**13.8. Federal Agencies (must be contacted and solicitations posted on their websites):**

Name and Address	Telephone and Web Site
<b>U.S. Small Business Administration</b>	(415) 744-6820 Extension 0
455 Market Street, Suite 600	Dynamic Small Business Search: <a href="http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm">http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm</a> <sup>1</sup>
San Francisco, CA 94105	Bid Notification: <a href="https://eweb1.sba.gov/subnet/common/dsp_login.cfm">https://eweb1.sba.gov/subnet/common/dsp_login.cfm</a> <sup>2</sup>
RE: Minority Enterprise Development Offices	
<b>U.S. Department of Commerce</b>	(415) 744-7415
Minority Business Development Agency	Website:
555 Montgomery Street	<a href="http://www.mbda.gov/">http://www.mbda.gov/</a> <sup>3</sup>
San Francisco, CA 94111	RE: Business Development Centers

**13.9. State Agencies (must be contacted):**

Name and Address	Telephone and Web Site
<b>California Department of Transportation</b>	Mailing Address: PO Box 942874
(CALTRANS) Business Enterprise Program <sup>4</sup>	Sacramento, CA 94274-0015
1820 Alhambra Blvd.	(916) 227-9599
Sacramento, CA 95816	<u>DBE Database:</u> <a href="http://www.dot.ca.gov/hq/bep/find_certified.htm">www.dot.ca.gov/hq/bep/find_certified.htm</a>
<b>CA Public Utilities Commission (CPUC)<sup>5</sup></b>	
505 Van Ness Avenue	<u>Directory:</u>
San Francisco, CA 94102-3298	<a href="https://sch.thesupplierclearinghouse.com/FrontEnd/SearchCertifiedDirectory.asp">https://sch.thesupplierclearinghouse.com/FrontEnd/SearchCertifiedDirectory.asp</a>

Notes:

1. The Contractor shall use the SBA's Dynamic Business Search database to search for potential subcontractors, suppliers, and/or manufacturers. Provide a copy of search records with GFE documentation.
2. The Contractor shall use SUB-Net to post subcontracting opportunities. The Contractor shall post Subcontractor opportunities at least 15 Working Days prior to bid opening. Small businesses can review this web site to identify opportunities in their areas of expertise. The web site is designed primarily as a place for large businesses to post solicitations and notices. Provide copy of the Display Solicitation Record with the GFE documentation.

3. The Contractors may use MBDA web portal to post subcontracting opportunities. If utilized, the Contractor shall post subcontractor opportunities at least 15 Working Days prior to Bid opening. Small businesses can review this web site to identify opportunities in their areas of expertise. The web site is designed primarily as a place for large businesses to post solicitations and notices. Provide copy of the Offer Overview with the GFE documentation.
4. Based on the federal DBE program, CALTRANS maintains a database and provides directories of minority and woman-owned firms. Provide copy of search records with GFE documentation.
5. CPUC maintains a database of DBE-owned business enterprises and serves to inform the public. Provide copy of search records with GFE documentation.

**14. GOOD FAITH EFFORT DOCUMENTATION SUBMITTALS:**

**14.1.** The affirmative GFE steps documentation shall be submitted **within 4 Working Days of the Bid Opening**. If this documentation is not submitted when due, the City will declare the Bid **non-responsive** and reject it.

**14.2.** The required documentation shall be submitted and logged in at the following address:

CITY OF SAN DIEGO  
PUBLIC WORKS CONTRACTS  
525 B STREET, SUITE 750, MS 908A  
SAN DIEGO, CA 92101

SUBJECT: AFFIRMATIVE GOOD FAITH EFFORT DOCUMENTATION  
BID NO. **K-18-1746-DBB-3**

**14.3.** The Contractor shall maintain the records documenting compliance with requirements including documentation of its GFE and data relied upon in formulating its fair share objectives.

**15. FORMS:**

**15.1.** The Contractor shall demonstrate that efforts were made to attract DBEs on this contract. The Contractor and Subcontractors shall take the steps listed in these specifications to assure that DBEs are used whenever possible as sources of supplies, construction, equipment, or services. In addition to the specified GFE documentation, the Bidder shall submit the following forms:

**15.1.1.** The following forms shall be completed and submitted within **4 Working Days of the Bid opening**. Failure to include any of the forms shall cause the Bid to be deemed **non-responsive**.

1. Form AA61 List of Work Made Available
2. Form AA62 Summary of Bids Received
3. Form AA63 Good Faith Effort List of Subcontractors Solicited



**FUNDING AGENCY PROVISIONS**  
**FORMS**

**LIST OF WORK MADE AVAILABLE**

List items of the Work the Bidder made available to DBE firms. Identify those items of the Work the Bidder might otherwise perform with its own forces and those items that have been broken down into economically feasible units to facilitate DBE participation. For each item listed, show the dollar amount and percentage of the Base Bid. The Bidder must demonstrate that enough work to meet the goal was made available to DBE firms.

ITEM OF WORK MADE AVAILABLE	NAICS CODE	BIDDER NORMALLY PERFORMS ITEM (Y/N)	ITEM BROKEN DOWN TO FACILITATE PARTICIPATION (Y/N)	AMOUNT	PERCENTAGE OF BASE BID





**ATTACHMENT E**  
**SUPPLEMENTARY SPECIAL PROVISIONS**

## **SUPPLEMENTARY SPECIAL PROVISIONS**

The following Supplementary Special Provisions (SSP) modifies the following documents:

1. The **2015 Edition** of the Standard Specifications for Public Works Construction (The "GREENBOOK").
2. The **2015 Edition** of the City of San Diego Standard Specifications for Public Works Construction (The "WHITEBOOK"), including the following:
  - a) General Provisions (A) for all Contracts.

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### **SECTION 1 – TERMS, DEFINITIONS, ABBREVIATIONS, UNITS OF MEASURE, AND SYMBOLS**

**1-2 TERMS AND DEFINITIONS.** To the "WHITEBOOK", item 54, "Normal Working Hours", ADD the following:

The **Normal Working Hours** are **7:00 AM** to **3:30 PM**.

**2-3.2 Self Performance.** To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. The self performance percentage requirement will be waived for Prime Contractors meeting the Class B License requirement of this Contract.

**2-5.3.4 Supporting Information.** To the "WHITEBOOK", ADD the following:

1. For landscaping and irrigation materials, submit samples and test results to the Engineer within 15 Days of the NTP.

### **SECTION 2 - SCOPE AND CONTROL OF WORK**

**2-9.1 Permanent Survey Markers.** To the "WHITEBOOK", item 3, DELETE in its entirety and SUBSTITUTE with the following:

3. You shall submit to the Engineer a minimum of 7 Days prior to the start of the Work a list of controlling survey monuments which may be disturbed. CMFS (or the private owner for Permit Work) shall perform the following:
  - a) Set survey points outside the affected Work area that reference and locate each controlling survey monument that may be disturbed.
  - b) File a Corner Record or Record of Survey with the County Surveyor after setting the survey points to be used for re-establishment of the disturbed controlling survey monuments.

- c) File a Corner Record or Record of Survey with the County Surveyor after re-establishment of the disturbed controlling survey monuments.

**ADD:**

**2-10** **AUTHORITY OF THE BOARD AND THE ENGINEER.** To the "GREENBOOK", Paragraph (2), DELETE in its entirety and SUBSTITUTE with the following:

The decision of the Engineer is final and binding on all questions relating to: quantities; acceptability of material, equipment, or work; execution, progress or sequence of work; requests for information (RFI), and interpretation of the Plans, Specifications, or other Contract Documents. This shall be precedent to any payment under the Contract. The Engineer shall be the single point of contact and shall be included in all communications.

**2-16** **CONTRACTOR REGISTRATION AND ELECTRONIC REPORTING SYSTEM.** To the "WHITEBOOK", item 1, DELETE in its entirety.

**SECTION 3 – CHANGES IN WORK**

**3-5.1** **Claims.** To the "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

**ADD:**

**3-5.1** **Claims.**

1. A Claim is a written demand by you that seeks an adjustment in the Contract Price, Contract Time, or other relief associated with a dispute arising under or relating to the Contract, including a breach of any provision thereof. A voucher, invoice, or other routine request for payment is not a Claim.
2. A Claim shall conform to these specifications and may be considered after the City has previously denied a request by you for a Change Order seeking the demanded relief.
3. You shall submit a Claim to the Engineer if a dispute occurs that arises from or relates to the Contract. The Claim shall seek all relief to which you assert you are entitled as a result of the event(s) giving rise to the dispute. Your failure to process a Claim in accordance with these specifications shall constitute a waiver of all relief associated with the dispute. Claims are subject to 6-11, "Right to Audit".
4. You shall continue to perform the Services and Work and shall maintain the Schedule during any dispute proceedings. The Engineer will continue to make payments for undisputed Services and Work.
5. The City's Claims process specified herein shall not relieve you of your statutory obligations to present claims prior to any action under the California Government Code.

**3-5.1.1 Initiation of Claim.**

1. You shall promptly, but no later than 30 Days after the event(s) giving rise to the Claim, deliver the Claim to the Engineer.
2. You shall not process a Claim unless the Engineer has previously denied a request by you for a Change Order that sought the relief to be pursued in the claim.

**3-5.1.1.1 Claim Certification Submittal.**

1. If your Claim seeks an increase in the Contract Price, the Contract Time, or both, submit with the Claim an affidavit certifying the following:
  - a) The Claim is made in good faith and covers all costs and delays to which you are entitled as a result of the event(s) giving rise to the Claim.
  - b) The amount claimed accurately reflects the adjustments in the Contract Price, the Contract Time, or both to which you believe you are entitled.
  - c) All supporting costs and pricing data are current, accurate, and complete to the best of your knowledge. The cost breakdown per item of Work shall be supplied.
  - d) You shall ensure that the affidavit is executed by an official who has the authority to legally bind you.

**3-5.1.2 Initial Determination.**

1. The Engineer will respond in writing to your Claim within 30 Days of receipt of the Claim.

**3-5.1.3 Settlement Meeting.**

1. If you disagree with the Initial Determination, you shall request a Settlement Meeting within 30 Days. Upon receipt of this request, the Engineer will schedule the Settlement Meeting within 15 Working Days.

**3-5.1.4 City's Final Determination.**

1. If a settle agreement is not reached, the City shall make a written Final Determination within 10 Working Days after the Settlement Meeting.
2. If you disagree with the City's Final Determination, notify the Engineer in writing of your objection within 15 Working Days after receipt of the written determination and file a "Request for Mediation" in accordance with 3-5.2, "Dispute Resolution Process".
3. Failure to give notice of objection within the 15 Working Days period shall waive your right to pursue the Claim.



### **3-5.1.5 Mandatory Assistance.**

1. If a third party dispute, litigation, or both arises out of or relates in any way to the Services provided under the Contract, upon the City's request, you shall agree to assist in resolving the dispute or litigation. Your assistance includes, but is not limited to the following:
  - a) Providing professional consultations.
  - b) Attending mediations, arbitrations, depositions, trials, or any event related to the dispute resolution and litigation.

#### **3-5.1.5.1 Compensation for Mandatory Assistance.**

1. The City will reimburse you for reasonable fees and expenses incurred by you for any required assistance rendered in accordance with 3-5.1.5, "Mandatory Assistance" as Extra Work.
2. The Engineer will determine whether these fees and expenses were necessary due to your conduct or failure to act.
3. If the Engineer determines that the basis of the dispute or litigation in which these fees and expenses were incurred were the result of your conduct or your failure to act in part or in whole, you shall reimburse the City for any payments made for these fees and expenses.
4. Reimbursement may be through any legal means necessary, including the City's withholding of your payment.

#### **3-5.2.3 Selection of Mediator.** To the "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. A single mediator, knowledgeable in construction aspects and acceptable to both parties, shall be used to mediate the dispute.
2. To initiate mediation, the initiating party shall serve a Request for Mediation at the American Arbitration Association (AAA) on the opposing party.
3. If AAA is used, the initiating party shall concurrently file with AAA a "Request for Mediation" along with the appropriate fees, a copy of requested mediators marked in preference order, and a preference for available dates.
4. If AAA is selected to coordinate the mediation (Administrator), within 10 Working Days from the receipt of the initiating party's Request for Mediation, the opposing party shall file the following:
  - a) A copy of the list of the preferred mediators listed in preference order after striking any mediators to which they have any objection.
  - b) A preference for available dates.
  - c) Appropriate fees.
5. If the parties cannot agree on a mediator, then each party shall select a mediator and those mediators shall select the neutral third party to mediate the matter.

**3-5.3 Forum of Litigation.** To the "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. It is the express intention that all legal actions and proceedings related to the Contract or Agreement with the City or to any rights or any relationship between the parties arising therefrom shall be solely and exclusively initiated and maintained in courts of the State of California for the County of San Diego.

**ADD:**

**3-5.4 Pre-judgment Interest.**

1. The parties stipulate that if a judgment is entered against a party for breaching this Contract, the pre-judgment interest shall be two percent (2%) per annum.

#### **SECTION 4 - CONTROL OF MATERIALS**

**4-1.3.3 Inspection of Items Not Locally Produced.** To the "WHITEBOOK", DELETE in its entirety.

**ADD:**

**4-1.3.3 Inspection of Items Not Locally Produced.** To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. When you intend to purchase materials, fabricated products, or equipment from sources located more than 200 miles (321.9 km) outside the geographical limits of the City, City Lab staff or a qualified inspection agency approved by the Engineer, shall be engaged at your expense to inspect the materials, equipment, or process.
2. This approval shall be obtained before producing any material or equipment. City Lab staff or inspector shall evaluate the materials for conformance with the requirements of the Plans and Specifications. You shall forward reports required by the Engineer. No materials or equipment shall be shipped nor shall any processing, fabrication or treatment of such materials be done without proper inspection by City Lab staff or the approved agent. Approval by said agent shall not relieve you of responsibility for complying with the requirements of the Contract Documents.
3. The Engineer may elect City Lab staff to perform inspection of an out-of-town manufacturer. You shall incur additional inspection costs of the Engineer including lodging, meals, and incidental expenses based on Federal Per Diem Rates, along with travel and car rental expenses. If the manufacturing plant operates a double shift, a double shift shall be figured in the inspection costs.
  - a) At the option of the Engineer, full time inspection shall continue for the length of the manufacturing period. If the manufacturing period will exceed 3 consecutive weeks, you shall incur additional inspection expenses of the Engineer's supervisor for a trip of 2 Days to the site per month.

- b) When the Engineer elects City Lab staff to perform out-of-town inspections, the wages of staff employed by the City shall not be part of the additional inspection expenses paid by you.
- c) Federal Per Diem Rates can be determined at the location below:

<https://www.gsa.gov/portal/content/104877>

- 4. The Engineer will perform inspections of out-of-town manufacturers for the items of Work specified here:
  - a) Staircase.

**4-1.3.5 Special Inspection.** To the “WHITEBOOK”, ADD the following:

- 5. The payment for special inspection Work specified under this section shall be paid in accordance with 4-1.3.4.1, “Payment”.

**4-1.3.6 Preapproved Materials.** To the “WHITEBOOK”, ADD the following:

- 3. You shall submit in writing a list of all products to be incorporated in the Work that are on the AML.

**4-1.6 Trade Names or Equals.** To the “WHITEBOOK”, ADD the following:

- 11. You shall submit your list of proposed substitutions for an “equal” item **no later than 5 Working Days after the determination of the Apparent Low Bidder** and on the City’s Product Submittal Form available at:

<http://www.sandiego.gov/publicworks/edocref/index.shtml>

**SECTION 5 – UTILITIES**

**5-2 PROTECTION.** To the “WHITEBOOK”, item 2, ADD the following:

- g) Refer to **Appendix G** for more information on the protection of AMI devices.

**SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK**

**6-1.1 Construction Schedule.** To the “WHITEBOOK”, item 9, DELETE in its entirety and SUBSTITUTE with the following:

- 9. Inclusive to the Contract Time, include 15 Working Days to the Schedule for the generation of the Punchlist. You shall Work diligently to complete all Punchlist items within 30 Working Days after the Engineer provides the Punchlist.

To the “WHITEBOOK”, item 20, ADD the following:

The **90 Calendar Day** for the Plant Establishment Period is included in the stipulated Contract Time.

To the "WHITEBOOK", item 22, subsection b, DELETE in its entirety and SUBSTITUTE with the following:

- b) A curve value percentage comparison between the Contract Price and the updated cash flow forecast for each Project ID included in the Contract Documents. Curve values shall be set on a scale from 0% to 100% in intervals of 5% of the Contract Time. Refer to the Sample City Invoice materials in the Contract Documents and use the format shown. Your invoice amounts shall be supported by this curve value percentage. For previous periods, use the actual values and percentages and update the curve value percentages accordingly.

**ADD:**

**6-3.2.1.1 Environmental Document.**

1. The City of San Diego has prepared a **Notice of Exemption** for **Palm Avenue Transitional Housing** Project No. **569136** as referenced in the Contract Appendix. You shall comply with all requirements of the **Notice of Exemption** as set forth in **Appendix A**.
2. Compliance with the City's environmental document shall be included in the Contract Price.

**6-8.1.1 Requirements Preparatory to Requesting a Walk-through.** To the "WHITEBOOK", ADD the following:

2. You shall notify the Engineer to arrange a final inspection of permanent BMPs installed and shall obtain the completed, signed, and stamped DS-563 Form 30 Days prior to the issuance of the Notice of Completion.

**SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR**

**7-3 INSURANCE.** To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

**7-3 INSURANCE.**

1. The insurance provisions herein shall not be construed to limit your indemnity obligations contained in the Contract.

**7-3.1 Policies and Procedures.**

1. You shall procure the insurance described below, at its sole cost and expense, to provide coverage against claims for loss including injuries to persons or damage to property, which may arise out of or in connection with the performance of the Work by you, your agents, representatives, officers, employees or Subcontractors.

2. Insurance coverage for property damage resulting from your operations is on a replacement cost valuation. The market value will not be accepted.
3. You shall maintain this insurance for the duration of this Contract and at all times thereafter when you are correcting, removing, or replacing Work in accordance with this Contract. Your liabilities under the Contract, e.g., your indemnity obligations, is not deemed limited to the insurance coverage required by this Contract.
4. The payment for insurance shall be included in the Contract Price as bid by you. Except as specifically agreed to by the City in writing, you are not entitled to any additional payment. Do not begin any Work under this Contract until you have provided and the City has approved all required insurance.
5. Policies of insurance shall provide that the City is entitled to 30 Days (10 Days for cancellation due to non-payment of premium) prior written notice of cancellation or non-renewal of the policy. Maintenance of specified insurance coverage is a material element of the Contract. Your failure to maintain or renew coverage or to provide evidence of renewal during the term of the Contract may be treated by the City as a material breach of the Contract.

**7-3.2 Types of Insurance.**

**7-3.2.1 Commercial General Liability Insurance.**

1. Commercial General Liability Insurance shall be written on the current version of the ISO Occurrence form CG 00 01 07 98 or an equivalent form providing coverage at least as broad.
2. The policy shall cover liability arising from premises and operations, XCU (explosions, underground, and collapse), independent contractors, products/completed operations, personal injury and advertising injury, bodily injury, property damage, and liability assumed under an insured's contract (including the tort liability of another assumed in a business contract).
3. There shall be no endorsement or modification limiting the scope of coverage for either "insured vs. insured" claims or contractual liability. You shall maintain the same or equivalent insurance for at least 10 years following completion of the Work.
4. All costs of defense shall be outside the policy limits. Policy coverage shall be in liability limits of not less than the following:

<u>General Annual Aggregate Limit</u>	<u>Limits of Liability</u>
Other than Products/Completed Operations	\$2,000,000
Products/Completed Operations Aggregate Limit	\$2,000,000
Personal Injury Limit	\$1,000,000
Each Occurrence	\$1,000,000

### **7-3.2.2 Commercial Automobile Liability Insurance.**

1. You shall provide a policy or policies of Commercial Automobile Liability Insurance written on the current version of the ISO form CA 00 01 12 90 or later version or equivalent form providing coverage at least as broad in the amount of \$1,000,000 combined single limit per accident, covering bodily injury and property damage for owned, non-owned, and hired automobiles ("Any Auto").
2. All costs of defense shall be outside the limits of the policy.

### **7-3.2.5 Contractors Builders Risk Property Insurance..**

1. You shall provide at your expense, and maintain until Final Acceptance of the Work, a Special Form Builders Risk Policy or Policies. This insurance shall be in an amount equal to the replacement cost of the completed Work (without deduction for depreciation) including the cost of excavations, grading, and filling. The policy or policies limits shall be 100% of this Contract value of the Work plus 15% to cover administrative costs, design costs, and the costs of inspections and construction management.
2. Insured property shall include material or portions of the Work located away from the Site but intended for use at the Site and shall cover material or portions of the Work in transit. The policy or policies shall include as insured property scaffolding, falsework, and temporary buildings located at the Site. The policy or policies shall cover the cost of removing debris, including demolition.
3. The policy or policies shall provide that all proceeds thereunder shall be payable to the City as Trustee for the insured, and shall name the City, the Contractor, Subcontractors, and Suppliers of all tiers as named insured. The City, as Trustee, will collect, adjust, and receive all monies which may become due and payable under the policy or policies, may compromise any and all claims thereunder, and will apply the proceeds of such insurance to the repair, reconstruction, or replacement of the Work.
4. Any deductible applicable to the insurance shall be identified in the policy or policies documents and responsibility for paying the part of any loss not covered because of the application of such deductibles shall be apportioned among the parties except for the City as follows: if there is more than one claimant for a single occurrence, then each claimant shall pay a pro-rata share of the per occurrence deductible based upon the percentage of their paid claim to the total paid for insured. The City shall be entitled to 100% of its loss. You shall pay the City any portion of that loss not covered because of a deductible at the same time the proceeds of the insurance are paid to the City as trustee.
5. Any insured, other than the City, making claim to which a deductible applies shall be responsible for 100% of the loss not insured because of the

deductible. Except as provided for under California law, the policy or policies shall provide that the City is entitled to 30 Days prior written notice (10 Days for cancellation due to non-payment of premium) of cancellation or non-renewal of the policy or policies.

**7-3.3 Rating Requirements.** Except for the State Compensation Insurance Fund, all insurance required by this Contract as described herein shall be carried only by responsible insurance companies with a rating of, or equivalent to, at least "A-, VI" by A.M. Best Company, that are authorized by the California Insurance Commissioner to do business in the State, and that have been approved by the City.

**7-3.3.1 Non-Admitted Carriers.** The City will accept insurance provided by non-admitted, "surplus lines" carriers only if the carrier is authorized to do business in the State and is included on the List of Approved Surplus Lines Insurers (LASLI list).

All policies of insurance carried by non-admitted carriers shall be subject to all of the requirements for policies of insurance provided by admitted carriers described herein.

**7-3.4 Evidence of Insurance.** Furnish to the City documents e.g., certificates of insurance and endorsements evidencing the insurance required herein, and furnish renewal documentation prior to expiration of this insurance. Each required document shall be signed by the insurer or a person authorized by the insurer to bind coverage on its behalf. We reserve the right to require complete, certified copies of all insurance policies required herein.

**7-3.5 Policy Endorsements.**

**7-3.5.1 Commercial General Liability Insurance.**

**7-3.5.1.1 Additional Insured.**

1. You shall provide at your expense policy endorsement written on the current version of the ISO Occurrence form CG 20 10 11 85 or an equivalent form providing coverage at least as broad.
2. To the fullest extent allowed by law e.g., California Insurance Code §11580.04, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured.
3. The additional insured coverage for projects for which the Engineer's Estimate is \$1,000,000 or more shall include liability arising out of:
  - a) Ongoing operations performed by you or on your behalf,
  - b) your products,
  - c) your Work, e.g., your completed operations performed by you or on your behalf, or
  - d) premises owned, leased, controlled, or used by you.

4. The additional insured coverage for projects for which the Engineer's Estimate is less than \$1,000,000 shall include liability arising out of:
  - a) Ongoing operations performed by you or on your behalf,
  - b) your products, or
  - c) premises owned, leased, controlled, or used by you.

**7-3.5.1.2 Primary and Non-Contributory Coverage.** The policy shall be endorsed to provide that the coverage with respect to operations, including the completed operations, if appropriate, of the Named Insured is primary to any insurance or self-insurance of the City and its elected officials, officers, employees, agents and representatives. Further, it shall provide that any insurance maintained by the City and its elected officials, officers, employees, agents and representatives shall be in excess of your insurance and shall not contribute to it.

**7-3.5.1.3 Project General Aggregate Limit.** The policy or policies shall be endorsed to provide a Designated Construction Project General Aggregate Limit that will apply only to the Work. Only claims payments which arise from the Work shall reduce the Designated Construction Project General Aggregate Limit. The Designated Construction Project General Aggregate Limit shall be in addition to the aggregate limit provided for the products-completed operations hazard.

**7-3.5.2 Commercial Automobile Liability Insurance.**

**7-3.5.2.1 Additional Insured.** Unless the policy or policies of Commercial Auto Liability Insurance are written on an ISO form CA 00 01 12 90 or a later version of this form or equivalent form providing coverage at least as broad, the policy shall be endorsed to include the City and its respective elected officials, officers, employees, agents, and representatives as additional insured, with respect to liability arising out of automobiles owned, leased, hired or borrowed by you or on your behalf. This endorsement is limited to the obligations permitted by California Insurance Code §11580.04.

**7-3.5.5 Builders Risk Endorsements.**

**7-3.5.5.1 Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City, and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

**7-3.5.5.2 Builders Risk – Partial Utilization.** If the City desires to occupy or use a portion or portions of the Work prior to Acceptance in accordance with this Contract, the City will notify you and you shall immediately notify your Builder's Risk insurer and obtain an endorsement that the policy or policies shall not be cancelled or lapse on account of any such partial use or occupancy. You shall obtain the endorsement prior to the City's occupation and use.



- 7-3.6 Deductibles and Self-Insured Retentions.** You shall pay for all deductibles and self-insured retentions. You shall disclose deductibles and self-insured retentions to the City at the time the evidence of insurance is provided.
- 7-3.7 Reservation of Rights.** The City reserves the right, from time to time, to review your insurance coverage, limits, deductibles and self-insured retentions to determine if they are acceptable to the City. The City will reimburse you, without overhead, profit, or any other markup, for the cost of additional premium for any coverage requested by the Engineer but not required by this Contract.
- 7-3.8 Notice of Changes to Insurance.** You shall notify the City 30 Days prior to any material change to the policies of insurance provided under this Contract.
- 7-3.9 Excess Insurance.** Policies providing excess coverage shall follow the form of the primary policy or policies e.g., all endorsements.
- 7-3.10 Architects and Engineers Professional Insurance (Errors and Omissions Insurance).**
1. For Contracts with required engineering services (e.g., Design-Build, preparation of engineered Traffic Control Plans (TCP), and etc) by you, you shall keep or require all of your employees or Subcontractors, who provide professional engineering services under this contract, Professional Liability coverage with a limit of **\$1,000,000** per claim and **\$2,000,000** annual aggregate in full force and effect.
  2. You shall ensure the following:
    - a) The policy retroactive date is on or before the date of commencement of the Project.
    - b) The policy will be maintained in force for a period of 3 years after completion of the Project or termination of this Contract, whichever occurs last. You agree that for the time period specified above, there will be no changes or endorsements to the policy that affect the specified coverage.
  3. If professional engineering services are to be provided solely by the Subcontractor, you shall:
    - a) Certify this to the City in writing and
    - b) Agree in writing to require the Subcontractor to procure Professional Liability coverage in accordance with the requirements set forth above.

**7-4** **NOT USED.** To the "GREENBOOK", DELETE in its entirety and SUBSTITUTE with the following:

**7-4** **WORKERS' COMPENSATION INSURANCE AND EMPLOYERS LIABILITY INSURANCE.**

1. In accordance with the provisions of §3700 of the California Labor Code, you shall provide at your expense Workers' Compensation Insurance and Employers Liability Insurance to protect you against all claims under applicable state workers compensation laws. The City, its elected officials, and employees will not be responsible for any claims in law or equity occasioned by your failure to comply with the requirements of this section.

2. Limits for this insurance shall be not less than the following:

<u>Workers' Compensation</u>	<u>Statutory Employers Liability</u>
Bodily Injury by Accident	\$1,000,000 each accident
Bodily Injury by Disease	\$1,000,000 each employee
Bodily Injury by Disease	\$1,000,000 policy limit

3. By signing and returning the Contract you certify that you are aware of the provisions of §3700 of the Labor Code which requires 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 you shall comply with such provisions before commencing the Work as required by §1861 of the California Labor Code.

**7-4.1** **Waiver of Subrogation.** The policy or policies shall be endorsed to provide that the insurer will waive all rights of subrogation against the City and its respective elected officials, officers, employees, agents, and representatives for losses paid under the terms of the policy or policies and which arise from Work performed by the Named Insured for the City.

**ADD:**

**7-6** **THE CONTRACTORS REPRESENTATIVE.** To the "GREENBOOK", ADD the following:

1. Both the representative and alternative representative shall be employees of the Contractor and shall not be assigned to a Subcontractor unless otherwise approved by the City in writing.

**7-13.4** **Contractor Standards and Pledge of Compliance.** To the "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. The Contract is subject to City's Municipal Code §22.3004 as amended 10/29/13 by ordinance O-20316.
2. You shall complete a Pledge of Compliance attesting under penalty of perjury that you complied with the requirements of this section.
3. You shall ensure that all Subcontractors complete a Pledge of Compliance attesting under penalty of perjury that they complied with the requirements of this section.

4. You may access the Pledge of Compliance at:  
[http://www.sandiego.gov/purchasing/pdf/contractor\\_standards\\_questionnaire.pdf](http://www.sandiego.gov/purchasing/pdf/contractor_standards_questionnaire.pdf)
5. You shall require in each subcontract that the Subcontractor shall abide by the provisions of the City's Municipal Code §22.3004. A sample provision is as follows:  
  
"Compliance with San Diego Municipal Code §22.3004: The Subcontractor acknowledges that it is familiar with the requirements of San Diego Municipal Code §22.3004 ("Contractor Standards"), and agrees to comply with requirements of that section. The Subcontractor further agrees to complete the Pledge of Compliance, incorporated herein by reference."

**ADD:**

**7-13.8 Equal Pay Ordinance.**

1. You shall comply with the Equal Pay Ordinance (EPO) codified in the San Diego Municipal Code (SDMC) in section 22.4801 through 22.4809, unless compliance is not required based on an exception listed in SDMC section 22.4804.
2. You shall require all of your Subcontractors to certify compliance with the EPO in their written subcontracts.
3. You shall post a notice informing your employees of their rights under the EPO in the workplace or job site.
4. By signing this Contract with the City of San Diego, you acknowledge the EPO requirements and pledge ongoing compliance with the requirements of SDMC Division 48, section 22.4801 et seq., throughout the duration of this Contract.

**7-20 ELECTRONIC COMMUNICATION.** To the "WHITEBOOK", ADD the following:

2. Virtual Project Manager shall be used on this Contract.

**7-21.1 General.** To the "WHITEBOOK", item 3, DELETE in its entirety and SUBSTITUTE with the following:

3. During the construction phase of projects, the minimum waste management reduction goal is 90% of the inert material (a material not subject to decomposition such as concrete, asphalt, brick, rock, block, dirt, metal, glass, and etc.) and 65% of the remaining project waste. You shall provide appropriate documentation, including a Waste Management Form attached as an appendix, and evidence of recycling and reuse of materials to meet the waste reduction goals specified.

## SECTION 9 - MEASUREMENT AND PAYMENT

### 9-3.1

**General.** To the WHITEBOOK, ADD the following:

3. The Lump Sum Bid item for "**Rehabilitation of Existing Hotel Building for the Operation of Transitional Housing Facility**" shall include and not be limited to renovation of an existing 24,154 square foot 61-room hotel; interior and exterior work to the existing building, including the parking lot and landscaped areas of the .98-acre site. The proposed interior and exterior work improvements include new office space, computer rooms, client community space, kitchens, storage, roofing and landscaping as specified in the Plans, Contract Documents, and Technicals.
4. The Lump Sum Bid item for "**Fire Protection**" shall include and not limited to the addition of fire sprinkler systems to the building including first floor, second floor and attic areas as specified in the Plans, Contract Documents, and Technicals.
5. The Lump Sum Bid item for "**Fire Alarm**" shall include and not limited to Fire-Life-Safety fire alarms upgrades as specified in the Plans, Contract Documents, and Technicals.
6. The Lump Sum Bid item for "**New Interconnecting Staircase**" shall include and not limited to a new interconnecting staircase from the first floor to the second floor as specified in the Plans, Contract Documents, and Technicals.
7. The **Alternate** Lump Sum Bid item for "**Photo Voltaic Panels for Parking Lot Trellis and Roof**" shall include and not limited to photo voltaic panels for coverage at parking lot trellis and roof as specified in the Plans, Contract Documents, and Technicals.

### 9-3.2

**Partial and Final Payment.** To the "GREENBOOK", paragraph (3), DELETE in its entirety and SUBSTITUTE with the following:

Upon commencement of the Work, an escrow account shall be established in a financial institution chosen by you and approved by the City. Documentation for an escrow payment shall have an escrow agreement signed by you, the City, and the escrow agent. From each progress payment, no less than 5% will be deducted and deposited by the City into the escrow account. Upon completion of the Contract, the City will notify the Escrow agent in writing to release the funds to you. Only the designated representative of the City shall sign the request for the release of Escrow funds.

## **EQUAL OPPORTUNITY CONTRACTING PROGRAM (EOCP) SECTION A – GENERAL REQUIREMENTS**

- 4.1 Nondiscrimination in Contracting Ordinance.** To the “WHITEBOOK”, subsection 4.1.1, paragraph (2), sentence (1), DELETE in its entirety and SUBSTITUTE with the following:

You shall not discriminate on the basis of race, gender, gender expression, gender identity, religion, national origin, ethnicity, sexual orientation, age, or disability in the solicitation, selection, hiring, or treatment of subcontractors, vendors, or suppliers.

**END OF SUPPLEMENTARY SPECIAL PROVISIONS (SSP)**

# TECHNICALS

# Technical Specifications



City San Diego - Palm Avenue Transitional Housing

1788 Palm Avenue

San Diego, California 92154

Owner	Prepared by
City San Diego 1788 Palm Avenue San Diego, California 92154	Gensler 225 Broadway, suite 100 San Diego, CA 92101 619.557.2500
	3.7.2018

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**SECTION 02 41 19 - SELECTIVE DEMOLITION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected portions of a building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Repair procedures for selective demolition operations.

**1.2 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to City ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

**1.3 PREINSTALLATION MEETINGS**

- A. Predemolition Conference: Conduct conference at Project. Review methods and procedures related to selective demolition including, but not limited to, the following:
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.
  - 6. Review phasing requirements.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For demolition firm.

1. Include lists of completed projects with project names and addresses, names and addresses of Architect and Resident Engineers and Owners, and other information specified.
- B. Proposed Environmental Protection, Dust-Control and Noise-Control Measures: Submit report, including drawings, that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  1. Interruption of utility services and duration of interruption.
  2. Coordination for shutoff, capping, and continuation of utility services.
  3. Use of stairs.
  4. Locations of temporary partitions and means of egress
  5. Means of protection for items to remain and items in path of waste removal from building.

**1.5 CLOSEOUT SUBMITTALS**

- A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

**1.6 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

**1.7 FIELD CONDITIONS**

- A. City assumes no responsibility for condition of areas to be selectively demolished.
  1. Conditions existing at time of inspection for bidding purpose will be maintained by City as far as practical.
  2. Before selective demolition, City will remove the following items:
    - a. Furniture, fixtures and equipment.
- B. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1.

2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Resident Engineer and Resident Engineer and City. Hazardous materials will be removed by Owner under a separate contract.
- C. Storage or sale of removed items or materials on-site will not be permitted.
- D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

## **1.8 WARRANTY**

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

## **PART 2 - PRODUCTS**

### **2.1 REPAIR MATERIALS**

- A. Use repair materials identical to existing materials.
  1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect and Resident Engineer.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

SELECTIVE DEMOLITION

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**3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS**

- A. Existing Services/Systems: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Existing Services/Systems to be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Arrange to shut off indicated utilities with utility companies.
  - 2. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Equipment to be Removed: Disconnect and cap services and remove equipment.
- C. Ballasts: If ballast is not labeled "No PCBs," or if the label is illegible, contact a ballast recycler for disposal.
- D. Mercury-Containing Devices: Mercury-containing devices include thermostats, silent switches, mechanical switches and relays or contacts. Dispose of these devices with an appropriate recycler.
- E. Nickel-Cadmium and Lead-Acid Batteries: Exit signs, emergency lighting units, alarm systems, smoke detectors and carbon-monoxide detectors may contain nickel-cadmium or lead-acid. Arrange with an appropriate recycler for disposal.
- F. Utility Requirements: Refer to Divisions 22 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

**3.3 PREPARATION**

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
  - 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  - 3. Protect existing site improvements, appurtenances, and landscaping to remain.



4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- C. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- E. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, and structural supports to preserve stability and prevent movement, settlement, or collapse of construction indicated to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

### **3.4 POLLUTION CONTROLS**

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
  2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

### **3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS**

- A. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
  - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
- D. Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Section for new roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.

### **3.6 PATCHING AND REPAIRS**

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- C. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- D. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- E. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### **3.7 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.
- D. Remove demolition waste materials from Project site and recycle or dispose of them according to the Whitebook/Greenbook.

**3.8 CLEANING**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION 02 41 19**

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SECTION 03 30 00 – CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Sections:
  - 1. Division 2 Section “Cement Concrete Pavement” for concrete pavement and walks.
  - 2. Division 3 Section “Concrete Toppings” for metallic and nonmetallic concrete floor toppings.

1.2 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.3 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mix water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Details of fabrication, bending and placement, prepared according to ACI 315, “Details and Detailing of Concrete Reinforcement.” Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support framework. Design and engineering of formwork are Contractor’s responsibility.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing of shoring.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Admixtures.
4. Curing materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. 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 formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
  1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code-Reinforcing Steel."
- F. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
  1. ACI 301, "Specification for Structural Concrete."
  2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.
  1. Avoid damaging coatings on steel reinforcement.
  2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963.

**PART 2 - PRODUCTS**

**2.1 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
    - c. Structural 1, B-B, or better, mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips,  $\frac{3}{4}$  by  $\frac{3}{4}$  inch, minimum.
- E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.
  - 2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in concrete surface.
  - 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

**2.2 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

**2.3 REINFORCEMENT ACCESSORIES**

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CSRI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

**2.4 CONCRETE MATERIALS**

- A. Portland Cement: ASTM C 150, Type I/II.
- B. Blended Hydraulic Cement: ASTM C 595, Type IP, Portland-pozzolan cement.
- C. Silica Fume: ASTM C 1240, amorphous silica.
- D. Normal-Weight Aggregate: ASTM C 33, uniformly graded, 1-inch maximum aggregate size.
- E. Water: Potable and complying with ASTM C 94.

**2.5 ADMIXTURES**

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- G. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

**2.6 WATERSTOPS**

- A. Flexible Rubber Waterstops: CE CDR-C 513, for embedding in concrete to prevent passage of fluids through joints.



- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluid through joints.
- C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophylic material for adhesive bonding to concrete.

## 2.7 VAPOR RETARDERS

- A. Vapor Retarder: Polyethelyne sheet, ASTM D 4397, not less than 10 mils thick.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.
- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2 inch sieve and 0 to 5 percent passing a No. 8 sieve.

## 2.8 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- B. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.
- C. Pigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement. Color selected by Architect and Resident Engineer.
- D. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

## 2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or whit burlap-polyethylene sheet.
- D. Water: Potable.

- E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B, 18 to 22 percent solids.
- H. Clean, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A.
- I. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type I, Class A.

2.10 RELATED MATERIALS

- A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.
- C. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- D. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.
- E. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- F. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
  - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
  - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
  - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- G. Reglets: Fabricate reglets of not less than 0.0217 inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- H. Dovetail Anchor Slots: Hot-dip galvanized steel, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete debris.

2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thickness from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.
- B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thickness from 1/4 inch.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109.

## 2.12 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash: 15 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
  3. Ground Granulated Blast-Furnace Slag: 50 percent.
  4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
  5. Silica Fume: 10 percent.
  6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
  7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent Portland minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
- D. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

- E. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer’s recommended rate, but not less than 1.5 lb./cu. Yd.
- F. Admixtures: Use admixtures according to manufacturer’s written instructions.
  - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.13 FABRICATION REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice.”

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
- B. Project Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.
- D. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in Work. Determine sizes and locations from trades providing such items.
- E. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- F. Coat contact surfaces of forms with form-release agent, according to manufacturer’s written instructions, before placing reinforcement.

**3.2 EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor bolts, accurately located, to elevations required.
  - 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

**3.3 REMOVING AND REUSING FORMS**

- A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.
- B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
  - 1. At least 70 percent of 28-day design compressive strength.
  - 2. Determine compressive strength of in-place concrete by testing representative field or laboratory cured test specimens according to ACI 301.
- C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

**3.4 SHORES AND RESHORES**

- A. Comply with ACI 318, ACI 301, and recommendation in ACI 347R for design, installation, and removal of shoring and reshoring.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

**3.5 VAPOR RETARDERS**

- A. Vapor Retarder: Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.

**3.6 STEEL REINFORCEMENT**

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain concrete cover. Do not tack weld crossing reinforcing bars.
- D. Shop or field weld reinforcement according to AWS D1.4, where indicated.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.

### 3.7 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect and Resident Engineer.
  1. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  2. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
  1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- C. Isolation Joints in Slab-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.

3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints as indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of Work. Field-fabricate joints in waterstops according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

- A. Before placing concrete, verify installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified.
- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
  - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
- F. Cold-Weather Placement: Place concrete according to recommendations in ACI 306.1.
- G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R.

3.10 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture impaired by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 374R limits for class of surface specified.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
  2. Do not apply rubbed finish to smooth-formed finish.
- C. Rubbed Finish: Apply the following to smooth-formed finished concrete:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.11 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.
1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighten until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.



- D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighnten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph applied coatings on floor coverings.
1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
  2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.
    - b. Specified overall values of flatness, F(F) 35; and levelness F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
    - c. Specified overall values of flatness, F(F) 30; and levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and levelness, F(L) 15; for suspended slabs.
    - d. Specified overall values of flatness, F(F) 45; and levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and levelness, F(L) 24.
  3. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10 foot (3.05 m) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/8 inch (3.2 mm).
- E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect and Resident Engineer before application.
- G. Slip-Resistive Aggregate Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
  2. After broadcasting and tamping, apply loat finish.
  3. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose slip-resistive aggregate.
- H. Mineral Dry-Shake Floor Hardener Finish: After initial floating, apply mineral dry-shake materials to surfaces according to manufacturer's written instructions and as follows:

1. Uniformly apply mineral dry-shake materials at a rate of 100 lb/100 sq. ft., unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of mineral dry shake materials over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second mineral dry-shake application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake material manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.13 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, or windy conditions existing before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
  3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.14 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
  1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  2. Do not apply to concrete that is less than seven days old.
  3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water, remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

### 3.15 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions. Defer joint filling until concrete has aged at least two months. Do not fill joints until construction traffic has substantially ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

- C. Install semigrid epoxy joint filler full depth in saw-cut joints (not including control joints at slab-on-grade) and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect and Resident Engineer. Remove and replace concrete that cannot be repaired and patched to Architect and Resident Engineer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repair formed surface defects which include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- D. Perform structural repairs of concrete, subject to Architect and Resident Engineer's approval, using epoxy adhesive and patching mortar.

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit reports during concrete placement according to requirements specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or fraction thereof of each concrete mix placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  - 2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  - 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  - 5. Compression Test Specimens: ASTM C 31; As a minimum, cast one set of four standard cylinder specimens for each composite sample. Additional specimens may be cast for the contractor's convenience and at the contractor's expense.
  - 6. Compressive-Strength Tests: ASTM C 39:
    - a. As a minimum, test two field-cured specimens at 7 days and two at 28 days.

## **Palm Avenue Transitional Housing**

- b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.
- C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- E. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect and Resident Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect and Resident Engineer.

END OF SECTION

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SECTION 03 33 10

LANDSCAPE CONCRETE SITE WALLS

PART 1.0 - GENERAL

1.1 SCOPE OF WORK

- A. This section covers the furnishing and installing of formed and unformed cast-in-place Landscape Concrete Site Walls; including formwork, finishing and curing in connection therewith; as shown and noted on the drawings and as specified.
- B. Landscape Site Concrete Walls includes all exterior concrete structures shown on Landscape Plans except walkways.
- C. Related work in other sections:
  - 1. 03 33 10 Landscape Site Concrete Walls
  - 2. 12 93 00 Site Furnishings
  - 3. 32 13 16 Decorative Concrete Paving
  - 4. 32 31 13 Chainlink Fences and Gates
  - 5. 32 84 00 Landscape Irrigation
  - 6. 32 93 16 Exterior Plants

1.2 CODES

- A. Except as modified by the requirements specified herein and/or the details on the drawings, concrete work shall conform to the "California Building Code" (CBC), Chapter 26, "Concrete".

1.3 REFERENCES

- A. The editions of the specifications and standards referenced herein, published by the following organizations, apply to the work only to the extent specified by the reference:
  - American Concrete Institute (ACI)
  - American Society for Testing and Materials (ASTM)
  - U.S. Department of Commerce (PS)

1.4 SUBMITTALS

- A. Submit samples for approval by Owner's Representative for the following:
  - 1. Concrete admixture(s)
  - 2. Aggregate(s)
  - 3. Surface Retarder
  - 4. Expansion Joint and Sealant
  - 5. Concrete mix designs (for each type of concrete). All design mixes shall be stamped and signed by a licensed engineer.

1.5 SAMPLE PANELS

LANDSCAPE SITE CONCRETE WALLS

03 33 10 - 1

- A. LIGHT SAND FINISH: Sample panel: Prepare at the job site wall types indicated. Sample panel shall be supervised and directed by Owner's Representative. Sample panels shall be constructed until Owner's Representative judges that the sample panels represent the appearance and intent per the Drawings.
  - 1. Mix Design: The concrete mix design used to prepare the sample panels shall be identical to that used for the project's architectural concrete.
  - 2. The sample panels shall be indicative as the standard of color, texture and workmanship of concrete site walls to be expected in the finished work. If the Owner's Representative rejects any sample panel for any reason, construct additional sample panels as required to secure his approval.
  - 3. Remove rejected sample panels from the job site and dispose of them legally.
  - 4. Samples shall be prepared in a timely manner to allow review by Owner's Representative prior to commencement of final installation.

## 1.6 QUALITY ASSURANCE

- A. Concrete designated in this section for all walls is architectural concrete and therefore the design of the mixes, design of forms, placing of concrete, production of finishes and final curing shall be so executed as to produce as near perfection as possible. Correct all concrete work, which does not conform to the requirements of the contract drawings, including strength, tolerances and finishing at no additional expense to the owner and without extension of time. Obtain Owner's Representative's approval of proposed corrective measures before initiating work.
- B. Provide mix designs in accordance with the applicable requirements of Section 03 30 00. Properties and proportions of architectural concrete shall conform to the requirements of Section 03 30 00 in addition to the requirements of this section.

## 1.7 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. The total estimated requirement of architectural aggregate plus anticipated losses and waste shall be procured from one source of supply. The Contractor will assure that the source of supply is adequate to provide, throughout the duration of the project, an aggregate which is uniform in size, color and shape. Should an aggregate be elected in which there is doubt about the quantity of a uniform supply, the Contractor shall require the supplier to remove the entire amount from the pit, mine or river and thoroughly mix and stockpile said aggregate for exclusive use of this project.

## PART 2.0 - PRODUCTS

### 2.1 MATERIALS

- A. Forming Materials: All forms shall be new; no reused or reconditioned forms will be permitted. Forms for Concrete Site Walls shall be built so that they are completely rigid, strong enough to withstand without deflection, movement or leakage, the high hydraulic pressures which result from rapid filling and heavy frequency vibration. All materials shall be new at start of work.



**B. Form accessories as required:**

1. Natural gray color concrete composed of Type II cement; sand; local rock (no black colored aggregates permitted); and water reducing, set retardant admixture.
2. Inform retarders: Inform retarder not requiring undercoating release creating a uniform etch with retard matrix not transferred to concrete, such as:
  - a. Euro-tard as manufactured by Grace Products.
  - b. Or Approved Equal
3. Fasteners for formwork and installation of rustication strips, bands, reglets and reveals shall be formed galvanized steel or other approved non-corrosive steel materials.
4. Form Ties: 1/4" inch snap ties, equipped with 1" diameter cone or cones which provide 1" or a 1-1/2" inch break-back. Whichever break-back size is selected, use throughout this work. Do not use different break-back sizes.
5. Form ties for extra support areas: 3/8" inch diameter she bolts complete with 1" inch diameter cones.
6. Stripping Gaskets: Resilient rectangular material non-absorbent and non-staining at junctions of formwork and at junctions for forms with columns and beams as required to permit removal and reuse of formwork without damage.
7. Form Gaskets: 1/8" inch x 1/2" inch adhesive backed foam tape, by Burke Company, Norton Sealants, Arlon Co. or equal.
8. Form Release Agent (compatible with sealer): Chemical non-staining release agent which will not affect the architectural concrete surface. Release agent shall be used in strict accordance with the manufacturer's recommendations. Final acceptance of form release agent depends on proven performance on sample panels. See required inform retarder prior to use of any form release agent.
9. Form sealer shall be one of the following products:
  - a) W.R. Grace Company "Formfilm"
  - b) Nox-Crete Chemicals, Inc. "Pre-Form"
  - c) Hunt Process Co. "Seal Form-L"
  - d) Or Approved Equal
10. Chairs and Spacers: Solid plastic of color matched to architectural concrete.
11. Reglets: "Type I Springlock Flashing Reglets" for casting into concrete, constructed from 3/16-inch thick stainless steel for exposed locations. Reglets shall be one of following products:
  - a) Fry Reglet Co.
  - b) Westex Manufacturing Ltd., Vancouver, B.C.
  - e) Or Approved Equal

12. Regular weight concrete aggregates per ASTM C-33 shall be "Imperial Valley" 3/8" rock as available through Ready-Mix Concrete, Escondido Plant, or approved equal.
13. Water Reducing, Set Retardant Admixture: ASTM C 494-82, Type D.
14. High Range Water Reducing Admixture: ASTM C 494-82, Type F.
15. All other concrete materials: As specified in Section 32 13 16, unless product is superseded by those specified herein.

### PART 3.0 - EXECUTION

#### 3.1 MIXING:

- A. Concrete shall be ready mixed concrete.

#### 3.2 TOLERANCES OF FORMED CONCRETE SITE WALLS:

- A. Formwork shall be constructed and finished so that concrete surfaces will conform to the tolerance limits listed below. Tolerances shall not be cumulative. Failure to comply with these limits will result in the Contractor, at his expense, filling and/or grinding the sub-standard surfaces, or if this is deemed impossible by the Owner's Representative, then the concrete section shall be removed and reconstructed at no expense to the owner.
- B. Variation from plumb for lines and surface of columns, walls, beams and arises:
  1. In any 10' length: 1/8" inch.
  2. Maximum for entire length: 1/2" inch
- C. Variation from the level or from the indicated elevations of tops of slabs, beams, and arises:
  1. Across Top: 1/8" inch.
  2. In any 10' length: 3/16" inch.
  3. In any bay or in any 20' length: 1/4" inch.
  4. Maximum for entire length: 1/2" inch.
- D. Deviation from Round: Out of round, 1/4" inch.

#### 3.3 FORMS

- A. Design, engineering and construction of forms shall be the Contractor's responsibility.
- B. Construct forms to shape, lines and dimensions of architectural concrete members. Spacing of studs, ties and other supporting members shall be such to support maximum pressures imposed by the wet concrete (mix). Final concrete surfaces shall conform to tolerances as specified.
- C. Seal joints between form units with non-absorptive foam tape or other approved means. Use stripping gaskets at junctions of forms and forms to beams and columns to facilitate stripping and reuse of forms without damage.

- D. Forms shall be tight to prevent concrete loss. Corner chamfer strips are not allowed, making mandatory especially tight well designed corners of the forms. Continuous girts and blocking shall be provided behind all plywood butt joints not backed.
- E. Formwork shall be cambered to compensate for construction deflections plus deadload deflections as required.
- F. Expansion and Control Joints: Locate expansion joints at 20 feet maximum on center, or where specifically indicated on the plans or as approved by the Owner's Representative.
- G. All forms shall be cleaned of extraneous loose material with compressed air, and thoroughly inspected before use. Forms with clips, dents, damaged corners or edges, scratches, gouges or other defects that will transfer to the concrete surface will be discarded. Forms shall be thoroughly wetted just before concrete placement. Have sufficient equipment available to allow for these procedures.

3.4 CONCRETE PLACING AND CONSOLIDATION:

A. General:

- 1. Place no concrete before forms are complete, reinforcement secured in place, all built-in items in place, form ties at construction joints tightened, and the work observed by Owner's Representative.
- 2. Keep a record of time and date of placing of concrete in each portion of the project.
- 3. Carry on concrete work as a continuous operation until selection of approved size and shape is completed. Cut-offs and construction joints shall be of approved detail and location.
- 4. Provide the Owner's Representative with 24 hours notice when the concrete is to be placed.
- 5. Provide such equipment and employ only those methods and arrangements of equipment, which will reduce a minimum separation of coarse aggregate from the concrete. Select the equipment for its ability to handle concrete of the lowest slump that can be consolidated by means of vibration after placement.

B. Placing:

- 1. Concrete shall be deposited as nearly as practicable directly in its final position and shall not be caused to flow such that the lateral movement will cause segregation of the course aggregate mortar or water from the concrete mass.
- 2. Retempering of mix, which has partially set, is prohibited. Place all concrete in forms not more than 1-1/2 hours after water is added to the mixture. Place no concrete when sun, wind, heat or limitations of provided facilities will prevent proper finishing and curing.
- 3. Clean transporting and handling equipment at frequent intervals and thoroughly flush with water before and after each day's run. Discharge of wash water into forms is not permitted. The ready mix trucks shall be thoroughly cleaned before each load.

4. When depositing in vertical sections greater than 5' deep, a tremie shall be placed between the reinforcing steel to a depth so that the freefall of concrete will not exceed 5' feet.
5. Deposit concrete vertically in its final position. Horizontal layers deeper than 24" inch not permitted. Placing procedures permitting escape of mortar or the flow of concrete itself not permitted.
6. Take special care to completely fill forms by depositing as near final position as possible, and to force concrete under and around reinforcement without displacement. After deposited concrete has taken initial set, exercise care to avoid jarring forms or placing strain on ends of projecting reinforcement.

C. Consolidation:

1. Place vibrators in the concrete rapidly to minimize entrapped air between concrete and forms, and thoroughly blend the layers. Remove vibrator slowly from concrete to break up and release air entrapped between concrete and forms. Minimum spacing of vibrator in sections shall be in accordance with manufacturer's recommended radius of influence.
2. Provide a minimum of 1 spare vibrator at each location where concrete is being placed during architectural concrete placing. Vibrators shall be 180-cycle, 2-1/2" inch diameter, minimum frequency 9,000 impulses per minute with amplitude no less than 0.040", to a maximum of 12,000 impulses per minute with an amplitude not less than 0.075" inch.
3. Vibrator heads shall not come within 2-1/2" inch of face of architectural concrete.
4. In the event during placing operation there is a delay of more than 15 minutes, manipulate previous left with vibrators just prior to placement of fresh concrete.

3.5 FORM REMOVAL

- A. Design forms to permit their removal without damaging architectural concrete. Do not pry against exposed concrete surfaces when removing the forms.
- B. Do not remove forms until concrete has attained sufficient strength to permit form removal with safety.

3.6 PROTECTING AND CURING

A. Protecting:

1. Protect concrete site walls from any damage by the elements and defacement of any nature during construction operations.
2. All corners and surfaces subject to possible damage shall be suitably protected.
3. Keep all exposed concrete free from laitance caused by spillage, leaking forms or other contaminants. In no event shall laitance be allowed to penetrate, stain or harden on surfaces, which have been sandblasted.

B. Curing

1. Use no curing method which could impair the appearance of concrete site wall surfaces.
2. Curing material used will restrict the loss of moisture to not more than 0.055 grams per square centimeter of surface.
3. All concrete shall be cured for a period of not less than 10 days. During this curing period no part of the concrete shall be permitted to become dry even for a short while. The curing medium shall be applied so as to prevent checking and cracking of the surface of the concrete immediately after placing and it shall be maintained so as to prevent loss of water from the concrete for the duration of the entire curing period. Fresh concrete shall be protected from heavy rains, flowing water, and mechanical injury. All concrete shall be protected from injurious action of the sun.
4. Methods of Curing: If cured with water, concrete shall be kept wet by mechanical sprinklers or by any other approved method, which will keep the surfaces continuously wet with "fresh" water.

3.7 FINISHING

- A. Apply a finish on architectural concrete surfaces as indicated on drawings or notes. Walls may be a different texture than curbs, based upon samples provided by Contractor. Otherwise, texture of concrete surfaces shall be as selected by the Owner's Representative from samples prepared in a range as follows:
  1. Light Sand finish: Expose fine aggregate with no exposure of coarse aggregate - 1/16" inch reveal.

3.8 DEFECTIVE CONCRETE:

- A. As specified in Section 03 30 10, with the added provision that architectural concrete that is discolored, stained or mottled, and cannot be satisfactorily repaired to the Owner's Representative's satisfaction, will be considered defective, and shall be replaced with satisfactory architectural concrete at no additional cost to the owner.

END OF SECTION 03 33 10

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SECTION 05 12 00 – STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes structural steel and architecturally exposed structural steel.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 1 Section “Quality Control” for independent testing agency procedures and administrative requirements.
  - 2. Division 5 Section “Metal Fabrications” for loose steel bearing plates and miscellaneous steel framing.
  - 3. Division 9 Section “Special Coatings” for surface preparation and priming requirements.
  - 4. Division 9 Section “Painting” for surface preparation and priming requirements.

1.2 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
- C. Shop Drawings detailing fabrication of structural steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
  - 3. Indicate size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
  - 4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation for design-build components.
- D. Qualification data for firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
  - 1. Structural steel, including chemical and physical properties.
  - 2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
  - 3. Direct-tension indicators.
  - 4. Shop primers.
  - 5. Non-shrink grout.

- F. Welding procedures specifications for all frame welds.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
  - 1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
    - a. Category: Category I, conventional steel structures.
    - b. Fabricator shall be registered with and approved by authorities having jurisdiction.
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC’s “Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design.”
  - 2. AISC’s “Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings.”
  - 3. AISC’s “Specification for Load and Resistance Factor Design of Single-Angle Members.”
  - 4. AISC’s “Seismic Provisions for Structural Steel Buildings.”
  - 5. Research council on Structural Connections’ (RCSC) “Specification for Structural Joints Using ASTM A325 or A490 Bolts.”
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the 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 projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
- E. Welding Standards: Comply with applicable provisions of AWS D1.1 “Structural Welding Code—Steel.”
  - 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.
- F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section “Project Meetings.”

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.



- B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
  - 1. Store fasteners in a protected place. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
  - 2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

## 1.5 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Structural Steel Shapes, Plates, and Bars: As follows:
  - 1. Wide-flange shapes: ASTM A992, Grade 50.
  - 2. Typical Base Plates and Connection Plates: ASTM A36.
  - 3. Angles and Channels: ASTM A36.
- B. Cold-Formed Structural Steel Tubing, Rectangular and Square: ASTM A500, Grade B, 46 ksi.
- C. Carbon-Steel Coatings: ASTM A27, Grade 65-35, medium-strength carbon steel.
- D. Anchor Rods, Bolts, Nuts, and Washers: As follows:
  - 1. Anchor Rods (Hooked, Headed, or Threaded and Nuted): ASTM F1554, Grade 36.
  - 2. Hex Nuts: ASTM A563, Grade A Hex-Nuts for rod diameters up to 1-1/2". ASTM A563, Grade A Heavy Hex-Nuts for larger rod diameters.
  - 3. Washers: ASTM F436, Type 1.
- E. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A; carbon-steel, hex-head bolts; ASTM A563, Gr. A carbon steel hex nuts; and flat, ASTM F436, Type 1 steel washers.
  - 1. Finish: Plain, uncoated.
  - 2. Finish: Hot-dip zinc coating, ASTM A153, Class C.
- F. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts, ASTM A563, Gr. A heavy hex carbon-steel nuts, and ASTM F436, Type 1 carbon-steel washers.
  - 1. Finish: Plain, uncoated.
  - 2. Direct-Tension Indicators: ASTM F959, Type 325.

- a. Finish: Plain, uncoated.
- b. Finish: Mechanically deposited zinc-coating, ASTM B695, Class 50.
- c. Finish: Mechanically deposited zinc-coating, ASTM B695, Class 50, epoxy coated.

G. Welding Electrodes: Comply with AWS requirements.

## 2.2 PRIMER

- A. Primer: Fast-curing, lead-and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.
- B. Primer: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOP-P-21035A or SSPC-Paint 20.

## 2.3 GROUT

- A. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Shrinkage-Resistant Grout: Premixed, factory-packaged, ferrous aggregate grout, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.
- C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.

## 2.4 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC Specifications referenced in this Section and in Shop Drawings.
  - 1. Camber structural steel members where indicated.
  - 2. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
  - 5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
  - 6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
  - 1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
  - 2. Comply with fabrication requirements, including tolerance limits, of AISC’s “Code of Standard Practice for Steel Buildings and Bridges” for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
  - 1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
  - 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

**2.5 SHOP CONNECTIONS**

- A. Shop install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
- B. Shop install and tighten high-strength bolts according to RCSC’s “Specification for Structural Joints Using ASTM A325 or A490 Bolts”
- C. Bolted Connections:
  - 1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
  - 2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
- D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
  - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

**2.6 SHOP PRIMING**

- A. Shop prime steel surfaces scheduled to be painted.

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- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
  - 1. SSPC-SP 2 “Hand Tool Cleaning”
  - 2. SSPC-SP 3 “Power Tool Cleaning”
  - 3. SSPC-SP 5 “White Metal Blast Cleaning”
  - 4. SSPC-SP 6 “Commercial Blast Cleaning”
  - 5. SSPC-SP 7 “Brush-Off Blast Cleaning”
  - 6. SSPC-SP 8 “Pickling”
  - 7. SSPC-SP 10 “Near-White Blast Cleaning”
  - 8. SSPC-SP 11 “Power Tool Cleaning to Bare Metal”
  
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer’s instructions and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from the first.
  
- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC’s “Painting System Guide No. 7.00” to provide a dry film thickness of not less than 1.5 mils.

## 2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A123, G-60.

## 2.8 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
  - 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.
  
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
  
- C. Additional testing, at Contractor’s expense, will be performed to determine compliance of corrected Work with specified requirements.
  
- D. Shop-bolted connections will be tested and inspected according to RCSC’s “Specification for Structural Joints Using ASTM A325 or A490 Bolts.”

- E. In addition to visual inspection, shop-groove welded connections will be inspected and tested according to requirements of AWS D1.1 groove and testing procedures listed below, at testing agency's option.
  - 1. Liquid Penetrant Inspection: ASTM E165.
  - 2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - 3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
  - 4. Ultrasonic Inspection: ASTM E164
  
- F. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
  - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Before erection proceeds, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
  
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained 80% of its design compressive strength.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
  
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
  - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
    - a. Comply with manufacturer's instructions for proprietary grout materials.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
  2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not use thermal cutting during erection.
- H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.
- 3.4 FIELD CONNECTIONS
- A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.
  - B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
  - C. Bolted Connections:
    1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
    2. Connection Type: Snug tightened, unless indicated as slip-critical, direct tension, or tension shear/bearing connections.
  - D. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting weld work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.

### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
  1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- E. In addition to visual inspection, field-groove welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
  1. Liquid Penetrant Inspection: ASTM E165.
  2. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
  4. Ultrasonic Inspection: ASTM E164.
- F. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding as follows:
  1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
  2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

### 3.6 CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

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1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section "Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas apply galvanizing repair paint according to ASTM A780.

END OF SECTION



**SECTION 05 50 00 - METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes metal fabrications, bracing and supports for construction specified in other Sections.

**1.2 FIELD CONDITIONS**

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

**PART 2 - PRODUCTS**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true. Drill holes for bolts to the exact diameter of the bolt. Provide screws threaded full length to the screw head.
  - 1. Anchor supports for securely to, and rigidly brace from, building structure. Laser level framing.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.

4. Quality of Workmanship:
- a. At concealed connections: No improvement from mill finish, except preparation necessary for priming is required. Welds are not required to be ground.
  - b. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness, pits, mill marks, nicks, or scratches show after finishing and contour of welded surface matches that of adjacent surface. Defects and distortions shall not be visible to the eye nor show through painted or polished surfaces.
- D. Touchup surfaces and finishes after erection. For materials exposed to view in the finished Project, clean field welds, bolted connections, and abraded areas and touchup paint with the same material as used for shop painting.
- E. Touchup surfaces and finishes after erection. For materials exposed to view in the finished Project, clean field welds, bolted connections, and abraded areas and touchup paint with anti-corrosive, anti-rust primer that is less than 250 g/L VOC compatible with shop applied primer.

**END OF SECTION 05 50 00**

**SECTION 05 51 00 - METAL STAIRS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Preassembled steel stairs with concrete-filled treads.
- B. Related Requirements:
  - 1. Section 05 52 13 "Pipe and Tube Railings" for pipe and tube railings.

**1.2 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For metal stairs and the following:
  - 1. Prefilled metal-pan stair treads.
  - 2. Nonslip aggregates and nonslip-aggregate finishes.
  - 3. Paint products.
  - 4. Grout.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show working points and column centerline locations in plan and in section. Include details of metal stairs and their connections, including stringers, treads, risers, headers, platforms, struts, hangers, supplemental steel framing for connection and alignment of threaded rod hangers to structural steel building framing, railings, handrails, guardrails, brackets, reinforcements, anchors, welded and bolted field and shop connections (size and location), and other supplemental information. Where conditions in three or more consecutive stories are exactly alike, the drawings may be broken and noted to include the duplicate runs.

1. For installed products indicated to comply with performance requirements and design criteria, submit shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Include plans and elevations at not less than 1" to 1'-0" scale, and include details of sections and connections at not less than 3" to 1'-0" scale.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

#### **1.5 QUALITY ASSURANCE**

- A. Standards: Except as modified by governing codes and the Contract Documents, comply with the applicable provisions and recommendations of the following:
1. National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual .
  2. National Association of Architectural Metal Manufacturers (NAAMM) Metal Stairs Manual .
  3. National Ornamental & Miscellaneous Metals Association (NOMMA) Metal Rail Manual .
- B. Fabricator/Installer Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.
1. Employ only experienced tradesmen for both fabrication and installation, who are capable of producing work of the highest standards of quality in the industry.
- C. 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 metal stairs (including handrails and railing systems) that are similar to those indicated for this Project in material, design, and extent.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### **1.6 FIELD CONDITIONS**

- A. Field Measurements: Where metal stairs are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
  - 1. Uniform Load: 100 lbf/sq. ft..
  - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.
  - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. Component Importance Factor is 1.5.
- E. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), the American Disabilities Act (ADA), and local regulatory requirements as applicable to stairs, handrails and the protection of openings; where regulatory requirements conflict the more stringent shall apply.

**2.2 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without pitting, seam marks, roller marks, rolled trade names, or blemishes.

**2.3 FERROUS METALS**

- A. General: Provide ferrous metal (steel and iron) in the form indicated, complying with the following requirements.
- B. Steel Tubing: ASTM A 500 (cold-formed) or ASTM A 513.

**2.4 FASTENERS**

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5. Select fasteners for type, grade, and class required.

**2.5 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Concrete Materials and Properties: Composed of ASTM C 150 Type I Portland cement, ASTM C 33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8 inch with at least 95% passing a 3/8 inch sieve and not more than 10% passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28-day compressive strength of 3000 psi.
- E. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

**2.6 STEEL-FRAMED STAIRS**

- A. Stair Framing:
  - 1. Fabricate stringers of steel tubes.
    - a. Provide closures for exposed ends of tube stringers.
  - 2. Construct platforms of steel tube headers and miscellaneous framing members as indicated to comply with performance requirements.
  - 3. Weld stringers to headers; weld framing members to stringers and headers.
- B. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.067 inch.

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
3. Shape metal pans to include nosing integral with riser.
4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
  - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

## **2.7 STAIR HANDRAILS AND RAILINGS**

- A. General: Comply with applicable requirements in Section 05 52 13 "Pipe and Tube Railings" for handrails and railings.

## **2.8 FINISHES**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated (non-galvanized) ferrous-metal surfaces by removing oil, grease, and similar contaminants in accordance with SSPC -SP 1 "Solvent Cleaning," followed with the SSPC surface-preparation specifications listed below. Surface preparation shall be done after fabrication and immediately prior to shop painting. Apply shop coat of paint within 4 hours after cleaning and before rust bloom occurs.
  1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply a minimum of one coat of shop primer to uncoated (non-galvanized) surfaces of metal fabrications, except those to be embedded in concrete or masonry and those to be field welded, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
  1. Dry Film Thickness of Primer: 2.5 to 3.0 mils, dry film thickness. Apply paint thoroughly and evenly to dry surfaces, free from holidays and pinholes, in accordance with manufacturers directions.
- E. Do not deliver metal stair work until primer has dried.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Metal Stair Installation, General: Erect stairs, railings and handrails, and infill panels square, plumb, straight and true to line and level, in the correct locations and in proper relation to adjoining work with neatly fitted joints and intersections. Installation shall be secure and rigid.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors. Drill holes for bolts to the exact diameter of the bolt. Provide screws threaded full length to the screw head
- C. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
- E. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Leave work exposed to view, including stair soffits, clean, smooth and neatly finished.
- G. Include supplementary parts necessary to complete each item, though such work is not definitely shown or specified.
- H. Handrail and Railing Installation, General: Use type of bracket with predrilled hole for exposed bolt anchorage. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by performance requirements. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
  - 1. Anchor posts to steel by welding directly to steel supporting members.
  - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- I. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to satisfy the performance requirements. Secure wall brackets to building construction as follows:
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

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3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to satisfy the performance requirements.
  
- J. Concrete Fill Installation: Place concrete fill into steel pan platforms and treads. Screed concrete fill level and finish with wood float. After screeding, permit concrete fill to cure until it can support the weight of workmen standing on boards.
  1. Refer to Division 09 Sections for finish flooring installation.
  
- K. Touch up surfaces and finishes after erection. Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.

**END OF SECTION 05 51 00**

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**SECTION 05 52 13 - PIPE AND TUBE RAILINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Steel pipe and tube railings.

**1.2 COORDINATION AND SCHEDULING**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
  - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. For installed products indicated to comply with performance requirements and design criteria, submit shop drawings signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

## **1.5 QUALITY ASSURANCE**

- A. Fabricator/Installer Qualifications: A firm experienced in producing handrails and railings similar to those indicated, with a record of successful in-service performance, with sufficient production capacity to produce required units without causing delay in the work.
  - 1. Employ only experienced tradesmen for both fabrication and installation, who are capable of producing work of the highest standards of quality in the industry.
- B. 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 handrails and railings that are similar to those indicated for this Project in material, design, and extent.
- C. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## **1.6 STORAGE, DELIVERY AND HANDLING**

- A. Store railings in a dry, well-ventilated, weathertight place. Deliver and handle so as to prevent any type of damage to the fabricated work.

## **1.7 FIELD CONDITIONS**

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with pipe and tube railings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- E. Regulatory Requirements: Comply with the requirements of Part 1910 of the Occupational Safety and Health Standards (OSHA), the American Disabilities Act (ADA), and local regulatory requirements as applicable to stairs, handrails and the protection of openings; where regulatory requirements conflict the more stringent shall apply.

**2.2 METALS, GENERAL**

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without pitting, seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes where exposed to view on finished units.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

**2.3 STEEL AND IRON**

- A. General: Provide steel and iron (ferrous metal) in the form indicated, complying with the following requirements.
- B. Pipe: ASTM A 53/A 53M, Type S –Ó Seamless, Grade A, suitable for close coiling or cold bending, Standard Weight (Schedule 40) minimum, unless another grade and weight are required to suit performance requirements.
  - 1. Black finish, unless otherwise indicated.
  - 2. Galvanized finish for exterior installations and where indicated.

- C. Tubing: ASTM A 500 (cold formed) Grade A or ASTM A 513, unless otherwise indicated or required to satisfy the performance requirements.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 1. Welded Headed Studs: AWS D1.1 (Type A or B as selected by fabricator), ASTM A 108 Grades 1010 through 1020 inclusive and bearing the minimum mechanical properties for studs as selected by fabricator to suit performance requirements.
- E. Cold Finished Steel Bars: ASTM A 108, grade as selected by fabricator.
- F. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch thick, with 1/4 inch holes 3/8 inch o.c. in staggered rows unless otherwise indicated to match Architect and Resident Engineer's selected sample of perforated steel sheet.

## **2.4 FASTENERS**

- A. General: Provide the following:
  - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
  - 2. Galvanized Steel Railings: Plated fasteners complying with ASTM B 633, or ASTM F 1941, Class Fe/Zn 12 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of complying with the performance requirements.

## **2.5 MISCELLANEOUS MATERIALS**

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded and as required at aluminum and stainless steel railings for color match, strength, and compatibility in fabricated items.
- B. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."
- C. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
  - 1. 94-258 Series Multi-Prime Fast Dry 2.8 VOC Universal Metal Primer; Pittsburgh Paints.
  - 2. B50 Z Kem Kromik Universal Primer Fast Dry; Sherwin-Williams Co.
  - 3. Series 37H Phenolic Alkyd Primer Chem-Prime; Tnemec.
- D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

## **2.6 FABRICATION**

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to comply with the performance requirements.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Shear, cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. Weld connections continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- J. Form changes in direction as indicated on the Drawings.
- K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.

- M. Fabricate joints that will be exposed to weather in a watertight manner.
- N. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns.
- O. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- P. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- Q. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- R. Perforated-Metal Infill Panels: Fabricate infill panels from perforated metal made from steel.
  - 1. Edge panels with U-shaped channels made from metal sheet, of same metal as perforated metal and not less than 0.043 inch thick.
  - 2. Orient perforated metal with pattern as indicated on Drawings.
- S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.
- T. Provide weep holes or another means to drain entrapped water in hollow sections of railing members that are exposed to exterior or to moisture from condensation or other sources.

## **2.7 FINISHES, GENERAL**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## **2.8 STEEL AND IRON FINISHES**

- A. Galvanized Railings: Hot-dip galvanize exterior steel and iron railings to comply with ASTM A 123. Hot-dip galvanize hardware for exterior steel and iron railings to comply with ASTM A 153/A 153M.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:



1. ASTM A 123, for galvanizing steel and iron products.
  2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- C. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- D. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- E. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- F. Primer Application: Apply shop primer to prepared surfaces of railings, except those with galvanized finishes and those to be field welded, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Dry Film Thickness of Primer: 2.5 to 3.0 mils, dry film thickness. Apply paint thoroughly and evenly to dry surfaces, free from holidays and pinholes, in accordance with manufacturers directions.
- G. Do not deliver primed railing work until primer has dried.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

#### **3.2 INSTALLATION, GENERAL**

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

- C. Adjust railings before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required to meet or exceed the performance requirements.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### **3.3 RAILING CONNECTIONS**

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

### **3.4 ANCHORING POSTS**

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows.
  - 1. Anchor posts to steel by welding directly to steel supporting members.

### **3.5 ATTACHING RAILINGS**

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Attach railings to wall with wall brackets, except where end flanges are used. Provide brackets with 1-1/2 inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to meet or exceed the performance requirements.
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

- C. Secure wall brackets and railing end flanges to building construction as required to meet or exceed the performance requirements and the following:
  - 1. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to satisfy the performance requirements.

**3.6 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." Section 09 91 23 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**3.7 PROTECTION**

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

**END OF SECTION 05 52 13**

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with timber.
3. Framing with engineered wood products.
4. Shear wall panels.
5. Rooftop equipment bases and support curbs.
6. Wood blocking, cants, and nailers.
7. Plywood backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Shear panels.
5. Power-driven fasteners.
6. Post-installed anchors.
7. Metal framing anchors.

#### 1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency,
  3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
  2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  5. Wood floor plates that are installed over concrete slabs-on-grade.

**2.3 FIRE-RETARDANT-TREATED MATERIALS**

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Treatment shall not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
  - 1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by testing agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawing.

**2.4 DIMENSION LUMBER FRAMING**

- A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
  - 1. Application: All interior partitions not indicated as load bearing.
  - 2. Species:
    - a. Hem-fir (north); NLGA.
    - b. Southern pine or mixed southern pine; SPIB.
    - c. Spruce-pine-fir; NLGA.
    - d. Hem-fir; WCLIB, or WWPA.
    - e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.



- f. Northern species; NLGA.
- g. Eastern softwoods; NeLMA.
- h. Western woods; WCLIB or WWPA.

B. Load-Bearing Partitions: As noted on the Drawings,.

- 1. Application: Exterior walls and interior load-bearing partitions.
- 2. Species: As noted on the Drawings.

C. Ceiling Joists: Construction or No. 2 grade.

- 1. Species:
  - a. Douglas fir-larch; WCLIB or WWPA.
  - b. Douglas fir-larch (north); NLGA.
  - c. Southern pine or mixed southern pine; SPIB.
  - d. Western woods; WCLIB or WWPA.

D. Joists, Rafters, and Other Framing Not Listed Above: As noted on the Drawings.

- 1. Species: As noted on the Drawings.

E. Exposed Framing Indicated to Receive a Stained or Natural Finish]: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

- 1. Species and Grade: As noted on the Drawings.

## 2.5 TIMBER FRAMING

A. Comply with the following requirements, according to grading rules of grading agency indicated:

- 1. Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; As noted on the Drawings.

## 2.6 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

- 1. Extreme Fiber Stress in Bending, Edgewise: As noted on the Drawings.
- 2. Modulus of Elasticity, Edgewise: As noted on the Drawings.

C. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to

ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Extreme Fiber Stress in Bending, Edgewise: As noted on the Drawings.
2. Modulus of Elasticity, Edgewise: As noted on the Drawings.

D. Wood I-Joists: Prefabricated units, I-shaped in cross section, made with solid or structural composite lumber flanges and wood-based structural panel webs, let into and bonded to flanges. Comply with material requirements of and with structural capacities established and monitored according to ASTM D 5055.

1. Web Material: Either OSB or plywood, complying with DOC PS 1 or DOC PS 2, Exposure 1.
2. Structural Properties: Depths and design values not less than those indicated.
3. Comply with APA PRI-400. Factory mark I-joists with APA-EWS trademark indicating nominal joist depth, joist class, span ratings, mill identification, and compliance with APA-EWS standard.

E. Rim Boards: Product designed to be used as a load-bearing member and to brace wood I-joists at bearing ends, complying with research or evaluation report for I-joists.

1. Manufacturer: Provide products by same manufacturer as I-joists, or approved equal.
2. Material: All-veneer product or product made from any combination solid lumber, wood strands, and veneers.
3. Thickness: 1-1/4 inches .
4. Comply with APA PRR-401, rim board grade. Factory mark rim boards with APA-EWS trademark indicating thickness, grade, and compliance with APA-EWS standard.

## 2.7 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.8 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.9 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners[ with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report as noted on the Drawings.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.10 METAL FRAMING ANCHORS

- A. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.
- D. Stainless-Steel Sheet: ASTM A 666, Type 304.
  - 1. Use for exterior locations and where indicated.

- E. Joist Hangers: As noted on the Drawings.
- F. I-Joist Hangers: As noted on the Drawings
- G. Top Flange Hangers: As noted on the Drawings.
- H. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.
- I. Post Bases: As noted on the Drawings.
- J. Joist Ties: As noted on the Drawings.
- K. Rafter Tie-Downs: As noted on the Drawings.
- L. Rafter Tie-Downs (Hurricane or Seismic Ties): As noted on the Drawings.
- M. Hold-Downs: As noted on the Drawings.

## 2.11 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking and similar supports to comply with requirements for attaching other construction.

- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- G. Do not splice structural members between supports unless otherwise indicated.
- H. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
  - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft, and to solidly fill space below partitions.
  - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- J. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable
2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for[ attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

### 3.4 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

B. Construct corners and intersections with three or more studs as noted on the Drawings.

C. Frame openings with multiple studs and headers as noted on the Drawings.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide support framing as noted on the Drawings.

**3.5 CEILING JOIST AND RAFTER FRAMING INSTALLATION**

- A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.
  - 1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal- size or 2-by-4-inch nominal- size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

**3.6 TIMBER FRAMING INSTALLATION**

- A. Install timber beams with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
- B. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch airspace at sides and ends of wood members.
- C. Install wood posts using metal anchors indicated.
- D. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

**3.7 PROTECTION**

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

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**SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes miscellaneous carpentry.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each type of process and factory-fabricated product indicated.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Stack lumber, plywood, and other panels; for lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

**PART 2 - PRODUCTS**

**2.1 WOOD PRODUCTS, GENERAL**

- A. Lumber: Comply with DOC PS 20 "American Softwood Lumber Standard" and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.
  - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- B. Wood Panels:
  - 1. Plywood: Comply with DOC PS 1 "Construction and Industrial Plywood" for plywood panels. Use exterior grade for panels in wet conditions.
  - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.

**2.2 FIRE-RETARDANT-TREATED MATERIALS**

- A. General: Provide chemical fire retardant process tested and labeled by UL with flame spread and smoke developed ratings of 25 or less. Comply with performance requirements in AWWA U1, Use Category UCFA as a minimum for pressure treatment. Size wood before treatment so that minimum cutting will be required after treatment. Kiln dry lumber to a maximum 19 percent moisture content, kiln dry plywood to a maximum 15 percent moisture content, after treatment. Treat indicated items and the following:
  - 1. Wood members required to be treated by Building Code having jurisdiction at the site and wood members specified as fire-retardant-treated.
- B. Identify fire-retardant-treated wood with appropriate classification marking of UL.

**2.3 MISCELLANEOUS LUMBER**

- A. Provide miscellaneous lumber for support or attachment of other construction, including blocking, nailers, and similar members.
- B. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
  - 1. Mixed southern pine, No. 2 grade; SPIB.
  - 2. Western Woods; WCLIB or WWPA, No. 2 Grade.

**2.4 PANEL PRODUCTS**

- A. Telephone, Data, Security, and Electrical Equipment Backing Panels:
  - 1. APA, Exposure 1, C-C Plugged, fire-retardant treated, manufactured with no added urea-formaldehyde, in thickness indicated or, if not indicated, not less than 3/4 inch thick.

**2.5 FASTENERS**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Power-Driven Fasteners: NES NER-272.
- C. Wood Screws: Select material, type, size, and finish required for each use. Comply with ASME B18.6.1.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- C. Use fasteners of appropriate type and length. Pre-drill members when necessary to avoid splitting wood.

**3.2 WOOD BLOCKING AND NAILER INSTALLATION**

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

**3.3 PANEL PRODUCT INSTALLATION**

- A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," and local utility requirements, if any, for plywood backing panels utilized as indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Countertop Underlayment: Bolt to miscellaneous steel framing.
  - 2. Plywood Backing Panels: Secure to wall using proper fastening devices for substrates encountered spaced 12 inches on center maximum at perimeter 1/2 inch from corners and three rows of 3 fasteners each in the backerboard field. Countersink fasteners flush with plywood surface. Butt adjacent panels without lapping.

**END OF SECTION 06 10 53**

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SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Sheathing joint and penetration treatment.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry".
2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that

periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

- A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- C. Factory mark panels to indicate compliance with applicable standard.

2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2.
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
- C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201/D 3201M at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings.

2.5 WALL SHEATHING

- A. Plywood Sheathing: As noted on the Drawings.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness As noted on the Drawings.
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: As noted on the Drawings.
  - 3.

2.6 ROOF SHEATHING

- A. Plywood Sheathing: As noted on the Drawings.
  - 1. Span Rating: Not less than 40/20.
  - 2. Nominal Thickness: As noted on the Drawings.

- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
  - 1. Span Rating: Not less than 40/20.
  - 2. Nominal Thickness: As noted on the Drawings.

2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

2.8 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.



- D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.
- E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 16 00

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## SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes interior architectural woodwork:
  - 1. Plastic-laminate cabinets.
  - 2. Solid-surfacing material countertops.
  - 3. Closet and utility shelving.
  
- B. Related Requirements:
  - 1. Section 05 50 00 "Metal Fabrications" for concealed countertop supports.
  - 2. Section 06 10 53 "Miscellaneous Rough Carpentry" for concealed blocking for millwork items.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: Submit product data for each material and product specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.
  - 1. Cabinet hardware and accessories.
  - 2. Finishing materials and processes.
  
- B. Shop Drawings: Submit shop drawings showing locations of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Elevations shall be drawn at a scale of not less than 1/2" = 1'-0" . Details shall be drawn at a scale of not less than 3" = 1'-0" .
  - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 2. Show locations and sizes of cutouts and holes for plumbing, electrical, computer and telephone equipment and other items installed in architectural woodwork.
  
- C. Samples: Submit samples of the following:
  - 1. Solid-surfacing materials, 6 inches square.

### **1.3 QUALITY ASSURANCE**

- A. **Single-Source Manufacturing and Installation Responsibility:** Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this Section, including fabrication, finishing, and installation. The manufacturer shall have successful experience in the custom fabrication and installation of architectural woodwork comparable to that shown and specified, be a member of the AWI, maintain an organized quality control program, perform its own in-house veneer lay-up work, and who retains facilities with sufficient capacity and quality to produce the required architectural woodwork without causing delay to the Project.
- B. **Quality Standard:** Fabricate and install all architectural woodwork in accordance with the applicable requirements of Architectural Woodwork Standards, 2nd edition, published jointly by AWI, AWMAC, and WI, unless more stringent requirements are specified or shown.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Field Conditions" Article.

### **1.5 FIELD CONDITIONS**

- A. **Environmental Limitations:** Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. **Field Measurements:** Where woodwork is indicated to fit to other construction, verify actual dimensions of other construction by accurate field measurements before fabrication of woodwork; and indicate measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on shop drawings.
  - 2. **Established Dimensions:** Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

### **1.6 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

**1.7 PREINSTALLATION COORDINATION MEETING**

- A. Meet at the Project site, prior to installation of architectural woodwork, to review the substrate preparation, installation and coordination with other trades, special details and conditions, and other topics related to the architectural woodwork. The preinstallation meeting shall include the Architect, Resident Engineer, the Contractor, architectural woodworker, and any subcontractors affected by the architectural woodwork installation.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. General: Provide materials that comply with requirements of the AWS quality standard for each type of woodwork and quality grade specified.
- B. Composite Wood Products: Products shall be made without urea formaldehyde.
- C. Composite wood products shall comply with requirements for formaldehyde as specified in ARB's Air Toxics Control Measure (ATCM) for Composite Wood. Those materials not exempted under the ATCM must meet the specified emission limits, in "CALgreen Requirements."
  - 1. Use composite wood products approved by the ARB as no-added formaldehyde (NAF) based resins or ultra-low emitting formaldehyde (ULEF) resins.
- D. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations in "CALgreen Requirements."
- E. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations in "CALgreen Requirements."
- F. Wood Panel Products:
  - 1. Medium Density Particleboard: A medium density particleboard (MDP) panel manufactured from 100 percent post industrial recycled wood residuals complying with ANSI A208.1, Type M-3-with a minimum 45 pcf density except that minimum for screw holding capacity on face shall be 247 pounds, an ASTM E 84 minimum Class C flame spread rating; minimum 3/4 inches thick, edged and faced as specified and manufactured with binder containing no added urea-formaldehyde.
  - 2. Hardboard: ANSI A135.4.
- G. Thermoset Decorative Overlay (Melamine): Particleboard or medium-density fiberboard with surface of thermally fused, melamine-impregnated decorative paper complying with the recommendations of the Composite Panel Association's Technical Bulletin "Laminating Composite Panels."
  - 1. Types: As indicated in the Finish Schedule on the Drawings.

- H. High-Pressure Decorative Laminate (PL-1): Complying with NEMA LD 3 for Horizontal General Purpose Grade (HGS) typically and Vertical General Purpose Grade (VGS) where specified. Nominal thickness for HGS and VGS laminates to be 0.048 inches +/-0.005 inches and 0.028 inches +/- 0.004 inches, respectively. Where high pressure decorative laminate is indicated to be faced with aluminum, provide aluminum sheet goods specifically made for laminating to vertical MDF and particleboard substrates in sheet thickness of 0.025 inches +/- 0.002 inches.
  - 1. Types: As indicated in the Finish Schedule on the Drawings.
    - a. Provide factory applied protective peel coat to prevent surface damage during fabrication and handling of aluminum faced decorative laminates. Remove protective peel coat after installation in accordance with the manufacturer's recommendations. If the film is left in place after installation, exposure to direct sunlight for a prolonged period may cause a paste residue and create other problems.
  - 2. Backing Sheets: Non-decorative, high pressure laminate, NEMA LD3, Grade, types and thickness to match face sheets and equalize pull.
  
- I. Solid-Surfacing Material (SS-1): Provide material that meets or exceeds ISSFA-2-01 performance standards, consisting of reacted monomers and resins, mineral fillers and pigments and manufactured in sheets of specific thicknesses. Solid surfacing material shall be solid, non-porous, homogeneous, hygienic, renewable, and, when applicable, may feature inconspicuous hygienic seams. Solid surfacing material shall be free from conspicuous internal strengthening fibers.
  - 1. Types: As indicated in the Finish Schedule on the Drawings.

**2.2 FIRE-RETARDANT-TREATED MATERIALS**

- A. Fire-retardant-treated lumber and plywood shall comply with VOC content in "CALgreen Requirements."
- B. Fire-Retardant-Treated Lumber: Materials impregnated with fire-retardant chemical formulations to comply with AWWA U1, Use Category UCFA. Kiln-dry material after treatment to levels required for untreated woodwork.

**2.3 CABINET HARDWARE AND ACCESSORIES**

- A. General: Provide cabinet hardware and accessory materials for a complete installation of architectural woodwork, except for items specified in Section 08 71 00 "Door Hardware."
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

- C. **Frameless Concealed Hinges for Cabinet Doors (European Type):** Concealed all-metal furniture hinges adaptable or engineered for 35 mm hinge cup boring pattern, with minimum 155 degree opening angle, three-dimensional hinge having adjustments located in the steel hinge arm, steel or die-cast zinc hinge cups, mounting plates, and plastic insertion dowels to receive hinge screws. Automatic soft closing shall engage only in the last 10 degrees of swing. All hinge pins and linkages shall be hardened. Complying with BHMA A156.9, B01602. Bright nickel finish (US15).
1. **Hinge Quantity:** Provide hinge quantity as recommended by hinge manufacturer based on cabinet door width, weight, thickness, door material, and hinge cup selection.
  2. **Metal Furniture Hinge Products and Manufacturers:** One of the following:
    - a. **Basis of Design:** Grass Tiomos Series; Grass America, Inc.; Kernersville, NC.
    - b. **Blumotion Series;** Blum USA; Stanley, NC.
    - c. **Salice;** Silencia Series 200.
    - d. **Or approved equal**
- D. **Wire Pulls:** Back mounted, 4 inches long, 3/8 inches in diameter fabricated from satin finished stainless steel (US32D), complying with BHMA A156.9, B52011, unless otherwise indicated.
- E. **Catches:** Magnetic, complying with BHMA A156.9, B03141 for single doors and B03161 for double doors.
1. **For Single Doors:** One of the following:
    - a. **CD41 Single Magnetic Cabinet Catch;** Stanley Commercial Hardware.
    - b. **900;** Rockwood Manufacturing Company, Rockwood, PA.
    - c. **246.94.701 housing x 246.94.702 counterpiece;** Hafele America Co. Archdale, NC.
    - d. **Or approved equal**
  2. **For Double Doors:** One of the following:
    - a. **901;** Rockwood Manufacturing Company.
    - b. **CD45 Double Magnetic Cabinet Catch;** Stanley Commercial Hardware.
    - c. **Or approved equal**
- F. **Cabinet Shelf Rests:** Nickel plated brass or steel, or stainless steel, minimum 6 mm diameter shelf support pegs in sockets, complying with BHMA A156.9, B04013. One of the following:
  1. **Hafele 282.01.701 x 282.50.704;** Hafele America, Co.
  2. **K-10S with K-2 Sleeve;** Brusso, Inc.
  3. **331 Series Flat Top Shelf Support Pin with 325 Series Insert Grommet;** Knappe and Vogt.
  4. **Or approved equal**
- G. **Closet Rods and Flanges:** 1-1/2 inch diameter, satin finished chrome plated steel or satin finished stainless steel with matching end flanges.
- H. **Drawer Slides:**

1. Drawers less than 4 inches deep: Similar to Accuride 7432 having full extension carburized steel ball bearing, side mounting, 100 lb. capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
  2. Drawers greater than 4 inches but less than 8 inches deep: Similar to Accuride 7432 having full extension carburized steel ball bearing, side mounting, 100 lb. capacity medium duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
  3. Drawers greater than 8 inches deep: Similar to Accuride 4032 having full extension carburized steel ball bearing, rail mounting, 150 lb. capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
  4. Refuse Cabinets: Similar to Accuride 3600-201 having full extension carburized steel ball bearing, bottom mounting, 175 lb. capacity heavy duty load rating, cold rolled steel slide members and ball retainers, cushioned in and outstops, progressive action, positive stop, bright electro zinc plate finish.
- I. Silencers: Provide rubber silencers on jamb and/or head and sill strike areas of all cabinet doors and drawers, 2 for paired doors, and 3 for single doors. Silencers shall be approximately 1/4-inch diameter, color compatible with adjacent finish.
- J. Door and Drawer Locks: All cabinet doors and drawers shall be furnished with locks. Finish exposed portions of locks to match cabinet pull finish. Furnish 2 keys with each lock and key all locks inside one room alike and provide masterkey for all locks in Project.
1. Drawers: Provide one of the following lock assemblies:
    - a. Cam lock similar to Hafele 235.10.261, 1-3/16 inch cylinder length, chrome plated, with straight and offset cams; Hafele America, Co., Archdale, NC.
    - b. Cam lock similar to CompX Type 170 Thick Panel Lock x LP-700 lock plug, satin nickel finish, with surface-mounted strike plate SP-100; CompX Timberline, Neenah, WI.
    - c. Or approved equal
  2. Single Doors: Provide one of the following lock assemblies:
    - a. Latch lock similar to Olympus 998/999 Series x 999-Strike, chrome plated, sized to fit opening; Olympus Lock, Inc., Lynnwood, WA.
    - b. Deadbolt similar to CompX CB-281 cylinder body x LP-700 lock plug, satin nickel finish, with surface-mounted strike plate SP-100; CompX Timberline, Neenah, WI.
    - c. Or approved equal
  3. Pairs of Doors: Provide the following:
    - a. At inactive leaf, Furniture bolt similar to Hafele 252.02.644, polished chrome, with strike 251.60.703; Hafele America, Co.
    - b. At active leaf, provide Single Door lock assembly.
    - c. Or approved equal
- K. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.



1. Product: Subject to compliance with requirements, provide "MM Solid Metal series" by Doug Mockett and Co., Inc. <http://www.mockett.com>
  2. Or approved equal
- L. Exposed Hardware Finishes: Unless otherwise specified above, or on the Drawings, all exposed portions of the woodwork hardware shall comply with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
  2. Satin Stainless Steel: BHMA 630.
- M. Hanging (Zee Clip) Strips: Extruded aluminum zee type interlocking clips; type, size and quantity for the condition of use.

## **2.4 FABRICATION, GENERAL**

- A. General: Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to the maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting. The width of scribe and filler panels shall not exceed 1/2 inch, or 1/2 inch clear dimension from adjacent wall to outside face of cabinet door in a 90 degree position, whichever is greater.
1. Interior Woodwork Grade: Custom complying with the referenced quality standard.
  2. Interior Woodwork Grades:
    - a. Custom Grade at plastic laminate-finished woodwork
- B. Fabricate woodwork to dimensions, profiles, and details indicated.
1. Reinforcing shown is minimum. Provide additional steel and lumber reinforcing as required to sustain imposed loads and to ensure a rigid assembly.
  2. Exposed surfaces shall be free from dents, tool marks, warpage, buckle, glue and open joints, or other defects affecting serviceability or appearance. Accurately fit all joints, corners and miters. Conceal all fasteners. Make threaded connections up tight so that threads are entirely concealed.
- C. Shop cut openings to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## **2.5 WOOD CABINETS FOR PLASTIC LAMINATE FINISH**

- A. AWS Type of Cabinet Construction: Flush overlay.
- B. Laminate Cladding for Exposed Surfaces: High-pressure decorative of grade indicated.
1. Horizontal Surfaces Other Than Tops: HGS.

2. Postformed Surfaces: HGP.
  3. Vertical Surfaces: VGS.
  4. Edges: HGS unless otherwise indicated.
  5. Colors, Patterns, and Finishes: As indicated on the Drawings and in the Finish Schedule.
- C. Materials for Semiexposed Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
1. Drawer Sides and Backs: Solid-hardwood lumber.
  2. Drawer Bottoms: Hardwood plywood.
- D. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
- E. Cabinet Locks: Provide door and drawer locks.

## **2.6 SOLID SURFACING COUNTERTOPS**

- A. General: Comply with AWS Section 11 and as follows.
- B. Solid-Surfacing-Material Thickness: 1/2 inch.
- C. Colors, Patterns, and Finishes: As indicated on the Drawings and in the Finish Schedule.
- D. Factory fabricate components to achieve required shapes, sizes, and profiles shown, without cracks, spalling, pits, surface porosity, chipped areas, or blisters.
1. Form all tops in one piece lengths. Provide adhesively bonded backsplashes and aprons in heights indicated. Form edges to profiles shown. If required, use 2 sheets of countertop sheet material laminated together using manufacturer's standard adhesive to form edges. Laminated sections shall be in close contact throughout. Adhesive stains will not be permitted.
  2. Provide separate 6 inch high end splashes.
  3. Countertops shall be factory cored for plumbing fittings provided under Division 22 Plumbing or as indicated on the Drawings.
- E. Radius corners and edges. Provide 1/8 inch radius.
- F. Finish exposed surfaces by trimming and grinding smooth.

## **2.7 CLOSET AND UTILITY SHELVING**

- A. General: Comply with AWS Section 10 and as follows.
- B. Shelf Material: Medium density particle board with plastic laminate or melamine veneer.
- C. Cleats: 3/4-inch solid lumber or thermoset decorative panel.
- D. Finishes: As shown and scheduled on the Drawings.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming before installation.

**3.2 INSTALLATION**

- A. Quality Standard: Install woodwork to comply with requirements of the AWS for the same grade specified in this Section for type of woodwork involved.
  - 1. Install woodwork level, plumb, true, with no distortions, and with no variations in flushness of adjoining surfaces. Shim as required with concealed shims.
  - 2. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- B. Anchor woodwork to blocking built in or directly attached to substrates. Secure to blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- C. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets without sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches on center with No. 10 wafer-head screws sized for 1-inch penetration into wood blocking, or hanging strips or with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- D. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Calk space between backsplash and wall with silicone sanitary sealant specified in Section 07 92 00 "Joint Sealants."
  - 2. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches on center and to walls with adhesive.

**3.3 ADJUSTING AND CLEANING**

- A. Repair damaged and defective woodwork to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean woodwork on exposed and semiexposed surfaces. Touchup shop-applied finishes to restore damaged or soiled areas.

**3.4 PROTECTION**

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, that ensures that woodwork will be without damage or deterioration at time of Substantial Completion.

**END OF SECTION 06 40 23**

**SECTION 07 21 00 - THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Glass-fiber blanket.
2. Loose-fill insulation.

B. Related Requirements:

1. Section 07 52 16 "Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
2. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

**1.2 ACTION SUBMITTALS**

A. Product Data: For each type of product.

**1.3 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: As determined by testing protocol required to achieve UL Classified rating. Identify products with appropriate markings of Underwriters Laboratories.
- B. Formaldehyde-Free: Third Party Certified with UL Environmental Validation.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

**PART 2 - PRODUCTS**

**2.1 GLASS-FIBER BLANKET**

- A. Manufacturers: Subject to compliance with requirements, product products by one of the following:
  1. CertainTeed Corporation
  2. Johns Manville.

3. Knauf Insulation.
  4. Owens Corning.
  5. Or approved equal
- B. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Glass-Fiber Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

## **2.2 LOOSE-FILL INSULATION**

- A. Manufacturers: Subject to compliance with requirements, product products by one of the following:
1. Certainteed.
  2. Johns Manville.
  3. Knauf Insulation.
  4. Or approved equal
- B. Glass-Fiber Loose-Fill Insulation: ASTM C 764, Type I for pneumatic application; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

## **2.3 INSULATION FASTENERS**

- A. Manufacturers: Subject to compliance with requirements, product products by one of the following:
1. AGM Industries, Inc.
  2. Gemco.
  3. Rodenhouse, Inc.
  4. Or approved equal

## **2.4 ACCESSORIES**

- A. Insulation for Miscellaneous Voids:
1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
- B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

**3.2 INSTALLATION, GENERAL**

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

**3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION**

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  - 5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
  - 6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.
    - a. Exterior Walls: Set units with facing placed toward exterior of construction.

- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
  - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
- C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.
  - 1. For Glass Mineral Wool (loose fill insulation), comply with NAIMA's "Recommendations for Installation in Residential and other Light Frame Construction for Fiber Glass Loose Fill Insulation" ([www.NAIMA.org](http://www.NAIMA.org)) or manufacturer's written instructions, whichever is more stringent.

### **3.4 PROTECTION**

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

### **3.5 INSULATION SCHEDULE**

- A. Insulation Type - External Walls : Unfaced, glass mineral wool blanket insulation.
- B. Insulation Type- Internal Walls : Foil-faced, glass mineral wool blanket insulation.
- C. Insulation Type - Attic: Glass fiber loose-fill insulation.

**END OF SECTION 07 21 00**



**SECTION 07 31 13 - ASPHALT SHINGLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Asphalt shingles.
  - 2. Underlayment.
  - 3. Metal flashing and trim.

**1.2 DEFINITION**

- A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

**1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
  - 1. Asphalt Shingles: Full size.
  - 2. Ridge and Hip Cap Shingles: Full size.
  - 3. Exposed Valley Lining: 12 inches square.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each type of asphalt shingle and underlayment product indicated, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For , from ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes.

**1.6 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. Asphalt Shingles: 100 sq. ft. of each type, in unbroken bundles.

**1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.
- B. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.
- C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.
- D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

**1.9 FIELD CONDITIONS**

- A. Environmental Limitations: Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

**1.10 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Manufacturing defects.
  - 2. Material Warranty Period: 30 years from date of Substantial Completion, prorated, with first 20 years nonprorated.
  - 3. Algae-Resistance Warranty Period: Asphalt shingles will not discolor for 10 years from date of Substantial Completion.
- B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt-shingle roofing that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

### 2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462/D 3462M, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide **CertainTeed Patriot AR Shingles**: Conforming to ASTM D 3018 Type I Self-Sealing; UL Certification of ASTM D 3462; ASTM D7158 Class "H"; ASTM D 3161 Class "F"Wind Resistance; and UL 790/ ASTM E108 Class "A"Fire Resistance; ceramic colored/UV resistant mineral surface granules across entire face of shingle; algae-resistant granules; no cut outs 215 pounds per square
  1. or comparable product by one of the following:
    - a. Atlas Roofing Corporation.
    - b. GAF Materials Corporation.
    - c. Owens Corning.
    - d. Or approved equal
  2. Color and Blends: As selected by Architect and Resident Engineer from manufacturer's full range.
- C. Hip and Ridge Shingles: Manufacturer's standard units to match asphalt shingles.

### 2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 4869/D 4869M, asphalt-saturated organic felts, nonperforated.
  1. Type: Type II.

### 2.4 RIDGE VENTS

- A. Rigid Ridge Vent: Manufacturer's standard, rigid section high-density polypropylene or other UV-stabilized plastic ridge vent for use under ridge shingles.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CertainTeed
  - b. Atlas
  - c. Air Vent, Inc.; a Gibraltar Industries company.
  - d. GAF Materials Corporation.
  - e. Owens Corning.
  - f. Or approved equal
2. Minimum Net Free Area: As recommended by manufacturer.
3. Width: As recommended by manufacturer.
4. Thickness: As recommended by manufacturer.

## **2.5 ACCESSORIES**

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- diameter, sharp-pointed, with a minimum 3/8-inch-diameter flat head and of sufficient length to penetrate 3/4 inch into solid wood decking or extend at least 1/8 inch through OSB or plywood sheathing.
  1. Shank: Smooth.
  2. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt-Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch minimum diameter.

## **2.6 METAL FLASHING AND TRIM**

- A. General: Comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."
- B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of the item.
  1. Apron Flashings: Fabricate with lower flange a minimum of 4 inches over and 4 inches beyond each side of downslope asphalt shingles and 6 inches up the vertical surface.
  2. Step Flashings: Fabricate with a headlap of 2 inches and a minimum extension of 4 inches over the underlying asphalt shingle and up the vertical surface.
  3. Open-Valley Flashings: Fabricate in lengths not exceeding 10 feet with 1-inch- high, inverted-V profile at center of valley and equal flange widths of 12 inches.
  4. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

- C. Vent Pipe Flashings: ASTM B 749, Type L51121, at least 1/16 inch thick. Provide lead sleeve sized to slip over and turn down into pipe, soldered to skirt at slope of roof, and extending at least 4 inches from pipe onto roof.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made for flashings and penetrations through asphalt shingles.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 UNDERLAYMENT INSTALLATION**

- A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Single-Layer Felt Underlayment: Install on roof deck parallel with and starting at the eaves. Lap sides a minimum of 2 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt-underlayment nails.
- C. Metal-Flashed, Open-Valley Underlayment: Install two layers of minimum 36-inch- wide underlayment centered in valley. Stagger end laps between layers at least 72 inches. Lap ends of each layer at least 12 inches in direction to shed water, and seal with asphalt roofing cement. Fasten each layer to roof deck.
  - 1. Lap roof-deck underlayment over first layer of valley underlayment at least 6 inches.

#### **3.3 METAL FLASHING INSTALLATION**

- A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07 62 00 "Sheet Metal Flashing and Trim."
  - 1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

- B. Apron Flashings: Extend lower flange over and beyond each side of downslope asphalt shingles and up the vertical surface.
- C. Step Flashings: Install with a headlap of 2 inches and extend over the underlying asphalt shingle and up the vertical surface. Fasten to roof deck only.
- D. Open-Valley Flashings: Install centered in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.
- E. Rake Drip Edges: Install rake drip-edge flashings over underlayment and fasten to roof deck.
- F. Eave Drip Edges: Install eave drip-edge flashings below underlayment and fasten to roof sheathing.
- G. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

### **3.4 ASPHALT-SHINGLE INSTALLATION**

- A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."
- B. Install starter strip along lowest roof edge, consisting of an asphalt-shingle strip with tabs removed with self-sealing strip face up at roof edge.
  - 1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
  - 2. Install starter strip along rake edge.
- C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.
- D. Fasten asphalt-shingle strips with a minimum of four roofing nails located according to manufacturer's written instructions.
  - 1. Where roof slope is less than 4:12, seal asphalt shingles with asphalt roofing cement spots.
  - 2. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- E. Open Valleys: Cut and fit asphalt shingles at open valleys, trimming upper concealed corners of shingle strips. Maintain uniform width of exposed open valley from highest to lowest point.
  - 1. Set valley edge of asphalt shingles in a 3-inch- wide bed of asphalt roofing cement.
  - 2. Do not nail asphalt shingles to metal open-valley flashings.
- F. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

- G. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
  - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

**END OF SECTION 07 31 13**

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**SECTION 07 52 16 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
2. Roof insulation.

B. Related Requirements:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
2. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

**1.2 DEFINITIONS**

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to Work of this Section.

**1.3 PREINSTALLATION MEETINGS**

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with City, Architect, Resident Engineer, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.

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9. Review roof observation and repair procedures after roofing installation.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
  1. Submit evidence of complying with performance requirements.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For roofing system to include in maintenance manuals.

#### **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
- C. Provide compatible accessory materials approved by roofing manufacturer.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

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**1.9 FIELD CONDITIONS**

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

**1.10 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 20 years from date of Substantial Completion, NDL.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Firestone Building Products.
  - 2. GAF Materials Corporation.
  - 3. Johns Manville.
  - 4. Siplast, Inc.
  - 5. Or approved equal
- B. Source Limitations: Obtain components including fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- B. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

**2.3 ROOFING SHEET MATERIALS**

- A. Roofing Membrane Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

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- B. Granule-Surfaced Roofing Cap Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:

- 1. Granule Color: Gray.

**2.4 BASE FLASHING SHEET MATERIALS**

- A. Backer Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

- B. Granule-Surfaced Flashing Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:

- 1. Granule Color: Gray.

**2.5 AUXILIARY ROOFING MATERIALS**

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

- 1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

- B. Asphalt Primer: ASTM D 41/D 41M.

- C. Cold-Applied Adhesive: Roofing system manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with roofing membrane and base flashings.

- D. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

- E. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

- F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

- G. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

**3.3 INSTALLATION, GENERAL**

- A. Comply with roofing system manufacturer's written instructions.
- B. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

**3.4 ROOFING INSTALLATION, GENERAL**

- A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
  - 1. Install roofing system MBS -2-N -L-, according to roof assembly identification matrix and roof assembly layout illustrations in NRCA's "The NRCA Roofing and Waterproofing Manual" and to Section requirements.
- B. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and as follows:
  - 1. Deck Type: N (nailable).
  - 2. Adhering Method: L (cold-applied adhesive).
  - 3. Number of Glass-Fiber Base-Ply Sheets: One.
  - 4. Number of SBS-Modified Asphalt Sheets: One.

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- 5. Surfacing Type: M (mineral-granule-surfaced cap sheet) .
- C. Start installation of roofing in presence of manufacturer's technical personnel.
- D. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.
  - 1. Backnail roofing sheets to nailer strips according to roofing system manufacturer's written instructions.
- E. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
  - 1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
  - 2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
  - 3. Remove and discard temporary seals before beginning work on adjoining roofing.

### **3.5 BASE-SHEET INSTALLATION**

- A. Install lapped base-sheet course, extending sheet over and terminating beyond cants. Attach base sheet as follows:
  - 1. Mechanically fasten to substrate.
  - 2. Adhere to substrate in a uniform coating of cold-applied adhesive.

### **3.6 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION**

- A. Install modified bituminous roofing sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
  - 1. Adhere to substrate in cold-applied adhesive.
  - 2. Unroll roofing sheets and allow them to relax for minimum time period required by manufacturer.
- B. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
  - 1. Repair tears and voids in laps and lapped seams not completely sealed.
- C. Install roofing sheets so side and end laps shed water.

**3.7 FLASHING AND STRIPPING INSTALLATION**

- A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
  - 1. Backer-Sheet Application: Mechanically fasten backer sheet to walls or parapets. Adhere backer sheet over roofing membrane at cants in cold-applied adhesive.
  - 2. Flashing-Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.
- B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.
- C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
  - 1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.
- D. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

**3.8 PROTECTING AND CLEANING**

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Resident Engineer.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**3.9 ROOFING INSTALLER'S WARRANTY SAMPLE**

- A. WHEREAS \_\_\_\_\_ of \_\_\_\_\_, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
  - 1. Owner: **<Insert name of Owner>**.
  - 2. Address: **<Insert address>**.
  - 3. Building Name/Type: **<Insert information>**.
  - 4. Address: **<Insert address>**.
  - 5. Area of Work: **<Insert information>**.
  - 6. Acceptance Date: \_\_\_\_\_.

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- 7. Warranty Period: **<Insert time>**.
- 8. Expiration Date: \_\_\_\_\_.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

- 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
  - a. lightning;
  - b. peak gust wind speed exceeding **<Insert mph>**;
  - c. fire;
  - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
  - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
  - f. vapor condensation on bottom of roofing; and
  - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
- 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
- 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
- 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
- 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

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- 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
- 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_.

- 1. Authorized Signature: \_\_\_\_\_.
- 2. Name: \_\_\_\_\_.
- 3. Title: \_\_\_\_\_.

**END OF SECTION 07 52 16**

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**SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Formed roof drainage system and concrete splash blocks This includes downspouts, scuppers, and conductor heads.
  - 2. Formed wall flashing and trim.
  - 3.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each product indicated.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.1.1: For sealants, adhesives and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
  - 2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
  - 3. Product Data for Section 5.504.4.3: For architectural paints and coatings, provide documentation including printed statement of VOC content showing compliance with Table 1 of the ARB, Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.
  - 4. Product Data for Section 5.504.4.3.1: Aerosol paints and coatings, provide documentation that products meet the PWMIR Limits for ROC in Section 94522 (a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Section 94522(c)(2 and (d)(2) of CCR Title 17.
- C. Shop Drawings: Show layouts, profiles, shapes, seams, dimensions, and details for fastening, joining, supporting, and anchoring sheet metal flashing and trim.

**1.3 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

- B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 SHEET METALS**

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
  - 1. Alclad Finish: Metallurgically bonded surfacing to both sides.
  - 2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat.
    - a. Color: As selected by Architect from manufacturer's full range.

### **2.3 MISCELLANEOUS MATERIALS**

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
  - 1. Slip Sheet: Rosin-sized paper, minimum 3 lbs./100 sq. ft..
- C. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
  - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
  - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
- D. Elastomeric Sealant: ASTM C 920 and Section 07 92 00 "Joint Sealants," elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat.

- F. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations in "CALgreen Requirements."
- G. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations in "CALgreen Requirements."
- H. Architectural paints and coatings shall comply with VOC limits as defined by local, regional, or state regulations in "CALgreen Requirements."
- I. Aerosol paints and coatings shall meet the Product-weighted MIR Limits for ROC in "CALgreen Requirements."
- J. Concrete Down Spout Splash Blocks: Provide splash blocks at the base of each downspout.

## **2.4 FABRICATION, GENERAL**

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
  - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal, and in thickness not less than that of metal being secured.

## **2.5 ROOF DRAINAGE SHEET METAL FABRICATIONS**

- A. Downspouts: Fabricate round downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
  - 1. Manufactured Hanger Style: To support gutter as indicated on drawings.
  - 2. Fabricate downspouts from the following material:
    - a. Aluminum: 0.024 inch thick, 3" round

- B. Gutters: Fabricate per SMACNA Style F, 4" wide, 3" deep min, with support brackets at 30" o.c., expansion covers as required, and inside straps.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
- D. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- E. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and butyl sealant.
- F. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
- H. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
  - 1. Aluminum: Use aluminum or stainless-steel fasteners.
- I. Seal joints with butyl sealant as required for watertight construction. Comply with recommendations of ASTM C 1193 and Section 07 92 00 "Joint Sealants."

**3.2 ROOF DRAINAGE SYSTEM INSTALLATION**

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Downspouts: Join sections with 1-1/2 inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

**END OF SECTION 07 62 00**

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**SECTION 07 84 13 - PENETRATION FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes through-penetration firestop systems for penetrations through fire-resistance-rated floor, roof, wall and partition assemblies, and smoke barriers, including both empty openings and openings containing penetrating items.

**1.2 INFORMATIONAL SUBMITTALS**

- A. Through-Penetration Firestopping Schedule: Submit, for information only, a Through-Penetration Firestopping Schedule indicating the type of through-penetration firestop system to be installed for each penetration. Indicate each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of testing and inspection agency acceptable to the authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
- B. Submit documentation, including illustrations, from qualified testing and inspecting agency applicable to each through-penetration firestop.
- C. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- D. At Project Closeout, submit a Record Schedule, signed by the Installer, of systems installed, the UL design designations, and the location of each system.

**1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: A firm or individual certified or licensed, by firestop system manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its firestop system materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced on the Drawings. Provide rated systems bearing classification marking of qualified testing and inspecting agency. Classification markings on penetration firestopping correspond to designations listed by UL in its "Fire Resistance Directory," Intertek ETL SEMKO in its "Directory of Listed Building Products," or FM Global in its "Building Materials Approval Guide."

#### **1.4 FIELD CONDITIONS**

- A. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

#### **1.5 COORDINATION**

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

### **PART 2 - PRODUCTS**

#### **2.1 FIRESTOPPING, GENERAL**

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  1. Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
- D. Gypsum Products: The use of gypsum products for through-penetration firestopping is strictly prohibited.

**2.2 PENETRATION FIRESTOPPING**

- A. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- B. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  - 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

**PART 3 - EXECUTION**

**3.1 INSTALLATION AND IDENTIFICATION**

- A. Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Through-penetration firestop system manufacturer's name.
  - 6. Installer's name.

**3.2 CLEANING AND PROTECTION**

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

**END OF SECTION 07 84 13**

**SECTION 07 92 00 - JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes joint sealants.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each joint sealant product indicated.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.1: For Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
  - 2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
  - 3.
- C. Samples: Submit samples for each exposed joint sealant product indicated.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original unopened containers. Store and handle materials in compliance with manufacturer's written instructions.

**PART 2 - PRODUCTS**

**2.1 MATERIALS, GENERAL**

- A. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations in "CALgreen Requirements."
- B. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations in "CALgreen Requirements."
- C. Colors: For fully concealed joints, provide the manufacturer's standard color of sealant which has the best overall performance characteristics for the application shown. For exposed joints, the Architect and Resident Engineer will select colors from the manufacturer's standard colors.

**2.2 JOINT SEALANTS**

- A. Mildew-Resistant Silicone Sealant (use for joints at plumbing fixtures, toilet room countertops and vanities): Complying with ASTM C 920, Type S (single component), Grade NS (non-sag), class 25, Use NT (non-traffic), Substrate uses G, A, and O; and containing a fungicide for mildew resistance; white color.
  - 1. Products: Provide one of the following:
    - a. Dow Corning; 786 Mildew Resistant Silicone Sealant.
    - b. Momentive; Sanitary SCS 1700.
    - c. Pecora Corporation; 898 Silicone Sanitary Sealant.
    - d. Tremco, an RPM Co.; Tremsil 200 Sanitary.
    - e. Or approved equal
  
- B. Latex Sealant: Complying with ASTM C 834, Type OP (opaque sealants):
  - 1. Products: Provide one of the following:
    - a. Pecora Corporation; AC-20 + Silicone.
    - b. DAP Products Inc.; Alex Plus Acrylic Latex Caulk Plus Silicone.
    - c. Tremco, an RPM Co.; Tremflex 834.
    - d. Or approved equal

**2.3 JOINT-SEALANT BACKING**

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
  
- B. Cylindrical Sealant Backings: One of the following preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding backings of flexible plastic foam complying with ASTM C 1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
  - 1. Type C: Closed-cell polyethylene foam material with a surface skin, which is nonabsorbent to liquid water and gas, non-outgassing in unruptured state; one of the following:
    - a. HBR Closed Cell Backer Rod; Nomaco, Inc.
    - b. MasterSeal 920; BASF Master Builders.
    - c. Mile High Foam, Backer Rod Mfg., Inc.
    - d. Or approved equal

## 2.4 MISCELLANEOUS MATERIALS

- A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- B. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and which will not stain nor mar the finish of surfaces adjacent to joints to which it is applied.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and the following requirements:
  - 1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, and surface dirt.
  - 2. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- C. Installation of Sealant Backings: Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- D. Installation of Sealants: Install sealants so they directly contact and fully wet joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, concave shaped 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.

- F. Cleaning: Clean excess sealants or sealant smears adjacent to joints as installation progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

**3.2 JOINT SEALANT SCHEDULE**

- A. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
  - 1. Control and Expansion Joints on Exposed Interior Surfaces of Exterior Walls: Latex sealant.
  - 2. Perimeter Joints of Exterior Openings Where Indicated: Latex sealant.
  - 3. Vertical Control and Expansion Joints in Stone and Tile Surfaces: Latex sealant.
  - 4. Perimeter Joints between Interior Wall Surfaces and Frames of Interior Doors, Windows, and Elevator Entrances: Latex sealant.
  - 5. Joints between Plumbing Fixtures and Adjoining Walls, Floors, and Counters: Mildew resistant silicone sealant.

**END OF SECTION 07 92 00**



**SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes hollow metal doors and frames.
  - 1. The integration of a security system into the hollow metal door and frame work is required. The Contractor shall be responsible for the total and complete coordination of the security system components into the Work.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each product indicated. Include material descriptions, core descriptions, label compliance, sound and fire-resistance ratings, and finishes for each type of door and frame specified.
- B. Shop Drawings: Submit door and frame schedule using same reference designations indicated on Drawings. Include opening size(s), handing of doors, frame throat dimensions, details of each frame type, elevations of door design types, details of construction, location and installation requirements of door hardware and reinforcements, hardware group numbers, details of joints and connections, fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.
  - 1. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for all fire rated door assemblies, all smoke and draft control door assemblies, and all temperature rise rated door assemblies.

**1.4 QUALITY ASSURANCE**

- A. Hollow Metal Door and Frame Standard: Comply with the applicable provisions and recommendations of the following publications by Hollow Metal Manufacturers Association (HMMA) Div. of National Association of Architectural Metal Manufacturers (NAAMM), unless more stringent requirements are indicated in the Contract Documents:
  - 1. HMMA "Hollow Metal Manual."
  - 2. HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames."

- B. **Manufacturer Qualifications:** A firm experienced in manufacturing hollow metal doors and frames similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. **Fire-Rated Door Assemblies:** Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 or UL 10C "Standard for Positive Pressure Fire Tests of Door Assemblies." Fire classification labels at all doors with fire ratings greater than 20 minutes shall indicate the temperature rise developed on the unexposed surface of the door after the first 30 minutes of fire exposure.
  - 1. Provide metal labels permanently fastened on each door which is within the size limitations established by the labeling authority having jurisdiction.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and Project site storage.
- B. Inspect doors and frames, on delivery, for damage. Tool marks, rust, blemishes, and other damage on exposed surfaces will not be acceptable. Remove and replace damaged items as directed by Architect and Resident Engineer. Store doors and frames at building site in a dry location, off the ground, and in such a manner as to prevent deterioration.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. **Manufacturers:** Subject to compliance with requirements, provide doors and frames by one of the following:
  - 1. **Hollow Metal Doors and Frames:**
    - a. Ceco Door Products; an Assa Abloy Group Company.
    - b. Curries Company; an Assa Abloy Group Company.
    - c. Steelcraft; an Allegion PLC Company.
    - d. Or approved equal

### **2.2 MATERIALS**

- A. **Specified Gage Thickness:** All specified gauge thicknesses are manufacturer's standard gauge.
- B. **Cold-Rolled Steel Sheets:** ASTM A 1008/A 1008M, CS (commercial steel), Type B; free of scale, pitting, or surface defects; pickled and oiled. Not less than 16 gauge, (0.053 inch) thick where frames are indicated to be built into exterior walls, hot dip galvanize after fabrication in compliance with ASTM A153/A153M, Class B.

- C. Inserts, Bolts, and Fasteners: Galvanized steel.
  - 1. Expansion Bolts and Shields: FS FF-S-325, Group III, Type 1 or 2.
  - 2. Machine Screws: FS FF-S-92, carbon steel, Type III cross recessed, design I or II recess, style 2C flat head.
- D. Paints and coatings shall comply with VOC content as shown in CALgreen Section 5.504.4.3.

### **2.3 KNOCKDOWN HOLLOW METAL FRAMES**

- A. Provide combination type knockdown hollow metal door frames to be used as both door buck and trim, formed to profiles shown, of minimum 16 gage thick cold-rolled steel.
  - 1. Frames shall be splined, tabbed, and miter fit, knockdown type compatible with adjacent construction conditions.
  - 2. Accurately machine, file, and fit exposed connections with hairline joints.
  - 3. Typical Anchorage: Frames shall be provided with concealed mechanical compression anchors at top of each jamb and each jamb shall be prepared and provided with provision for anchorage at floor line of jamb return face.
  - 4. Miter and anchorage type subject to acceptance of Architect and Resident Engineer.
- B. Mortise, reinforce, drill and tap frames for mortise type hardware. Provide internal reinforcement for surface type hardware which is to be field drilled and tapped per requirements hereinbefore specified for welded frames and including silencers. Locate hardware in frames to match location specified and in accordance with the hardware schedule and templates.

### **2.4 FABRICATION**

- A. Fabricate doors and frames rigid, neat in appearance, and free of defects, warp, wave, and buckle. Accurately form metal to sizes and profiles indicated. Accurately machine, file, and fit exposed connections with hairline joints. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
- B. Exposed Fasteners: Provide countersunk flat heads for exposed screws and bolts, unless otherwise indicated.
- C. Hardware Preparation: Prepare doors and frames to receive hardware, including cutouts, reinforcement, mortising, drilling, and tapping, according to final hardware schedule and templates provided by hardware supplier. Secure reinforcement by spot welding. Comply with applicable requirements of ANSI/BHMA A156.115 and A156.115W specifications for door and frame preparation for hardware. Factory reinforce doors and frames to receive surface-applied hardware. Factory drill and tap for surface-applied hardware, except at pushplates and kickplates provide reinforcing only.

## **2.5 STEEL SHEET FINISHES**

- A. General: Clean, treat and prime surfaces of fabricated hollow metal door and frame work, inside and out, whether exposed or concealed in the construction.
- B. Factory Priming for Field-Painted Finish: Apply shop primer immediately after surface preparation and pretreatment. Apply a sufficient number of coats, baked on, to obtain uniformly smooth exposed surfaces. Touchup surfaces having runs, smears, or bare spots.
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, corrosion-inhibiting, lead- and chromate-free, universal primer complying with ANSI A250.10 acceptance criteria; compatible with substrate and field-applied finish paint system indicated.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General: Install doors and frames according to the referenced standards, the reviewed shop drawings, and manufacturer's written recommendations and installation instructions.
- B. Frames: Install frames where indicated. Extend frame anchorages below fills and finishes. Coordinate the installation of built-in anchors for wall and partition construction as required with other work.
  - 1. Knock-Down Frames: Install knock-down frames in locations shown, in perfect alignment and elevation, plumb, level, straight and true, and free from rack.
  - 2. At fire-rated openings, install frames according to NFPA 80.
- C. Wood Door Installation: Refer to Section 08 14 16 "Flush Wood Doors."
- D. Apply hardware in accordance with hardware manufacturer's instructions and Section 08 71 00 "Door Hardware." Drill and tap for machine screws as required. Do not use self tapping sheet metal screws. Adjust door installation to provide uniform clearance at head and jambs, and to contact stops uniformly. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.
  - 1. Field cut existing hollow metal doors and frames indicated to receive new hardware. Field cutting shall be executed in a workmanlike manner and shall not void the existing door and frame labeling.

### **3.2 ADJUSTING AND CLEANING**

- A. Final Adjustments: Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
  - 1. Finish Painting: Refer to Section 09 91 23 "Interior Painting."
- C. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise defective.
- D. Institute protective measures required throughout the remainder of the construction period to ensure that hollow metal doors and frames will be without damage or deterioration, at time of Substantial Completion.

**END OF SECTION 08 11 13**

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**SECTION 08 14 16 - FLUSH WOOD DOORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes solid core flush wood doors.
  - 1. The integration of a security system into the flush wood door work is required. The Contractor shall be responsible for the total and complete coordination of the security system components into the Work.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each type of door required. Include factory-finishing specifications.
  - 1. Submit laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.
- B. Shop Drawings: Submit shop drawings indicating location, size, thickness, and hand of each door; elevation of each kind of door; construction details not covered in the product data; location and extent of hardware blocking; undercuts, special beveling, and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware of factory machined doors.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate fire label requirements including fire rating time duration, maximum temperature rise requirements, and smoke label requirements.
  - 4. Indicate routing of electrical conduit and dimensions and locations of cutouts in wood doors to accept electric hardware devices.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Certificate of Compliance for Fire Rated Doors: Provide copies of testing agency's Certificate of Compliance for all fire rated door assemblies, all smoke and draft control door assemblies, and all temperature rise rated door assemblies.

**1.4 QUALITY ASSURANCE**

- A. Quality Standard: Comply with the applicable provisions and recommendations of AWI's "Architectural Woodwork Quality Standards Illustrated, 8th Edition, Version 2.0, Section 1300" where standards and specifications conflict the more stringent shall be required.

- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252, and UL 10C "Standard for Positive Pressure Fire Tests of Door Assemblies." Fire classification labels at all doors with fire ratings greater than 20 minutes shall indicate the temperature rise developed on the unexposed surface of the door after the first 30 minutes of fire exposure.
  - 1. Provide metal labels permanently fastened on each door which is within the size limitations established by the labeling authority having jurisdiction.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in heavy duty cardboard cartons or poly bags.
- C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site, do not drag wood doors across one another.

**1.6 FIELD CONDITIONS**

- A. Environmental Limitations: Do not deliver or install doors until wet work , such as masonry, concrete, stone, tile, terrazzo, plastering, wallboard joint treatment, is complete and dried, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period. Do not expose doors to sudden changes in temperature such as forced heat used to dry out the site.

**1.7 WARRANTY**

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship for the life of the original installation of the door. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance to requirements, provide products by one of the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries, Architectural Door Division.



3. Marshfield Door Systems, Inc. [www.marshfielddoors.com](http://www.marshfielddoors.com)
4. VT Industries.
5. Or approved equal

## **2.2 DOOR CONSTRUCTION**

### **A. General:**

1. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain added formaldehyde.

### **B. Doors for Opaque Finish:**

1. Grade: Custom.
2. Face Veneer: Medium-density overlay.
3. Thickness: 1-3/4 inch unless otherwise indicated.
4. Materials:
  - a. Particleboard Core Material: Complying with ANSI A208.1, Grade 1-LD-1 or 1-LD-2.
5. Construction: AWI Section 1300, PC-5 CE. Stiles, rails, and blocking bonded to core then entire unit abrasive planed before veneering. Crossbanding materials shall extend full width of door with grain running horizontally, tapeless spliced without voids or show through (telegraphing), and directly glued to core and blocking. Sand crossbanding before application of face veneer. Face veneer shall extend full height of door with grain running vertically, tapeless spliced without voids or show through (telegraphing), and directly glued to cross band. Glue lines between face veneer, crossbanding, and blocking shall be of a type to comply with the specified warranty using the hot plate process.

### **C. Fire Rated Door Construction:**

1. Construction: AWI Section 1300, FD-5, with particleboard or mineral core as required to provide fire rating indicated, and faced to match non-rated fire doors. Provide required label(s) on each door.
2. Blocking: For mineral-core doors, provide composite blocking, of same thickness as core, approved for use in doors of fire ratings indicated, and as follows:
  - a. 5-1/2 inch wide minimum top-rail blocking consisting of minimum 1/2 inch wide single length mill option hardwood outer band and single length lumber inner band fabricated of same materials as vertical edges.
  - b. Provide either two 4-1/2 inch by 18 inch minimum sized lock blocks on each door stile or a single 10 inch high continuous lock rail located on lockcase body centerlines.

### **D. Wood Beads for Light Openings in Wood Doors: Manufacturer's standard flush designed, solid wood, rectangular shaped, back beveled or quirked, beads matching veneer species of door faces. Include glazing compounds or tapes sized for back bevel or quirk provided. Include finish nails for removable stops sized in accordance with wood door manufacturer's recommendations.**

- E. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include glazing compounds or tapes and concealed metal glazing clips for opening size and fire rating indicated. Include finish nails for removable stops sized as required for fire rating indicated.

## **2.3 FABRICATION**

- A. Fabricate doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated.
  - 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3 unless otherwise indicated to match existing frame hardware preparations. Comply with final hardware schedules, door frame Shop Drawings, AWI Section 1300-G-20, BHMA A156.115-W standards, and hardware templates.
  - 1. Coordinate measurements of hardware mortises in frames to verify dimensions and alignment before factory machining.
  - 2. Locate lock and latchsets in doors to match existing strike locations on existing door frames; locate hinges in doors to match hinge locations on existing door frames.
  - 3. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required. Install light beads with fasteners spaced for opening size and fire rating indicated. Install wood bead moldings with finish nails and countersink without striking bead. Fill countersunk heads with putty matching wood bead color.

## **2.4 SHOP PRIMING**

- A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer/sealer as standard with door manufacturer. Surfaces shall be clean and dry before priming. Apply primer/sealer uniformly without bare spots, runs, or sags.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Hardware: Apply hardware to new doors in accordance with hardware manufacturer's instructions and Section 08 71 00 "Door Hardware." For particleboard core doors drill pilot holes of proper size for installing hinge screws. Adjust hardware items just prior to final inspection. Leave work in complete and proper operating condition.

1. Factory wrapping shall be maintained on new doors during construction period, and all hardware shall be installed by cutting the factory wrapping at the mounting location of the hardware item.
- B. General Door Installation Standards: Install doors in locations indicated to comply with manufacturer's written instructions, referenced quality standard, and as indicated. Where standards conflict the more stringent shall apply.
  1. Install fire-rated doors in corresponding fire-rated frames according to fire label requirements.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; and to contact stops uniformly, do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Field cutting, fitting or trimming, shall be executed in a workmanlike manner. Machine doors for hardware. Seal cut and trimmed surfaces immediately after fitting and machining using clear varnish or sealer.
  1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
  2. Comply with fire label requirements for fire-rated doors.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge, matching clearances specified for factory prefitting, and to contact stops uniformly. Field cutting, fitting or trimming, if required, shall be executed in a workmanlike manner.
  1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
- E. Field-Finished Doors: Refer to the following for finishing requirements:
  1. Section 09 91 23 "Interior Painting."

### **3.2 ADJUSTING AND PROTECTION**

- A. Rehang or replace doors that do not swing or operate freely.
- B. Protection: Protect wood doors to ensure that the wood door work will be without damage or deterioration at the time of Substantial Completion.
  1. Refinish or replace wood doors damaged during installation. Replace any new wood doors that are warped, twisted, demonstrate core show through, are not true in plane, or cannot be refinished to the satisfaction of the Architect and Resident Engineer.

**END OF SECTION 08 14 16**

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**SECTION 08 31 13 - ACCESS DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes access doors and frames.

**1.2 COORDINATION**

- A. Verification: Obtain specific locations and sizes for required access doors from trades requiring access to concealed equipment, and where shown on the drawings, and indicate on schedule specified in "Submittals" Article.

**1.3 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each type of access door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

**1.4 QUALITY ASSURANCE**

- A. Single-Source Responsibility: Obtain access doors of each type for entire project from one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction per test method indicated.
  - 1. Vertical Access Doors: NFPA 252 or UL 10B.
- C. Size and Location Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule.

**PART 2 - PRODUCTS**

**2.1 METALS**

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

**2.2 ACCESS DOORS AND FRAMES**

- A. Flush Access Typical Doors and Trimless Frames for Horizontal Surfaces [(AD##)]: Fabricated from glass fiber reinforced gypsum.
  - 1. Locations: Gypsum board ceiling surfaces.
  - 2. Door: Minimum 1/8 inch thick glass fiber reinforced gypsum, set flush with surrounding gypsum wallboard finish surfaces.
  - 3. Frame: Minimum 1/8 inch thick glass fiber reinforced gypsum, with tapered square edge.
  - 4. Hinges and Latch: None, lay-in manual push up type.
  - 5. Product:
    - a. Acudor Products, Inc.; GFRG Recessed Access Door for Drywall Ceilings.
    - b. Chicago Metallic Ceiling Systems and Specialty Products: Glass Reinforced Gypsum Drywall Ceiling Access Doors.
    - c. Formglas, Inc.: Interior Ceiling Access Panel.
    - d. IntexForms Inc.; Series AP Access Panel.
    - e. Wind-Lock; Stealth Access Panels.
    - f. Or approved equal

**2.3 FABRICATION**

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Steel Access Doors: Fabricate units of continuous welded steel construction. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  - 1. Provide special sized access doors where required or requested.
- C. Frames:
  - 1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame for steel frames.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Comply with manufacturer's instructions for installation of access doors. Coordinate installation with work of other trades.
- B. Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.
- C. Install access doors flush with adjacent finish surfaces or recessed to receive finish material.

- D. Adjust doors and hardware after installation for proper operation.
- E. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

**END OF SECTION 08 31 13**

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## SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes aluminum-framed entrances and storefronts. The aluminum-framed entrance and storefront work includes the following:
1. Aluminum swing entrance doors and framing, including hardware, stripping and thresholds.
  2. Aluminum trim, and similar items.
  3. Painting and coating in conjunction with the above aluminum items.
  4. Internal steel and aluminum reinforcements.
  5. Internal and perimeter sealing, joint fillers, and gasketing systems.
  6. Anchors, shims, fasteners, inserts, expansion devices, accessories, support brackets and attachments.
  7. Glass and glazing.
  8. Security system components may be incorporated into the door and frame openings of all aluminum-framed entrance and storefront work at the City's option. Cooperate with the City's security system contractors if the City chooses to incorporate security system components during the course of the Work.

#### 1.2 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each aluminum-framed entrance and storefront product specified.
- B. Shop Drawings: Submit shop drawings showing scaled elevations, plans, and sections of the aluminum-framed entrance and storefront work. Full scale sections shall be prepared and submitted for details of the assemblies that cannot be shown in the elevations or sections. Include with shop drawings metal thickness of all metal components, glass thicknesses, metal finishes, location and installation requirements of door hardware and reinforcements, and all other pertinent information as necessary or requested by the Architect and Resident Engineer to indicate compliance with the Contract Documents. Details of field connections, anchorage, and their relationship to the work of others shall be clearly indicated for the coordination of the work by other building trades. Details of fastening and sealing methods and product joinery shall be shown to ensure proper performance of the field installation. No work shall be fabricated until shop drawings for that work have been approved by Architect and Resident Engineer for fabrication.
1. Hardware Schedule: Organize schedule into sets based on hardware specified. Include name of item and manufacturer, and complete designation of every item required for each entrance door.
  2. Indicate routing of electrical conduit and dimensions and locations of cutouts in doors and frames to accept electric hardware devices.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Structural Calculations: Submit, for information only, copies of structural calculations indicating complete compliance with the specified performance requirements. Calculations shall be prepared, signed and sealed by a Professional Engineer registered in the state wherein the work is to be erected.
- B. Product Test Reports: Submit certified product test reports based on tests performed by an AAMA Accredited Laboratory clearly describing in written form, and in shop drawing form, compliance of each aluminum-framed entrance and storefront assembly with requirements indicated based on comprehensive testing.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Subcontract the aluminum-framed entrance and storefront work to a firm which is specialized in the erection of entrances and storefronts and who has successfully installed work similar in design and extent to that required for the Project, in not less than two projects of similar scope .
- B. Preinstallation Conference: Conduct conference at Project site. Prior to the start of the aluminum-framed entrance and storefront work, and at the Contractor's direction, meet at the site and review the installation procedures and coordination with other work. Meeting shall include Contractor, City, aluminum-framed entrance and storefront installer, sealant installer, as well as any other subcontractors or material technical service representatives whose work, or products, must be coordinated with the aluminum-framed entrance and storefront work.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging of components shall be so selected to protect the components from damage during shipping and handling.
- B. Storage on Site: Store aluminum-framed entrance and storefront components in a location and in a manner to avoid damage to the components. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of metals.

**1.6 FIELD CONDITIONS**

- A. Field Measurements: Verify dimensions of supporting structure by field measurements before fabrication so that the entrance and storefront work will be accurately designed, fabricated and fitted to the structure. Indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Use Contractor's lines and benchmarks as a basis for measurements.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating entrance and storefront work without field measurements. Coordinate supporting structure construction to ensure actual dimensions correspond to established dimensions.

- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to, power supplies, fire alarm system and detection devices, access control system, security system, building control system.

**1.7 WARRANTY**

- A. Special Warranty: Submit a 2 year written warranty, beginning from date of substantial completion, and executed by the Contractor, manufacturer and the aluminum-framed entrance and storefront installer agreeing to repair or replace components of entrance and storefront systems that develop defects in materials or workmanship within the specified warranty period. Defects include structural failures, sealant failures, deterioration of metals, metal finishes, failure of operating components to function properly, and any other evidence of failure or deterioration of the aluminum-framed entrance and storefront work to meet performance requirements.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturer Qualifications: The drawings and specifications are based on Arcadia AFG451T Series (Off-set glazed, thermal 2"x 4 1/2" for 1" glass) systems. Award the fabrication of aluminum framed entrances and storefront components to a single firm specializing in the fabrication of aluminum framed entrances and storefront components who has successfully produced work similar in design and extent to that required for the project, in not less than two projects of similar scope to the satisfaction of the Architect and Resident Engineer. The fabricator shall have sufficient production capacity, have organized quality control and testing procedures, and published written and illustrated installation manuals, to produce and properly install the aluminum framed entrances and storefront assemblies required without causing delay in progress of the Work. Other manufacturers capable of producing aluminum framed entrances and storefront systems meeting the performance requirements include the following:
  - 1. EFCO Corporation division of Pella.
  - 2. Moduline Division of Oldcastle Building Envelope.
  - 3. TRACO div. of Kawneer Company, Inc.
  - 4. Wausau Window and Window Wall Systems.
  - 5. YKK AP America Inc.
  - 6. Graham Architectural Products Corp.
  - 7. Or approved equal
- B. Source Limitations: Obtain aluminum framed entrances and storefronts from single source from single manufacturer.

**2.2 PERFORMANCE REQUIREMENTS**

- A. General: Provide aluminum-framed entrance and storefront systems meeting or exceeding the following performance requirements:

1. Structural Properties:

- a. Lateral Loads: The aluminum-framed entrance and storefront work, including glass, shall be designed, fabricated and installed to withstand a maximum inward and outward lateral pressure of 5 lbf/sf for sidelights and 20 lbf/sq. ft. for the active door panels.
- b. Seismic Loads: As required by CBC.
- c. Deflection Limitations:
  - 1) Deflections: Base calculations for the following deflections upon the combination of maximum direct lateral pressures, building deflections, and erection tolerances.
    - a) The deflection of any framing member in a direction normal to the plane of the wall when subjected to the full lateral pressures specified above shall not exceed 1/175 of the glass edge length or 3/4 inch whichever is less, except limit deflection of glass to 1/2 inch.
    - b) Glass, sealants and interior finishes shall not be included to contribute to framing member strength, stiffness or lateral stability.
- d. Dead Loads:
  - 1) Maximum full deadload deflections, parallel (in-plane) to wall plane, of framing members shall not reduce glass bite or glass coverage, to less than 75 percent of the design dimension, and shall not reduce edge clearance to less than 25 percent of design dimension or 1/8 inch whichever is greater.
  - 2) Limit deflections of metal members spanning door openings to 1/300. The clearance between the member and an operable door shall be no less than 1/16 inch.
  - 3) Twisting (rotation) of the horizontals due to the weight of the glass shall not exceed 1 degree, measured between ends and center of each span.
- e. Operational (Traffic) Loads: Design and fabricate aluminum-framed entrances to withstand the operating loads which result from heavy traffic conditions using the specified hardware, without measurable permanent deflection. Limit elastic deflections so as to provide the normal degree of rigidity required to avoid glass breakage, air leaks and other objectionable results of excessive flexibility. Provide weatherstripping at stiles, sill and head rails of door leaves, to minimize sound leaks.
  - 1) Accommodate seismic movement as required by local code authorities to maintain exit doors in operable condition in case of seismic event.

B. Building Frame Movement: Design, fabricate and install aluminum-framed entrances and storefronts to withstand building movements including loading deflections, shrinkage, creep and similar movements.

C. Design Modifications:

1. Submit design modifications necessary to meet the performance requirements and field coordination.
2. Variations in details or materials shall not adversely affect the appearance, durability or strength of components.
3. Maintain the general design concept without altering size of members, profiles and alignment.

## **2.3 MATERIALS**

- A. Aluminum: Conform to the requirements published in AA "Aluminum Standards and Data," referenced ASTM standards and the following. All aluminum extrusions shall be manufactured to dimensional tolerances so as to eliminate any edge projection or misalignment at joints. Unless otherwise specified, provide alloy and temper as required to suit performance requirements and finish(es) indicated. Provide concealed extruded bars, rods, shapes and tubes in alloys as recommended by the fabricator to join or reinforce assembly of exposed aluminum components.
1. Alloys:
    - a. Sheet and Plate: Alloy 5005 and ASTM B 209, "Anodizing Quality."
    - b. Extruded Bars, Rods, Shapes, and Tubes: Alloy 6063 and ASTM B 221, "Anodizing Quality."
    - c. Bars, Rods, and Wire: ASTM B 211.
- B. Glass and Glazing Materials: As specified in Section 08 80 00 "Glazing."
- C. Anchors and Fasteners:
1. Material: Carbon steel complying with either ASTM A325 or SAE Grade 5.
  2. Anchor and Fastener Metal Alloy Types, Designations and Standards: Alloys as selected by fabricator to prevent corrosion resistance with the components fastened. Do not use self-drilling, self-tapping type fasteners.
  3. Do not use exposed anchors and fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
  4. Where fasteners are subject to loosening or turn out from thermal and structural movements, lateral loads, or vibration, use self-locking devices.
- D. Weather Stripping:
1. Compressible Weatherstripping: Compressible weatherstripping gaskets fabricated from extruded multi-fingered PVC, silicone or neoprene, replaceable, held in adjustable depth extruded metal strips to be mortised into edge of door panels for minimum exposure, metal finish to match finish of door.
  2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements, replaceable, held in adjustable depth extruded metal strips to be mortised into edge of door panels for minimum exposure.

**2.4 HARDWARE**

- A. General: Provide hardware indicated and as scheduled. Finish exposed parts to match butt or pivot finish, unless otherwise indicated.
- B. Ball-Bearing Butts: See Door Hardware 087100.
- C. Closers, General: See Door Hardware 087100.
- D. Thresholds: See Door Hardware 087100.

**2.5 SEALING MATERIALS**

- A. Concealed Sealing Materials: All sealing materials concealed within the entrances and storefronts shall be silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.
- B. Exposed Sealing Materials: Sealants, exposed at entrance and storefront perimeter joints in contact with adjacent cladding materials are specified in Section 07 92 00 "Joint Sealants."

**2.6 FABRICATION**

- A. General: Fabricate the entrances and storefronts to the designs, shapes, and sizes shown using the materials specified and shown to produce assemblies which meet or exceed the performance requirements. To the greatest extent possible complete fabrication, assembly, finishing, hardware applications and other work before shipment to Project site.
  - 1. Metal Wall Thickness: Provide shapes as shown and as required to suit the performance requirements but with wall thickness of not less than 1/8 inch.
  - 2. Door Stile and Rail Dimensions:
    - a. Bottomrails: Provide minimum 10 inches high one piece bottomrail unless otherwise indicated on the Drawings.
    - b. Stiles and Top Rail Dimensions: Medium stile; 3-1/2 inch nominal width..
    - c. Door Thickness: 1-3/4 inches.
    - d. Preglaze door units to greatest extent possible, in coordination with installation and hardware requirements. Glazing, whether in factory or in field, shall be performed in accordance with Section 08 80 00 "Glazing."
    - e. Fabricate all doors and frames to accommodate the swing direction shown.
  - 3. Provide extruded aluminum entrance door inserts at door frames designed with bosses sized to receive selected door gasket.
- B. Glazing Stops and Gaskets: Provide continuous interior glazing stops with concealed fasteners for all doors and frames. Provide stops with hairline joints at corners. Provide stops with beveled, not square, shouldered profile unless otherwise shown.

- C. Glass Components: Provide holes and cutouts in glass to receive hardware and accessories before tempering glass. Drill, countersink, and chamfer holes using tooling, materials and methods which are selected and applied to prevent spalling of the cut glass surfaces at holes and cutouts. The internal surface of holes and cutouts shall be smooth with minimal roughness from drilling operations. Do not cut, drill, or make other alterations to glass after tempering.
  - 1. Fully temper glass using horizontal (roller-hearth) process and fabricate so, when installed, roll-wave distortion is parallel with bottom edge of door or lite.
  - 2. Heat Soaking: After tempering, expose 100% of all fabricated glass units to European Standard EN14179 heat soaking process to reduce the potential for inclusion related glass breakage.
  - 3. Factory assemble components and factory install hardware to greatest extent possible.
  
- D. Metal Components: Doors and frames shall be cut, reinforced, drilled and tapped in strict accordance with the printed door hardware manufacturer's templates and instructions. Provide solid steel hardware reinforcements, securely fastened to doors and frames where door hardware is to be attached.
  - 1. Security system components may be incorporated into the door and frame openings of all entrance doors and frames. Provide all cutouts required by the City's security system vendor and all prewiring for vendor provided security system devices. Wherever storefront and entrance framing components are to receive wiring, provide unobstructed clear paths free of burrs and sharp objects with pull strings to facilitate wiring.

**2.7 ALUMINUM FINISHES**

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
  
- B. Finish Application:
  - 1. Apply thermosetting acrylic enamel coatings to all exposed surfaces of storefront and entrance components.
  - 2. Apply anodized coatings to all exposed surfaces of storefront and entrance components.
  
- C. Appearance of Finished Work: During production, maintain large size color range samples for use in comparing against production material. Variations in appearance of abutting or adjacent pieces are acceptable if they are within the range of approved samples. Noticeable variations in the same piece are not acceptable.
  
- D. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
  
- E. Thermosetting Acrylic Enamel Coating: Complying with AAC12R1X and the following:

1. Thermosetting acrylic enamel finish coating containing either an acrylic based resin, polyester based resin, or not less than 50 percent of "Kynar 500" or "Hylar 5000" fluorocarbon resin specially formulated for spray application to extrusions and preformed aluminum metal shapes. Pretreatment of aluminum surface and application of the finish shall be performed under specifications issued by the licensed formulator to approved applicator. Remove die markings, scratches, abrasions, dents and other blemishes before applying finish. Coating films shall be uniform and free from flow lines, streaks, blisters, sags or other surface imperfections in the dry-film state on all surfaces.
2. Thickness: Minimum 1.0 mil total dry film thickness (+/- 0.2 mil).
3. Coating Performance Criteria: Acrylic based resin shall meet or exceed AAMA 2603, 50% kynar based resin shall meet or exceed AAMA 2604.
4. Color: One custom color to match Architect and Resident Engineer's paint sample.
5. Manufacturer, Coating System: One of the following:
  - a. PPG Paints; Duracron Thermosetting Acrylic and Polycron Thermosetting Acrylic resin or Acrynar 50% pvdf.
  - b. Valspar, Inc.; Acroflur.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Coordinate entrance and storefront work with the work of other Sections and provide items to be placed during the installation of other work at the proper time to avoid delays in the work.
- B. Place such items, including concealed overhead framing, accurately in relation to the final location of entrance and storefront components.

#### **3.2 EXAMINATION**

- A. Examine the substrates, adjoining construction, and conditions under which the Work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
  1. Before beginning installation of the entrance and storefront work examine all parts of the existing building structural frame indicated to support the entrance and storefront work. Notify Contractor in writing, of any dimensions, or conditions, found which will prevent the proper execution of the entrance and storefront work, including specified tolerances. Use Contractor's offset lines and bench marks as basis of measurements.

#### **3.3 INSTALLATION**

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints.



1. Cut and trim component parts of the entrance and storefront work during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely to protect material and remove all evidence of cutting and trimming. Remove and replace members where cutting and trimming has impaired strength or appearance, as directed by Architect and Resident Engineer.
  2. Set components within the erection tolerances with uniform joints. Place components on shims and fasten to supporting substrates using bolts and similar fasteners. Use stainless steel shims at structural connections only. U shaped shims at structural connections are not permitted. Use aluminum, stainless steel, or high impact polystyrene shims at other connections.
  3. Do not erect components which are warped, deformed, bowed, dented, defaced or otherwise damaged as to impair its strength or appearance. Remove and replace members damaged in the process of erection.
  4. No holes or slots shall be burned, cut into, or field drilled in building framing members without the written acceptance of the structural engineer.
- B. Entrance and Storefront Framing: Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- C. Entrance Doors: Doors shall be securely anchored in place to a straight, plumb and level condition, without distortion. Adjust doors to operate smoothly, without binding, with hardware functioning properly. Weatherstripping contact, and hardware movement, shall be field tested and final adjustment, and lubrication, made for proper operation and performance of doors.
1. Door Hardware: Refer to Section 08 71 00 "Door Hardware."
  2. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
  3. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
- D. Install glazing to comply with requirements of Section 08 80 00 "Glazing," unless otherwise indicated.
- E. Install perimeter sealant to comply with requirements of Section 07 92 00 "Joint Sealants," unless otherwise indicated.
- F. Concealed Sealing Components: Apply sealant and gasket components which are integral to the entrance and storefront systems in strict accordance with the each component manufacturer's printed instructions. Before applying components remove all mortar, dust, dirt, moisture, and other foreign matter which will be deleterious to the intended performance of the component. Mask adjoining exposed surfaces to avoid spilling, dripping, dropping or other unintended contact of the sealing components onto adjacent exposed surfaces.

### **3.4 ERECTION TOLERANCES**

- A. The entrance and storefront systems shall be fabricated and erected to accommodate the dimensional tolerances of the structural frame while providing the following as installed tolerances.

1. Variation from theoretical calculated position as located in plan or elevation in relation to established floors lines, column lines and other fixed elements of the structure, including variations from plumb, level, straight and member size: +/- 1/4 inch max in any 20'-0" run, column-to-column bay, or floor-to-floor height.
2. Alignment: Where surfaces abut in line, and meet at corners, limit offset from true alignment to 1/32 inch.
3. Variation from angle, or plumb, shown: +/- 1/8 inch max in any 10'-0" run or story height, non-cumulative.
4. Variation from slope, or level, shown: +/- 1/8 inch max in any 20'-0" run or column-to-column bay, non-cumulative.

### **3.5 ANCHORAGE**

- A. Anchorage of the entrance and storefront work to the structure shall be in accordance with the accepted shop drawings.

### **3.6 WELDING**

- A. Weld with electrodes and by methods recommended by manufacturer of material being welded, and in accordance with AWS D1.1 for concealed steel members.

### **3.7 REMOVAL OF DEBRIS**

- A. All debris caused by, or incidental to, the erection of the entrance and storefront work shall be removed from the site and disposed of legally.

### **3.8 CLEANING**

- A. Clean metal surfaces promptly after installation, exercising care to avoid damage to factory finished exposed surfaces.
- B. Wash glass on both faces not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer. Remove excess glazing and sealant compounds, dirt, and other substances.
- C. Immediately remove any deleterious material from surfaces of aluminum.

### **3.9 PROTECTION**

- A. Institute protective measures required throughout the remainder of the construction period to ensure that entrance and storefront work will be without damage or deterioration, at time of acceptance.

## **END OF SECTION 08 41 13**

**SECTION 08 53 13 - VINYL WINDOWS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes vinyl-framed windows.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.
- B. Shop Drawings: For vinyl windows.
  - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For manufacturer and Installer.

**1.5 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.
- B. Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

**1.6 WARRANTY**

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection, water leakage, and air infiltration.
    - c. Faulty operation of movable sash and hardware.
    - d. Deterioration of materials and finishes beyond normal weathering.
    - e. Failure of insulating glass.
  - 2. Warranty Period:
    - a. Window: 10 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Source Limitations: Obtain vinyl windows from single source from single manufacturer.

**2.2 WINDOW PERFORMANCE REQUIREMENTS**

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
  - 1. Window Certification: WDMA certified with label attached to each window.

**2.3 VINYL WINDOWS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Milgard, Style Line Series Vinyl window, Horizontal Slider, 6110 Series 1 3/8" nail fit setback, frame 2 7/8", sash 1 3/16" structural class HS-LC25, positive action locking mechanism, nylon rollers, extruded vinyl snap monorail roller track, fin seal polypropylene pile weatherstripping or equal by
  - 2. All Seasons Window & Door Mfg.; All Seasons Commercial Division, Inc.
  - 3. CertainTeed Corporation.
  - 4. Crestline Windows and Doors.
  - 5. Fleetwood Windows & Doors.
  - 6. Graham Architectural Products Corporation.
  - 7. Jeld-Wen, Inc.

8. Kolbe & Kolbe Millwork Co., Inc.
  9. Pella Corporation.
  10. Weather Shield Mfg., Inc.
  11. Or approved equal
- B. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Horizontal sliding.
- C. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
1. Finish: Integral color, white.
  2. Gypsum Board Returns: Provide at interior face of frame.
- D. Insulating-Glass Units: ASTM E 2190.
1. Glass: ASTM C 1036, Type 1, Class 1, q3, Milgard 3/32 SunCoat MAX Dual with air fill, no grid, foam spacer with minimum  $U=0.32$  and minimum  $SHGC=0.25$ ,  $VT=0.5$ , or equal by specified manufacturers.
- E. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
1. Exposed Hardware Color and Finish: As selected by Architect and Resident Engineer from manufacturer's full range.
- G. Horizontal-Sliding Window Hardware:
1. Sill Cap/Track: Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
  2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
  3. Roller Assemblies: Low-friction design.
- H. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

**2.4 INSECT SCREENS**

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
  - 1. Type and Location: Full, outside for sliding sashes.
- B. Glass-Fiber Mesh Fabric: mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.
  - 1. Mesh Color: Manufacturer's standard.

**2.5 FABRICATION**

- A. Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.
- B. Glaze vinyl windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

**3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
  - 1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

**END OF SECTION 08 53 13**

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**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. Gate Hardware.
  - 4. Power supplies for electric hardware.
  - 5. Door position switches.
- B. 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.
  - 5. 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.
    - b) ICC/ANSI A117.1 - 1998 – Specifications for making buildings and facilities usable by physically handicapped people. [omit for CA work – not applicable]
  - 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
    - a) NFPA 80 – 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 D. 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. Point-to-point wiring diagrams.
  - 12. Manufacturer’s technical data and installation instructions for electronic hardware.
  - 13. Date of jobsite visit.
- 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 and Resident Engineer 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:
  - 1. 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, Resident Engineer and Contractor.
    - a) 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 and Resident Engineer 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: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
  8. 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 and Resident Engineer. 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:

1.	Locksets:	Three years
2.	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 year
6.	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.

**1.9 REGULATORY REQUIREMENTS:**

- A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2016 California Building Code, Section 11B-404.2.7.
  - 1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.
- B. Handles, pull, latches, locks, other operable parts:
  - 1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2016 California Building Code Section 11B-309.4.
  - 2. Force required to activate the operable parts: 5.0 pounds maximum, per 2016 California Building Code Section 11B-309.4.
- C. 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 2016 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.
  - 1. 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.
- D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2016 California Building Code Section 11B-404.2.8.
  - 1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.
- E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2016 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
  2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.
- F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2016 California Building Code Section 11B-404.2.3.
1. Exception: In alterations, a projection of 5/8 inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
  2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2016 California Building Code 11B-307.4.
- G. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2016 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2016 California Building Code Section 11B-303.2 & ~.3.
- H. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- I. Pairs of doors with independently-activated hardware both leaves: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2016 California Building Code Section 11B-703.4.2.
- J. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2016 California Building Code, Section 1005.7.1.
1. In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height, per 2016 California Building Code, Section 1005.7.1 at Exception 1.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS:**

A. Manufacturers and their abbreviations used in this schedule:

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 and Resident Engineer 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 and Resident Engineer 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.
  - 2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.
- D. Continuous Hinges:
  - 1. Geared-type aluminum.
    - a) Use wide-throw units where needed for maximum degree of swing, advise architect and Resident Engineer 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 and Resident Engineer approval.

**2.3 LOCKSETS, LATCHSETS, DEADBOLTS:**

- A. Extra Heavy Duty Cylindrical Locks and Latches: as scheduled.
  - 1. Chassis: cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
  - 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, “Rhodes” 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

**B. Standard Duty Cylindrical Locks and Latches:** as scheduled.

1. **Chassis:** cylindrical design, corrosion-resistant plated cold-rolled steel, through-bolted.
2. **Locking Spindle:** stainless steel, interlocking design.
3. **Latch Retractors:** forged steel. **Balance of inner parts:** corrosion-resistant plated steel or stainless steel.
4. **Backset:** 2.75 inches typically, more or less as needed to accommodate frame, door or other hardware.
5. **Lever Trim:** accessible design, independent operation, spring-cage supported, minimum 2.00 inches clearance from lever mid-point to face of door.
6. **Lock Series and Design:** Schlage AL series, “Saturn” design.
7. **Certifications:**
  - a) ANSI A156.2, 1994, Series 4000, Grade 2.
  - b) UL listed for A label and lesser class single doors up to 4 feet x 8 feet.
8. **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. **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.



- 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: hex dogging.
- 2. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
- 3. Fire-Labeled Devices: UL label indicating “Fire Exit Hardware”.
- 4. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.

**2.5 CLOSERS**

**A. Surface Closers: LCN 1450 series**

- 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
- 2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
- 3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal and full complement bearings.
- 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
- 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
- 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
- 7. Pressure Relief Valve (PRV) Technology: not permitted.
- 8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

**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.
- D. Seals: Four-fingered type at head & jambs. Inelastic, rigid back, not subject to stretching. Self-compensating for warp, thermal bow, door settling, and out-of-plumb. Adhesive warranted for life of installation.
- E. 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.
  - 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.
  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 and Resident Engineer.
  4. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
  5. 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.
- F. 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.
- G. 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.

**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.

**2.8 KEYING REQUIREMENTS:**

- A. Key System: Schlage Everest utility-patented keyway, conventional cylinders. Utility patent protection to extend at least until 2014. For estimate use factory GMK charge. Initiate and conduct meetings(s) with Owner and I-R Security & Safety Consultants representatives to determine system keyway(s), 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/Contractor will install permanent cylinders/cores.
- B. Keys
1. New factory registered master key system
  2. Non-I.C. construction keying: furnish inserted type partial key. At substantial completion, remove inserts in Owner's presence; demonstrate consequent non-operability of construction key. Give all removed inserts and all construction keys to Owner, provide accounting for all the pieces.
  3. Furnish 15 construction keys.
  4. Furnish 2 construction insert extractor tool 35-057.
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.

- D. Cylinders: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: furnish 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”.
- F. Bitting List: furnish 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.
- A. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
  - 1. Notify Architect and Resident Engineer of code conflicts before ordering material.
  - 2. Locate latching hardware between 34 inches to 44 inches above the finished floor, per California Building Code, Section 1008.1.9.2 and 1133B.2.5.2.
  - 3. Locate panic hardware between 36 inches to 44 inches above the finished floor.
  - 4. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- B. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop’s action.
- C. 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. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.
  - 3. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.

### 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 and Resident Engineer.
  - 1. 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 and Resident Engineer.
  - 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 and Resident Engineer 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.

### 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.
    - a) 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. Fire-rated doors:

1. 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.
- C. 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 and Resident Engineer.

**3.8 HARDWARE SETS**

HW SET: 01

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2 EA	CONT. HINGE	112XY TWP CON	628	IVE
1 EA	ELEC PANIC HARDWARE	RX-EL-3549A-EO-CON	626	VON

DOOR HARDWARE

**08 71 00 - 13**

**Palm Ave Transitional Housing**

1	EA	ELEC PANIC HARDWARE	RX-EL-3549A-NL-OP-388CON	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 12" O	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES BUMP WMS	689	LCN
1	EA	THRESHOLD	545A (OR AS REQ'D PER SILL DETAIL)	A	ZER
2	EA	WIRE HARNESS (DOOR)	CON- (LENGTH AS REQ'D)		SCH
2	EA	WIRE HARNESS (FRAME)	CON-6W		SCH
2	EA	DOOR CONTACT	7764	628	SCE
1	EA	POWER SUPPLY	PS914 900-2RS 900-BBK		VON

SEALS BY ALUMINUM DOOR/FRAME MANUFACTURER.  
KEY FOB READER AND WIRING BY SECURITY CONTRACTOR.

HW SET: 02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	3549A-EO	626	VON
1	EA	PANIC HARDWARE	3549A-NL-OP-388	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
2	EA	90 DEG OFFSET PULL	8190HD 12" O	630	IVE
2	EA	CONCEALED CLOSER	2030 SERIES BUMP WMS	689	LCN
1	EA	THRESHOLD	545A (OR AS REQ'D PER SILL DETAIL)	A	ZER

SEALS BY ALUMINUM DOOR/FRAME MANUFACTURER.

HW SET: 02A

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	3549A-NL-OP-388	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	90 DEG OFFSET PULL	8190HD 12" O	630	IVE
1	EA	CONCEALED CLOSER	2030 SERIES BUMP WMS	689	LCN
1	EA	THRESHOLD	545A (OR AS REQ'D PER SILL DETAIL)	A	ZER

SEALS BY ALUMINUM DOOR/FRAME MANUFACTURER.

DOOR HARDWARE

**08 71 00 - 14**

HW SET: 03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 04

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50PD RHO	626	SCH
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 05

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 06

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	AX-98-L-BE-F-06	626	VON
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE

**Palm Ave Transitional Housing**

1 EA GASKETING 188SBK PSA BK ZER

HW SET: 07

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1 EA	OH STOP	450S	630	GLY
3 EA	SILENCER	SR64	GRY	IVE

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 08

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	STOREROOM LOCK	ND80PD RHO	626	SCH
1 EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1 EA	GASKETING	188SBK PSA	BK	ZER

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 09

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1 EA	PANIC HARDWARE	AX-98-L-NL-06	626	VON
1 EA	RIM CYLINDER	20-022	626	SCH
1 EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1 EA	DOOR SWEEP	39A	A	ZER
1 EA	THRESHOLD	545A	A	ZER
		(OR AS REQ'D PER SILL DETAIL)		
1 EA	GASKETING	188SBK PSA	BK	ZER



HW SET: 10

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 11

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	GASKETING	188SBK PSA	BK	ZER

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 12

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	BARN DOOR TRACK & HARDWARE	9710 X LENGTH AS REQUIRED	628	HAG
1	EA	DOOR PULL, 1" ROUND	PR 8103EZHD 10" N	630	IVE

HW SET: 13

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	HOTEL KEY CARD LOCK	MATCH EXISTING HOTEL KEY CARD LOCK	626	UNK
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER
1	EA	DOOR GUARD	482	626	IVE

DOOR HARDWARE

08 71 00 - 17

**Palm Ave Transitional Housing**

1 EA VIEWER U698 626 IVE

HW SET: 14

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	PRIVACY LOCK	AL40S SAT	626	SCH
1 EA	FLOOR OR WALL STOP	FS436 OR WS406/407CCV AS REQ'D	626	IVE
3 EA	SILENCER	SR64	GRY	IVE

HW SET: 15

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	STOREROOM LOCK	AL80PD SAT	626	SCH

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 16

EACH TO HAVE:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA	HOTEL KEY CARD LOCK	MATCH EXISTING HOTEL KEY CARD LOCK	626	UNK
1 EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 17

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	HOTEL KEY CARD LOCK	MATCH EXISTING HOTEL KEY CARD LOCK (WITH PRIVACY FUNCTION)	626	UNK
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 18

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PRIVACY LOCK	AL40S SAT	626	SCH

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 19

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HOTEL KEY CARD PANIC TRIM	MATCH EXISTING HOTEL KEY CARD LOCK	626	UNK
1	EA	PANIC HARDWARE	AX-98-EO	626	VON
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	THRESHOLD	545A (OR AS REQ'D PER SILL DETAIL)	A	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER

RE-USE BALANCE OF EXISTING HARDWARE.

HW SET: 20

**Palm Ave Transitional Housing**

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	SET	CONST LATCHING BOLT	FB61P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80PD RHO (7/8" LTC STRIKE)	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	SURFACE CLOSER	1450 SCUSH FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	ASTRAGAL	41AA	AA	ZER
1	EA	GASKETING	188SBK PSA	BK	ZER

HW SET: 21

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	AX-98-L-NL-06	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ FC	689	LCN
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 22

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	HOTEL KEY CARD PANIC TRIM	MATCH EXISTING HOTEL KEY CARD LOCK	626	UNK
1	EA	PANIC HARDWARE	AX-98-EO	630	VON

BALANCE OF HARDWARE BY GATE MANUFACTURER.

HW SET: 23

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-EL-AX-98-L-NL-06-CON	626	VON
1	EA	RIM CYLINDER	20-022	626	SCH
1	EA	WIRE HARNESS (DOOR)	CON- (LENGTH AS REQ'D)		SCH
1	EA	WIRE HARNESS (FRAME)	CON-6W		SCH
1	EA	POWER SUPPLY	PS914 900-2RS 900-BBK		VON

BALANCE OF HARDWARE BY GATE MANUFACTURER.  
KEY FOB READER, DOOR CONTACT AND WIRING BY SECURITY CONTRACTOR.

HW SET: 24

EACH TO HAVE:

EXISTING HARDWARE TO REMAIN.

END OF SECTION

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**SECTION 08 80 00 - GLAZING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Doors.
  - 2. Storefront framing.
- B. Refer to Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for requirements applicable to single subcontract responsibility for glazing.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each glass product and glazing material indicated.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.1: For sealants, adhesives and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
  - 2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Manufacturer Certificates: Submit a letter from glass manufacturer certifying that he has reviewed the glazing details proposed for the Project, including the use of gaskets and sealants, and that each product to be furnished is recommended for the application shown.
- B. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
  - 1. Material Certificates: Submit glass treatment certificates signed by manufacturer of the heat-soaked glass products certifying that products furnished comply with requirements.
- C. Warranties: Submit special warranties specified in this Section.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: Submit maintenance data for each applied glass film to be installed or applied, including recommendations and instructions for cleaning, maintenance, removal, and replacement of same.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- C. Safety Glass: Comply with the applicable requirements of the laws, codes, ordinances and regulations of Federal and Municipal authorities having jurisdiction; wherever requirements conflict, the more stringent shall be required. Obtain approvals from all such authorities. As a minimum, provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission "Safety Standard for Architectural Glazing Materials," as published in the Code of Federal Regulations) and ANSI Z97.1.
  - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Locate permanent markings in one corner, and in the same location, of each glass lite in accordance with the requirements of the SGCC labeling guidelines. Markings shall have a nominal size of no greater than 1-inch in diameter, and be located with glass edge clearances, at the corner, by not more than 3/4-inch up and 3/4-inch over.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials.



**PART 2 - PRODUCTS**

**2.1 PRODUCTS AND MANUFACTURERS**

- A. Refer to Finish Schedule on the Drawings for the extent of glass types and locations. Confirm the levels of heat treatment required for each glass type scheduled as contained in Articles "Performance Requirements" and "Quality Assurance."

**2.2 PERFORMANCE REQUIREMENTS**

- A. General: Provide and install glazing systems capable of withstanding impact loads without failure of any kind, including loss or breakage of glass, failure of seal or gaskets, exudation of glazing sealants, and excessive deterioration of glazing materials.
- B. Glass Design: Glass thicknesses and heat treatments indicated are minimum requirements. Glazing details shown are for convenience of detailing only and are to be confirmed by the Contractor relative to cited standards and final framing details.
  - 1. At wood framed, provide glass thickness such that the center of glass deflection at a full lateral pressure of 5 psf in a direction normal to the plane of the wall shall not exceed 1/2 inch . Confirm glass thicknesses and heat treatments, as required to meet the performance requirements.
  - 2. Confirm glass thicknesses and heat treatments, as required to meet the performance and testing requirements specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts"

**2.3 PRIMARY FLOAT GLASS**

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); Class 1, ultra clear low iron with visible light transmission of not less than 91 percent and as indicated in Door and Window Types Schedule on the Drawings.
  - 1. Ultra Clear, Low Iron Glass: Where indicated in the schedules clear, low iron glass shall mean low iron products as follows:
    - a. AGC Asahi Glass Co. Ltd.; Krystal Klear.
    - b. Guardian Industries Corp.; UltraWhite.
    - c. Pilkington North America; Optiwhite.
    - d. Vitro S.A.B. de C.V.; Starphire.
    - e. Or approved equal

**2.4 HEAT-TREATED FLOAT GLASS**

- A. General: Heat-treat glass where required to meet safety glazing requirements.

- B. **Sizes and Cutting:** Prior to heat treatment, cut glass to required sizes as determined by accurate measurement of openings to be glazed, making allowance for required edge clearances. Cut and process edges in accordance with glass manufacturer's recommendations. Do not cut or treat edges in the field. Make all internal cuts for hardware, access, or glass-mounted trim or accessories before heat treating.
- C. **Fully Tempered Glass:** Provide glass complying with ASTM C 1048, Kind FT, and meeting the requirements of ANSI Z97.1. Surface compression shall be equal to or greater than 10,000 psi . After tempering, heat-soak 100 percent of all fabricated glass units to European Union Standard EN14179 to reduce the potential for inclusion related glass breakage. Statistical heat soaking shall not be permitted.

## **2.5 FIRE-RATED GLAZING PRODUCTS**

- A. **Laminated Ceramic Glazing Material:** Two lites of clear ceramic glazing material laminated together to produce a laminated lite of minimum 5/16 inch nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. ; and as follows:
  - 1. **Fire-Protection Rating:** As indicated for the assembly in which the glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Polished on both surfaces, transparent.
  - 3. **Product:** Provide one of the following:
    - a. "FireLite Plus"; Nippon Electric Glass Co., Ltd. and distributed by Technical Glass Products.
    - b. Pyran Platinum L; SaftiFirst div. of O'Keeffe's, Inc.
    - c. Keralite FR-L; Vetrotech.
    - d. Or approved equal

## **2.6 GLAZING SEALANTS**

- A. **Gasket, Blocking, and Spacer Wet Glazing Materials:** Silicone, compatible with and adherent to each material it will be in contact with, as recommended by the manufacturer to fulfill performance requirements.
  - 1. **VOC Content:** For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations in "CALgreen Requirements."
- C. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations in "CALgreen Requirements."
- D. **Butt Glazing Sealants:** Refer to Section 07 92 00 "Joint Sealants" for butt glazing sealant.
- E. **Glazing Sealant for Fire-Resistive Glazing Products:** Identical to product used in test assembly to obtain fire-protection rating.

1. VOC Content: Provide glazing sealants and sealant primers having not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.7 GLAZING GASKETS**

- A. Dense Compression Gaskets: Continuous extruded EPDM with cross-sectional profile, physical properties, and tolerances as recommended by the glass manufacturer, and as required to comply with the performance requirements specified and shown, all in compliance with the applicable provisions of ASTM C 864, Option II.

## **2.8 MISCELLANEOUS GLAZING MATERIALS**

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces and wet glazing materials contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations in "CALgreen Requirements."
- D. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations in "CALgreen Requirements."
- E. Setting Blocks: EPDM complying with ASTM C 864 (Option II), blocks, 85 +/- 5 Shore A durometer hardness, 1/16 inch less than the channel width, and length based on the face area the glass unit to be supported in accordance with GANA standards and glass manufacturer recommendations but not less than 4 inches .
- F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

## **2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS**

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
  1. Edge and Surface Conditions: Comply with the recommendations of AAMA "Structural Properties of Glass" for "clean-cut" edges, except comply with manufacturer's recommendations when they are at variance therewith.
- B. Cutting: Do not nip glass edges. Edges may be wheel cut or sawed and seamed at manufacturer's option. For glass to be cut at site, provide glass 2 inches larger than required in both dimensions, so as to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat-treated glass.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine glass framing, with glazier and glass framing erector present, for compliance with the following:
  - 1. Compliance with the specified manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Minimum required face or edge clearances.
  - 3. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Clean glazing stops, glazing channels, and rabbets which will be in contact with the glazing materials immediately before glazing. Remove coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately before application of primers. Wipe metal surfaces with IPA (isopropyl alcohol).
  - 1. Prime surfaces to receive glazing compounds. When priming, comply with wet glazing manufacturer's recommendations.
- B. Inspect each glass unit immediately before installation. Do not install any units which are improperly sized or have damaged edges, scratches or abrasion, or other evidence of damage. Remove labels from glass immediately after installation.

### **3.3 GLAZING, GENERAL**

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
  - 1. All glass units shall be installed in accordance with the glass manufacturer's recommendations.
- B. Glazing channel dimensions as indicated on Drawings. Provide necessary bite on glass, minimum edge and face clearances, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to surfaces indicated to receive glazing materials.

- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless more stringent requirements are recommended by glass manufacturer.
  - 1. For Glass Units Less Than 72 Inches : Locate setting blocks at sill one-quarter of the width in from each end of the glass unless otherwise recommended by the glass manufacturer.
  - 2. For Glass Units 72 Inches or Greater: Locate setting blocks at sill one-eighth of the width in from each end of the glass, but not less than 6 inches , unless otherwise recommended by the glass manufacturer.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Set glass lites with uniform pattern, draw, bow, and similar characteristics, producing the greatest possible degree of uniformity in appearance on the entire wall elevation.
  - 1. Set glass units with void between edge of units and glazing channel.
- H. Where wedge-shaped gaskets are driven into one side of channel to pressurize gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- I. Miter cut gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away.

### **3.4 PROTECTION AND CLEANING**

- A. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way and from any source, including natural causes, accidents, and vandalism.
- B. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass and film manufacturer.

**END OF SECTION 08 80 00**

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**SECTION 09 24 00 - CEMENT PLASTERING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Exterior vertical plasterwork (stucco).

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood framing and furring included in portland cement plaster assemblies.
2. Section 07 21 00 "Thermal Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.

**1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

- B. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified 12 by 12 inches, and prepared on rigid backing.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

**1.5 FIELD CONDITIONS**

- A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 deg F.

3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.
4. Protect contiguous work from damage by plastering operations. Do not allow runoff water from plaster to drain over glass or metal surfaces. Cover all window and door frames, sills, ledges, and pavement before starting plastering operations.

## **PART 2 - PRODUCTS**

### **2.1 METAL LATH**

- A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/ A 653M, G60, hot-dip galvanized-zinc coating.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Alabama Metal Industries Company; a Gibraltar Industries company.
    - b. CEMCO; California Expanded Metal Products Co.
    - c. ClarkDietrich Building Systems.
    - d. Marino\WARE.
    - e. Phillips Manufacturing Co.
    - f. Or approved equal
  2. Diamond-Mesh Lath: Flat, 3.4 lb/sq. yd..
- B. Paper Backing: FS UU-B-790a, Type I, Grade D, Style 2 vapor-permeable paper.
  1. Provide paper-backed lath at exterior locations.

### **2.2 ACCESSORIES**

- A. General: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
- B. Metal Accessories:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Alabama Metal Industries Company; a Gibraltar Industries company.
    - b. CEMCO; California Expanded Metal Products Co.
    - c. ClarkDietrich Building Systems.
    - d. Marino\WARE.
    - e. Phillips Manufacturing Co.
    - f. Or approved equal
  2. Foundation Weep Scream: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 zinc coating.



3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
4. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60, hot-dip galvanized-zinc coating.
5. Cornerbeads: Fabricated from zinc.
  - a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
  - b. Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.
6. Casing Beads: Fabricated from zinc; square-edged style; with expanded flanges.
7. Control Joints: Fabricated from zinc; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
8. Expansion Joints: Fabricated from zinc; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.

### **2.3 MISCELLANEOUS MATERIALS**

- A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
- B. Bonding Compound: ASTM C 932.
- C. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
- D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

### **2.4 PLASTER MATERIALS**

- A. Portland Cement: ASTM C 150/C 150M, Type I.
  1. Color for Finish Coats: Gray.
- B. Colorants for Job-Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color to match Architect and Resident Engineer's sample.
- C. Sand Aggregate: ASTM C 897.

### **2.5 PLASTER MIXES**

- A. General: Comply with ASTM C 926 for applications indicated.
- B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
  1. Portland Cement Mixes:

- a. Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
  - b. Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.
- C. Base-Coat Mixes for Use over Unit Masonry: Single base (scratch) coat for two-coat plasterwork on low-absorption plaster bases as follows:
- 1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 0 to 3/4 part lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
- D. Job-Mixed Finish-Coat Mixes:
- 1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that surfaces are protected from direct sun, drying winds (real or artificial) and that substrates conform to ASTM C 926.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.
- B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

#### **3.3 INSTALLING METAL LATH**

- A. Metal Lath: Install according to ASTM C 1063.
  - 1. Partition Framing and Vertical Furring: Install flat-diamond-mesh lath.

#### **3.4 INSTALLING ACCESSORIES**

- A. Install according to ASTM C 1063 and at locations indicated on Drawings.
- B. Reinforcement for External (Outside) Corners:

1. Install lath-type, external-corner reinforcement cornerbead at exterior locations.
  2. Install cornerbead at interior locations.
- C. Control Joints: Locate as approved by Architect and Resident Engineer for visual effect and as follows:
1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
    - a. Vertical Surfaces: 144 sq. ft..
    - b. Horizontal and Other Nonvertical Surfaces: 100 sq. ft..
  2. At distances between control joints of not greater than 18 feet o.c.
  3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
  4. Where control joints occur in surface of construction directly behind plaster.
  5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

### **3.5 PLASTER APPLICATION**

- A. General: Comply with ASTM C 926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
  2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
  3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.
- B. Bonding Compound: Apply on unit masonry substrates for direct application of plaster.
- C. Walls; Base-Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three-coat plasterwork with 3/4-inch total thickness, as follows:
1. Portland cement mixes.
- D. Walls; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having 3/8-inch thickness on masonry, as follows:
1. Portland cement mix.
- E. Plaster Finish Coats: Apply to provide finish to match existing.

### **3.6 PLASTER REPAIRS**

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

**3.7 CLEANING AND PROTECTION**

- A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

**END OF SECTION 09 24 00**

**SECTION 09 29 00 - GYPSUM BOARD**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Tile backing panels.

**1.2 ACTION SUBMITTALS**

- A. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.1.1: For sealants, adhesives and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
  - 2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.

**1.3 QUALITY ASSURANCE**

- A. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- B. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.
- C. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

**1.5 FIELD CONDITIONS**

- A. Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory."

**2.2 MATERIALS, GENERAL**

- A. General: For fire rated assemblies, provide materials, including accessories and fasteners produced by one manufacturer, or, when products of more than one manufacturer are used in a rated system, they shall be acceptable to authorities having jurisdiction.

**2.3 INTERIOR GYPSUM BOARD**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. National Gypsum Company.
  - 5. USG Corporation.
  - 6. Or approved equal
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- C. Gypsum Board: ASTM C 1396/C 1396M.
  - 1. Type X:
    - a. Thickness: 5/8 inch .
    - b. Long Edges: Tapered.
    - c. Location: Vertical surfaces, where required for fire-resistance-rated assembly, and where indicated on Drawings.

- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M, manufactured to have more sag-resistance than regular-type gypsum board.
  - 1. Thickness: 5/8 inch .
  - 2. Long Edges: Tapered.
  - 3. Location: Interior ceiling surfaces.
  
- E. Moisture and Mold Resistant Board: ASTM C 1396/C 1396M; with moisture- and mold-resistant core and facing surfaces.
  - 1. Core: 5/8 inch.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
  - 4. Location: Interior ceiling surfaces.

**2.4 TILE BACKING PANELS**

- A. Tile Backing Panels:
  - 1. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with core type and in thickness indicated. Available products include:
    - a. G-P Gypsum Corp.; Dens-Shield Tile Backer.
    - b. National Gypsum Company; GOLD BOND Brand E2XP Tile Backer.
    - c. USG; Securock Glass Mat Sheathing.
    - d. Or approved equal
  
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

**2.5 TRIM ACCESSORIES**

- A. Interior Steel Trim Accessories: ASTM C 1047; formed metal sheet steel zinc coated by hot-dipped process. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047.
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead with both face and back flanges to receive joint compound; use at exposed panel edges.
  - 3. U-Bead with face and back flanges; face flange formed to be left without application of joint compound: Use where indicated.
  - 4. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot, with removable strip covering slot opening. Use where indicated.
  
- B. Aluminum Trim Accessories: Extruded aluminum trim with 1/4 inch diameter holes in fins for attachment to gypsum board or studs; longest lengths available in profiles indicated; primed for finish painting; sized for scheduled gypsum board thickness shown.

**2.6 JOINT TREATMENT MATERIALS**

- A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of the products and joint treatment materials for each application indicated.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, flanges of trim accessories, and fasteners, use setting-type taping compound.
  - 3. Second Coat: For filling over tape, beads and fasteners. Use setting-type, sandable topping compound.
  - 4. Third Coat: For finishing over tape, beads and fasteners. Use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
  - 1. Moisture/Mold-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

**2.7 AUXILIARY MATERIALS**

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. One of the following:
  - 1. SHEETROCK Acoustical Sealant; U.S. Gypsum.
  - 2. AC-20 FTR; Pecora.
  - 3. Or approved equal
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  - 2. Product: Subject to compliance with requirements, provide one of the following:



- a. Roxul AFB; Roxul Inc.
  - b. Rockwool Acoustic Slabs; Rockwool Ltd.
  - c. SAFB Blankets; Thermafiber LLC.
  - d. Or approved equal
- D. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations as shown in CALgreen Section 5.504.4.1.
- E. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations as shown in CALgreen Section 5.504.4.2.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates to which gypsum board assemblies attach or abut, installed door frames and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### **3.2 APPLYING AND FINISHING PANELS**

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840, GA-216, and the gypsum board manufacturer's recommendations, where standards conflict, the more stringent shall apply. Install specialty gypsum board as specified below except where manufacturer's instructions conflict; follow manufacturer's instructions for specialty performance board to maintain warranty coverage.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Single-Layer Application:
- 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
  - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints or avoid them entirely.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
    - b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

- E. Tile Backing Panels:
  - 1. Glass-Mat, Water-Resistant Backing Panel: Install with 1/4 inch gap where panels abut other construction or penetrations.
- F. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- G. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions.
- H. Attach gypsum panels to framing provided at openings and cutouts.
- I. Cover both faces of stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Fit gypsum panels around ducts, pipes, and conduits.
  - 2. Where partitions intersect open exterior and interior wall kickers, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by the wall kickers and other structural members; allow 1/4 to 3/8 inch wide joints to install sealant.
  - 3. Where chase walls are shown, provide bracing between parallel rows of studs. Unless otherwise shown, provide gypsum board braces no less than 1/2 inch thick by 12 inches wide and cut to width of chase. Locate at quarter points in wall height between each pair of parallel studs. Fasten with not less than 3 screws at each stud.
- J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4 to 1/2 inch wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- L. Cut openings in gypsum board for electrical outlets, piping and other penetrations. Maintain close tolerances so that edges will be covered by plates and escutcheons. Cut both face and back paper. Do not install electrical outlets back to back on opposing sides of partitions.
- M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
  - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
  - 2. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
  - 3. Install fasteners not less than 3/8 inch from ends or edges of gypsum board sheets, spacing fasteners opposite each other on adjacent ends or edges.

4. Begin fastening from center of gypsum board and proceed toward edges and corners.
5. Apply pressure on surface of gypsum board adjacent to fasteners being driven to ensure that gypsum board will be secured tightly to supporting members.
  - a. Drive fastener with shank perpendicular to face of board.
  - b. Drive screws with a power screwdriver as recommended by gypsum board manufacturer. Set heads of screws slightly below surface of paper without cutting paper.

### **3.3 INSTALLING TRIM ACCESSORIES**

- A. General: Fasten trim accessories according to manufacturer's written instructions for type, length, and spacing of fasteners.
- B. Install corner beads at external corners.
- C. Install interior trim accessories where edge of gypsum panels would otherwise be exposed or semiexposed. Provide interior trim accessories with face flange formed to receive joint compound.
- D. Install aluminum trim accessories where indicated.
- E. Install control joints in locations indicated and where directed by the Architect and Resident Engineer for visual effect, or if not indicated or directed by the Architect and Resident Engineer, provide control joints in accordance with ASTM C 840 which is as follows:
  1. Where a partition, wall or ceiling traverses a construction joint (expansion, seismic, or building control element) in the base building structure.
  2. Where a wall or a partition runs in an uninterrupted straight plane exceeding 30 linear feet.
  3. Control joints in interior ceilings with perimeter relief shall be installed so that linear dimensions between control joints do not exceed 50 feet and total area between control joints does not exceed 2500 square feet.
  4. Control joints in interior ceilings without perimeter relief shall be installed so that linear dimensions between control joints do not exceed 30 linear feet and total area between control joints does not exceed 900 square feet.
  5. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

### **3.4 FINISHING GYPSUM BOARD ASSEMBLIES**

- A. General: Apply joint treatment at gypsum board joints, flanges of interior trim and aluminum trim accessories, interior angles, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated. Produce surfaces free of tool marks and ridges ready for decoration of type indicated. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Glass-Mat, Water-Resistant Backing Panels: Do not use paper tape and joint compound. Finish according to manufacturer's written instructions.
- E. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
  - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
  - 3. Level 3: Typically not used.
  - 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
  - 5. Add texture to gypsum board walls and ceilings to match existing textured finishes.

**3.5 CLEANING AND PROTECTION**

- A. Clean floors of all gypsum board debris and leave broom clean. Excess material, scaffolding, tools and other equipment are to be removed upon completion of the Work.
- B. Provide final protection and maintain conditions that ensure gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

**END OF SECTION 09 29 00**

**SECTION 09 30 00 - TILING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes porcelain tile.

**1.2 PERFORMANCE REQUIREMENTS**

- A. General: Provide floor tiles complying with the following standard and performance requirements.
- B. Dynamic Coefficient of Friction (DCOF): For tile installed on walkway surfaces, provide products with the following value as determined by testing identical products by the DCOF AcuTest Method per ANSI A 137.1, 2012 Edition.
  - 1. Walkway Surfaces: Minimum 0.42.

**1.3 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each product indicated.
- B. Shop Drawings: Submit shop drawings showing the extent of each type of movement joint. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples: Submit samples showing full range of color and texture variations expected.
  - 1. Full size units of each type, composition, color, and finish of tile.
  - 2. Assembled samples with grouted joints for each color grout and for each type, composition, color, and finish of tile.
  - 3. Thresholds in 6-inch lengths, each type.
  - 4. Metal edge strip trim in 6-inch lengths, each type.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements specified for slip resistance.
- B. Maintenance Instructions: Submit maintenance instructions for each type of product specified.
- C. Master Grade Certificates: Submit master grade certificates for each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

- D. Product Certificates: Submit manufacturers certifications for each type of grout and bonding material being provided are suitable for the intended use and meet or exceed the referenced standards and the requirements of this specification.

**1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

**1.6 QUALITY ASSURANCE**

- A. Installer: Engage an installer, with successful commercial tile installations similar in material, design, and scope to that indicated.
- B. Source Limitations for Tile: Obtain tile from one source or producer, and from same production run and of consistent quality in appearance and physical properties for each contiguous area.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

**1.8 FIELD CONDITIONS**

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
- B. Maintain temperatures within range recommended by the mortar and grout manufacturer, but not less than 50 deg F or more than 90 deg F, in spaces during tile setting. After installation maintain temperatures within range recommended by the mortar and grout manufacturer.
- C. Close spaces to traffic during tile flooring installation.
- D. Close spaces to traffic for 72 hours after tile flooring installation.
- E. Shade all tile, materials and the work area from direct sunlight during the installation as needed to prevent rapid evaporation caused by excessive heat or wind.

**PART 2 - PRODUCTS**

**2.1 TILE PRODUCTS, GENERAL (TL)**

- A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 "Specifications for Ceramic Tile, " and ANSI A137.2, "Specifications for Glass Tile," for types, compositions, and other characteristics indicated.
  - 1. Products and Manufacturers: Provide Daltile glazed porcelain tile Colour Scheme, 12"x12" floor tile and 6" x 12" cove base tile, color to be selected by Architect and Resident Engineer from Group 1 color range with minimum of 17 color options or equal by:
    - 2. Interceramic.
    - 3. Crossville.
    - 4. Arizona Tile.
    - 5. Or approved equal.

**2.2 ACCESSORY MATERIALS**

- A. Thresholds: Fabricate to provide transition between adjacent floor finishes. Bevel edges at 1:2 slope, limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
  - 1. Thresholds: Reuse existing or match existing stone thresholds.
- B. Waterproofing for Toilet Room Tile Installations:
  - 1. Fabric-Reinforced and Unreinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)(ASTM D 3960), and fabric reinforcement which are compatible with mortar bed specified and complying with ANSI A118.10; one of the following:
    - a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.
    - b. LATICRETE International Inc.; Laticrete 9235 Waterproof Membrane.
    - c. MAPEI Corporation; Mapelastix AquaDefense. Ardex; Ardex 8+9.
    - e. Or approved equal.

**2.3 SETTING AND GROUTING MATERIALS**

- A. Manufacturers:
  - 1. Custom Building Products.
  - 2. LATICRETE International Inc.
  - 3. MAPEI Corporation.
  - 4. ARDEX.
  - 5. Or approved equal.

- B. Source Limitations: For each tile installation, obtain compatible formulations of setting and grouting materials containing latex or latex additives from a single manufacturer.
- C. Polymer-Modified Tile Grout (For Typical Applications): ANSI A118.7.
  - 1. Polymer Type: Dry, redispersible latex/polymer powder form, prepackaged with other dry ingredients or a liquid latex admixture.
  - 2. Colors: As selected by Architect and Resident Engineer from manufacturers standards to match tile being grouted.

**2.4 MISCELLANEOUS MATERIALS**

- A. Joint Sealants:
  - 1. Typical Surfaces: 'Mildew-Resistant Silicone Sealant', as specified in Section 07 92 00, Joint Sealants.
  - 2. Floor Joints: 'Two-Part Polyurethane Sealant for Paving Applications', as specified in Division 07 Section "Joint Sealants."
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

**2.5 MIXING MORTARS AND GROUT**

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions. Add materials and liquid latex additives in accurate proportions. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

**PART 3 - EXECUTION**

**3.1 PREINSTALLATION MEETING**

- A. Prior to the installation of tile, and at the Contractor's direction, meet at the project site to review the material selections, substrate preparations, installation procedures, coordination with other trades, special details and conditions, standard of workmanship, and other pertinent topics related to the Work. The meeting shall include the City, Architect, Resident Engineer, the Contractor, tile installer, tile and setting material manufacturer's representatives, and representatives of other trades or subcontractors affected by the installation.

**3.2 EXAMINATION**

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present.



1. Verify that substrates for setting tile are sound and free of voids, bugholes, rock pockets, honeycombs, and protrusions; and which are dry; clean; free of oil, waxy films, and curing compounds. Grind or scarify concrete substrates to remove existing floor adhesive and mortar residues (if any), laitance, films, sealing and curing compounds if they are determined to be present on the substrate.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
3. Verify that joints and cracks in the existing floor substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect and Resident Engineer.
4. Do not commence installation of flooring materials until floor substrate is within the following tolerances in all directions. If substrate is not within tolerance, level the substrate using a method and a product(s) that is compatible with and acceptable to the setting materials manufacturer.
  - a. Subfloor Surfaces to Receive Thinset and Medium Set Setting Beds: +/- 1/8 inch in 10 feet No valleys or ridges greater than 1/8 inch Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.3 PREPARATION**

- A. Remove paint, coatings, including curing compounds and other substances that are incompatible with tile-setting materials.
- B. Blending: Color blend tiles at Project site before installing.
  1. Furnish the same lots, batches, etc. within the same contiguous areas of the site (i.e., corridors on the same floors, common rooms which adjoin each other, etc.).

### **3.4 INSTALLATION, GENERAL**

- A. Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" and the TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation," that apply to types of setting and grouting materials and to methods indicated.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area beginning at thresholds. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

- E. Finished Surfaces: Unless otherwise accepted in the sample installation(s), if any, finished surfaces shall present a flat, even appearance, free from waver, projections, and depressions.
- F. Movement (Contraction, Control, Expansion, and Isolation Joints) Joints: Locate sealant filled movement joints where recommended by the manufacturer of mortar and grout materials but not less than the requirements of TCNA EJ171 which follows, and as accepted by the Architect and Resident Engineer. Form movement joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles. Where movement joints are to be butted, the ends shall touch and align.
  - 1. Spacing Guidelines:
    - a. 20 to 25 feet in each direction where interior tile work is not exposed to direct sunlight or moisture.
    - b. 8 to 12 feet in each direction where interior tile work is exposed to direct sunlight and moisture.
    - c. Where tilework abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, and where changes occur in backing materials, but not at drain strainers.
    - d. In the joint between tiles making up the inside corner of planes.
    - e. All contraction, control, expansion, isolation, seismic and cold joints in the horizontal structure and vertical surfaces shall continue through the tile surfaces, but not through membranes.
    - f. Vertical and Horizontal Joints Widths: Widths for quarry tile and paver tile shall be the same as the grout joint but not less than 1/4 inch or the width of the contraction, control, expansion, seismic, isolation joint whichever is greater; widths for ceramic mosaic tile and glazed wall tile shall not be less than 1/8 inch or the width of the control, expansion, seismic, joint whichever is greater.
    - g. Keep movement joints free from dirt, debris, grout, mortar, and setting bed materials. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

### **3.5 WATERPROOFING INSTALLATION**

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
  - 1. Do not install tile over waterproofing until waterproofing has cured, and at each horizontal installation, has been tested for water tightness. Test waterproofing membrane for watertightness by damming the floor drain, and creating a dam at the perimeter of the waterproofed basin followed by filling the basin with water, marking the height, and verifying the same height after 48 hours. Repair leaks before continuing with the installation of subsequent tile.

### **3.6 FLOOR TILE INSTALLATION**

- A. Thinset Tile over Waterproof Membrane (Toilet Rooms): Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for setting bed methods, installation methods related to types of subfloor construction, and grout installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply.
1. Mortar: Latex-Portland Cement Mortar: ANSI A108.5.
  2. Concrete Subfloors, Interior: TCNA F122 (on ground) and F122A (above ground).
    - a. Apply the mortar to waterproofed slab with the flat side of the trowel.
    - b. With a trowel, having notches sized as recommended by the mortar manufacturer, comb the surface of the mortar with the notched side of the trowel removing excess mortar. Spread only as much mortar as can be covered in the time limits established by the mortar manufacturers recommendations.
    - c. Wipe the back of each tile, with a damp sponge, to remove all dust or dirt immediately before applying mortar to tiles.
    - d. Immediately after wiping tile backs, but prior to placing tile, the mortar shall be troweled to back of tile for 100% coverage to thickness of not less than 1/16-inch.
    - e. Place tiles onto mortar bed, maintaining 1/8-inch wide joints, and true accurate pattern as shown. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set.
    - f. Prohibit foot and wheel traffic on tiled floors for period of time as recommended by the mortar manufacturer.
  3. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. For typical installations, comply with Latex-portland cement: ANSI A108.10; grout installation for kitchen installations, epoxy grout: ANSI A108.6. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.
- B. Stone Thresholds: Install stone thresholds in one piece, notched to fit neatly at door jambs; set in same type of setting bed as abutting field tile in accordance with TCNA Method TR611.

### **3.7 WALL TILE INSTALLATION**

- A. Install in accordance with the mortar manufacturer's recommendations and requirements indicated below for ANSI setting bed methods, TCNA installation methods related to types of construction, and grout ANSI installation methods and grout types. Where recommendations and methods conflict, the manufacturer's recommendations shall apply. Exercise care to quickly remove spillage from faces of tile using damp sponges. Rake out joints to depth required to receive grout as tile units are set.
1. Latex Portland Cement Mortar Installation (using specified latex portland cement mortar material): ANSI A108.5.

2. Gypsum Wallboard, Interior (Latex Portland Cement Mortar) Method: TCNA W243, place tiles maintaining 1/8-inch wide joints, and true accurate pattern as shown.
3. Grout Installation: Do not begin grouting tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed. Remove spacers, if any, prior to grouting. Comply with Latex-portland cement: ANSI A108.10. Fill joints of cushion edged tile to the depth of the cushion; fill joints of square edge tile flush with the tile surface. Do not permit mortar, mounting mesh, or spacer material to show through grouted joints. Provide hard finished grout, which is uniform in color, smooth, and without voids, pinholes, or low spots. Tool surfaces with shallow concave profile.

### **3.8 CLEANING AND PROTECTING**

- A. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
  1. Remove grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work. Replace all cracked, chipped, and broken tile units with matching tile units; patched tile units will not be permitted.
- C. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with minimum 40 lb kraft paper or other heavy, breathable, covering during construction period to prevent staining, damage, and wear.
- D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

**END OF SECTION 09 30 00**

**SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes resilient wall base, resilient stair accessories, and moldings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data for each type of product indicated.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.1.1: For sealants, adhesives and caulks, provide documentation including printed statement of VOC content showing compliance with SCAQMD Rule 1168 VOC limits and CCR (California Code of Regulations) Title 17 for aerosols.
  - 2. Product Data for Section 5.504.4.1.2: Provide documentation for aerosol adhesives, and smaller unit sizes of adhesives, sealant, and caulking compounds (in units of product, less packaging, which do not weigh more than one (1) pound and do not consist of more than sixteen (16) fluid ounces) comply with statewide VOC standards and prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.
  - 3. Product Data for Section 5.504.4.3: For architectural paints and coatings, provide documentation including printed statement of VOC content showing compliance with Table 1 of the ARB, Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.
  - 4. Product Data for Section 5.504.4.3.1: Aerosol paints and coatings, provide documentation that products meet the PWMIR Limits for ROC in Section 94522 (a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Section 94522(c)(2 and (d)(2) of CCR Title 17.

**PART 2 - PRODUCTS**

**2.1 RESILIENT WALL BASE**

- A. Products and Manufacturers: As indicated in Finish Schedule on Drawings. Nominal thickness not less than 1/8 inch unless greater thickness is scheduled. All resilient base shall be manufactured from rubber complying with ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous). Provide all resilient wall base in continuous coils to minimize field butt joints.
- B. Provide all resilient wall bases with a coved base toe style typically; and with straight flat or toeless base style at carpet, unless otherwise indicated in Finish Schedule on Drawings.

**2.2 RESILIENT STAIR ACCESSORIES**

- A. Treads: Complying with FS RR-T-650.
- B. Size: Lengths and depths to fit each stair tread in one piece or, for treads exceeding maximum lengths manufactured, in equal-length units.
- C. Risers: Integral one-piece with tread.
- D. Risers: Integral one-piece with tread.
- E. Products and Manufacturers for Resilient Stair Accessories: Refer to Finish Schedule on Drawings.

**2.3 RESILIENT MOLDING ACCESSORY**

- A. Description: Reducer strip for resilient floor covering.
- B. Material: Rubber.

**2.4 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation provided or approved by resilient product manufacturers for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional regulations as shown in CALgreen Section 5.504.4.1.
  - 2. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with regulations as shown in CALgreen Section 5.504.4.2.
  - 3. Paints and coatings shall comply with VOC content as shown in CALgreen Section 5.504.4.3.
- C. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove paint, sealers, existing floor covering adhesive residues, substrate coatings and other substances that are incompatible with adhesives to be used for installing resilient stair accessories using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates indicated to receive resilient stair accessories.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient stair accessories products immediately before installation.

### **3.3 RESILIENT WALL BASE INSTALLATION**

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. Job-Formed Corners:
  1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

**3.4 RESILIENT ACCESSORY INSTALLATION**

- A. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
  - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
  
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

**3.5 CLEANING AND PROTECTION**

- A. Remove adhesive and other blemishes from exposed surfaces.
  
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
    - a. Do not wash surfaces until after time period recommended by manufacturer.
  
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

**END OF SECTION 09 65 13**



**SECTION 09 65 43 - LINOLEUM FLOORING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes linoleum sheet floor coverings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each product specified.
- B. Shop Drawings: Show locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Samples for Verification: In manufacturer's standard size, but not less than 6 by 9 inch sections of each different color and pattern of floor covering required.
  - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For City's maintenance program.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

**1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer, who has completed flooring covering similar in material, design, and extent to that indicated for this Project and whose work has resulted in flooring covering installations with a record of successful in-service performance and who employs workers for this Project that are competent in heat-welding techniques required by manufacturer for floor covering installation.

**1.7 FIELD CONDITIONS**

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F , in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

**PART 2 - PRODUCTS**

**2.1 LINOLEUM FLOOR COVERING**

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Armstrong World Industries, Inc.; LinoArt Rhythmics Sheet or equal by.
  - 2. Azrock Commercial Flooring, DOMCO Tarkett Inc.;
  - 3. Forbo Industries, Inc.;
  - 4. Or approved equal
- B. Color and Pattern: As selected by Architect and Resident Engineer from manufacturer's full range.
- C. Sheet Floor Covering: ASTM F 2034.
  - 1. Roll Size: In manufacturer's standard length by not less than 78 inches wide.
- D. Seaming Method: Heat welded.
- E. Thickness: 0.10 inch .
- F. Fire-Test-Response Characteristics:
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

**2.2 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor covering manufacturer for products and substrate conditions indicated.
- C. Heat-Welding Bead: Solid-strand product of floor covering manufacturer.
  - 1. Color: As selected by Architect and Resident Engineer from manufacturer's full range to contrast with floor covering.
- D. Metal Edge Strips: Extruded aluminum with mill finish, of width shown, of height required to protect exposed edge of floor covering, and in maximum available lengths to minimize running joints.

**PART 3 - EXECUTION**

**3.1 INSTALLATION, GENERAL**

- A. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
  - 1. Do not install floor coverings until they are same temperature as space where they are to be installed.
- B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- E. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.
- F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- G. Perform the following operations immediately after completing floor covering installation:
  - 1. Remove adhesive and other blemishes from floor covering surfaces.

2. Sweep and vacuum floor coverings thoroughly.
3. Damp-mop floor coverings to remove marks and soil.
  - a. Do not wash floor coverings until after time period recommended by manufacturer.
- H. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

### **3.2 SHEET FLOOR COVERING INSTALLATION**

- A. Unroll sheet floor coverings and allow them to stabilize before cutting and fitting.
- B. Lay out sheet floor coverings as follows:
  1. Maintain uniformity of floor covering direction.
  2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
  3. Match edges of floor coverings for color shading at seams.
  4. Avoid cross seams.
  5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

**END OF SECTION 09 65 43**

## SECTION 09 91 13 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Galvanized metal.
  - 2. Wood.
  - 3. Portland cement plaster (stucco).
- B. Related Requirements:
  - 1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates.
  - 2. Section 05 52 13 "Pipe and Tube Railings" for shop priming pipe and tube railings.

#### 1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

**1.6 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Benjamin Moore & Co.
  - 2. California Paints.
  - 3. Coronado Paint; Benjamin Moore Company.
  - 4. Frazee Paint; Comex Group.
  - 5. Glidden Professional.
  - 6. Pratt & Lambert.
  - 7. Sherwin-Williams Company (The).
  - 8. Dunn Edwards
  - 9. Or approved equal

**2.2 PAINT, GENERAL**

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
  2. Nonflat Paints and Coatings: 50 g/L.
- D. Colors: As selected by Architect and Resident Engineer from manufacturer's full range.
1. Twenty percent of surface area will be painted with deep tones.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Wood: 15 percent.
  2. Portland Cement Plaster: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

#### **3.2 PREPARATION**

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- E. Wood Substrates:
  - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### **3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed to view:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Tanks that do not have factory-applied final finishes.



**3.4 CLEANING AND PROTECTION**

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect and Resident Engineer, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

**3.5 EXTERIOR PAINTING SCHEDULE**

- A. Galvanized-Metal Substrates:
  - 1. Latex System MPI EXT 5.3A:
    - a. Prime Coat: Primer, galvanized, water based, MPI #134.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5).
- B. Wood Substrates: Wood trim.
  - 1. Latex over Latex Primer System MPI EXT 6.3L:
    - a. Prime Coat: Primer, latex for exterior wood, MPI #6.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
- C. Portland Cement Plaster Substrates:
  - 1. Latex System MPI EXT 9.1A:
    - a. Prime Coat: Latex, exterior, matching topcoat.
    - b. Intermediate Coat: Latex, exterior, matching topcoat.
    - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.

**END OF SECTION 09 91 13**

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**SECTION 09 91 23 - INTERIOR PAINTING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes surface preparation and field application of paint systems on the following interior substrates:
  - 1. Gypsum board.
  - 2. Steel.

**1.2 DEFINITIONS**

- A. General: The following terms apply to this Section. Gloss level shall be determined according to ASTM D 523.
  - 1. Gloss Level 1(Flat, or Matte): Not more than 5 units at 60 degrees and 10 units at 85 degrees.
  - 2. Gloss Level 4 (Satin or Low Luster): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
  - 3. Gloss Level 5 (Semigloss): 35 to 70 units at 60 degrees.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.504.4.3: For architectural paints and coatings, provide documentation including printed statement of VOC content showing compliance with Table 1 of the ARB, Architectural Coatings Suggested Control Measure, unless more stringent local limits apply.
  - 2. Product Data for Section 5.504.4.3.1: Aerosol paints and coatings, provide documentation that products meet the PWMIR Limits for ROC in Section 94522 (a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Section 94522(c)(2 and (d)(2) of CCR Title 17.

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: 1 gal. of each material and color applied.

**1.5 QUALITY ASSURANCE**

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

**1.6 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Benjamin Moore Family of Products (Benjamin Moore, Coronado, Corotech, Insl-x, LenMar) [www.benjaminmoore.c](http://www.benjaminmoore.c)
  - 2. PPG Paints (PPG) [www.ppgaf.com](http://www.ppgaf.com)
  - 3. Sherwin-Williams Co. (SW)
  - 4. Dunn Edwards
  - 5. Or approved equal

**2.2 PAINT, GENERAL**

- A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and with the substrates indicated, under conditions of service and application, as demonstrated by manufacturer based on testing and field experience. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
  - 1. Flat Paints and Coatings: VOC content of not more than 50 g/L Nonflat Paints and Coatings: VOC content of not more than 100 g/L.
  - 3. Dry Fog Coatings: VOC content not more than 150 g/L.
  - 4. Primers, Sealers, and Undercoaters: VOC content not more than 100 g/L.
  - 5. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content not more than 250 g/L.
  - 6. Zinc-Rich Industrial Maintenance Primers: VOC content not more than 340 g/L.

7. Pre-Treatment Wash Primers: VOC content not more than 420 g/L. Floor Coatings: VOC content not more than 100 g/L.
  8. Shellacs, Clear: VOC content not more than 730 g/L.
  9. Shellacs, Pigmented: VOC content not more than 550 g/L.
- C. Architectural Paints and coatings shall comply with VOC content in "CALgreen Requirements."
- D. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- E. Colors and Gloss: As selected by the Architect and Resident Engineer from Manufacturer's full range of colors. For generic paint system requirements, refer to the "Interior Paint Schedule" at the end of Part 3, as applicable to the respective conditions of use.
1. The number of paint colors and gloss are indicated by manufacturer and color type; designated as "PT##."
  2. Furnish the same lots, batches, etc. within the same contiguous areas of the building (i.e., corridors on the same floors, common rooms which adjoin each other, etc.).

## **2.3 PREPARATORY COATS**

- A. Primer Sealer, Latex, Interior:
1. Benjamin Moore; Ultra Spec 500 Interior Latex Primer (N534).
  2. PPG; Speedhide Zero Interior Latex Sealer Quick-Drying (6-4900).
  3. SW; ProMar 200 Zero VOC Interior Latex Primer (B28W02600).
  4. Or approved equal
- B. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

## **2.4 WATER-BASED PAINTS**

- A. Latex, Interior, Gloss Level 1 (Flat):
1. Benjamin Moore; Ultra Spec 500 Interior Flat (N536).
  2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Flat (6-4110XI).
  3. SW; ProMar 200 Zero VOC Interior Latex Flat (B30-2600 Series).
  4. Or approved equal
- B. Latex, Interior, Gloss Level 3 (Eggshell).
1. Benjamin Moore; Ultra Spec 500 Interior Eggshell (N538).
  2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Eggshell (6-4310XI).
  3. SW; ProMar 200 Zero Interior VOC Latex Eg-Shel (B20-2600 Series).
  4. Or approved equal

- C. Latex, Interior, Gloss Level 5 (Semigloss):
  - 1. Benjamin Moore; Ultra Spec 500 Interior Semi-Gloss (N539).
  - 2. PPG; SPEEDHIDE zero Interior Zero-VOC Latex Semi-Gloss (6-4510XI).
  - 3. SW; ProMar 200 Zero VOC Latex Semi-Gloss (B31-2600 Series).
  - 4. Or approved equal

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with manufacturer's requirements for paint application. Comply with procedures specified in PDCA P4.
  - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

### **3.2 PREPARATION**

- A. Remove hardware and hardware accessories, cover plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible, provide surface-applied protection before surface preparation and painting.
- B. Before applying paint or other surface treatments, clean substrates of substances that could impair bond of paints. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime.
  - 1. Gypsum Wallboard: Repair all surfaces in gypsum wallboard with wallboard joint finishing compound or spackling compound, filled out flush and sanded smooth. Clean all surfaces and taped joints of dust, dirt and other contaminants and be sure they are thoroughly dry before applying paint.
  - 2. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
  - 3. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- D. Mix and prepare paint materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tint each undercoat a lighter shade to facilitate identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

### **3.3 APPLICATION**

- A. Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in Finish Schedule on Drawings.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  4. Extend coatings in exposed surfaces, as required, to maintain system integrity and provide desired protection.
    - a. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place.
  5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint front and back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces. Paint access panels, electrical panels, air diffusing outlets, supply and exhaust grilles, louvers, exposed conduit, primed hardware items, primed outlet covers, primed wall and ceiling cover plates and other items in painted areas to match the areas in which they occur unless otherwise directed by the Architect and Resident Engineer.
- B. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
    - a. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
    - b. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- c. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  2. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
  1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  1. Paint the following work where exposed in equipment rooms:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Tanks that do not have factory-applied final finishes.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
  2. Paint the following work where exposed in occupied spaces:
    - a. Uninsulated metal piping.
    - b. Uninsulated plastic piping.
    - c. Pipe hangers and supports.
    - d. Metal conduit.
    - e. Plastic conduit.
    - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.



- G. Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### **3.4 CLEANING**

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.
- C. After completing painting operations in each space or area, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection, if any.

### **3.5 PROTECTION**

- A. Protect work of other trades, whether being painted or not, against damage from paint application. Correct damage to work of other trades by cleaning, repairing or replacing, and refinishing, as approved by Architect and Resident Engineer, and leave in an undamaged condition.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### **3.6 INTERIOR PAINTING SCHEDULE**

- A. Gypsum Board Substrates:
  - 1. Latex System:
    - a. Primer: Sealer, latex, interior.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior (gloss as indicated in Finish Schedule).
- B. Steel Substrates:
  - 1. High-Performance Architectural Latex System:
    - a. Primer: Acrylic.
    - b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
    - c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).
- C. Steel (Factory-Primed) Substrates:
  - 1. High-Performance Architectural Latex System:

- a. Primer: Acrylic (applied over factory primer).
- b. Intermediate Coat: Latex, interior, high performance architectural; matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural (gloss as indicated in Finish Schedule).

**END OF SECTION 09 91 23**

**SECTION 10 14 23 - PANEL SIGNAGE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Panel signs.

**1.2 ACTION SUBMITTALS**

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples: For each exposed product and for each color and texture specified.

**1.3 WARRANTY**

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's current "ADA Standards for Accessible Design".

**2.2 PANEL SIGNS**

A. Panel Sign : Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Solid-Sheet Sign and Returns: Acrylic sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
  - a. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
2. Sign-Panel Perimeter: Finish edges smooth.
  - a. Edge Condition: Square cut.
  - b. Corner Condition in Elevation: Square.
3. Mounting: Manufacturer's standard method for substrates indicated Surface mounted to wall with two-face tape.
4. Surface Finish and Applied Graphics:
  - a. Integral Acrylic Sheet Color: As selected by Architect and Resident Engineer from full range of industry colors.
  - b. Painted Finish and Graphics: Manufacturer's standard, factory-applied acrylic polyurethane, in color as selected by Architect and Resident Engineer from manufacturer's full range.
  - c. Overcoat: Manufacturer's standard baked-on clear coating.

### **2.3 PANEL-SIGN MATERIALS**

- A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Install signs so they do not protrude or obstruct according to the accessibility standard.
  3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
- B. Mounting Methods:
  1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
- C. Remove temporary protective coverings and strippable films as signs are installed.

## **END OF SECTION 10 14 23**

## SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Public-use washroom accessories.
  2. Public-use shower room accessories.
  3. Private-use bathroom accessories.

#### 1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
  2. Identify accessories using designations indicated.

#### 1.4 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, visible silver spoilage defects.
  2. Warranty Period: 15 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 WASHROOM ACCESSORIES**

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser (TP-1):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Toilet Tissue Dispenser for single roll B-273, surface mounted or comparable product by one of the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bradley Corporation.
    - d. Or approved equal
- C. Combination Towel (Folded) Dispenser/Waste Receptacle (PTWR):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Recessed Paper Towel Dispenser/Waste Receptacle B-369 or comparable product by one of the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bradley Corporation.
    - d. Or approved equal
- D. Grab Bar (GB36 and GB42):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick 1 1/4" diameter straight grab bar peened B-5806.99 sizes per drawings or comparable product by one of the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bradley Corporation.
    - d. Or approved equal
- E. Mirror Unit (M):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick channel framed mirror B-165, sizes per drawings or comparable product by one of the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bradley Corporation.
    - d. Or approved equal

- F. Shower Curtain Rod (R-1):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Heavy duty Shower Curtain Rod B-207, length for space or comparable product by one of the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bradley Corporation.
    - d. Or approved equal
  
- G. Towel Bar (TB18 and TB24):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Surface Mounted Towel Bar B-673, 24" long and 18" long or comparable product by one of the following:
    - a. American Specialties, Inc.; ASI Group.
    - b. Basco, Inc.
    - c. Or approved equal

**2.2 MATERIALS**

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- C. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- D. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

**2.3 FABRICATION**

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to City's representative.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

**3.2 ADJUSTING AND CLEANING**

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

**END OF SECTION 10 28 00**



**SECTION 10 44 00 - FIRE-PROTECTION SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section fire protection specialties includes fire extinguishers and fire extinguisher cabinets.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, panel style.
- B. CALgreen Submittals:
  - 1. Product Data for Section 5.508.1: Provided documentation showing that proposed HVAC, refrigeration and fire suppression equipment contains no Chlorofluorocarbons (CFCs) or Halons, as required in CALgreen Section 5.508.1.1 and Section 5.508.1.2.

**1.3 QUALITY ASSURANCE**

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Listing: Fire extinguishers shall be UL listed with UL Listing Mark for type, rating, and classification of extinguisher.

**1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 FIRE EXTINGUISHERS**

- A. General: Provide fire extinguishers for each fire extinguisher cabinet and at other locations indicated.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb. nominal capacity, in enameled-steel container.
- C. Located on Drawings by Designation: FE.
- D. HVAC, refrigeration, and fire suppression equipment and systems, shall contain no CFCs or halons.

### **2.2 FIRE-EXTINGUISHER CABINETS**

- A. General: Provide fire extinguisher cabinets of suitable size for housing fire extinguishers of types and capacities specified.
- B. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
  1. Fire-Rated Cabinets: Listed and labeled to meet requirements in ASTM E 814 for fire-resistance rating of wall where it is installed.
    - a. Construct fire-rated cabinets with double walls fabricated from 0.0478 inch thick, cold-rolled steel sheet lined with minimum 5/8 inch thick, fire-barrier material.
  2. Cabinet Trim Material: Manufacturer's standard steel sheet.
  3. Door Style: Vertical duo panel with frame.
- C. Accessories:
  1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect and Resident Engineer.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Pressure-sensitive vinyl letters.
      - 3) Lettering Color: Black.
      - 4) Orientation: Vertical.

- D. Products and Manufacturers: One of the following:
  - 1. Larsens Manufacturing Company: Occult Series Fire Extinguisher Cabinets.
  - 2. Potter Roemer: Dana Series Fire Extinguisher Cabinets.
  - 3. JL Industries, Inc.: Embassy Series Fire Extinguisher Cabinets.
  - 4. Or approved equal
- E. Located on Drawings by designation: FEC.

### **2.3 FINISHES**

- A. General: Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.
- B. Painted Finishes: Provide painted finish to comply with requirements indicated below for extent, preparation and type:
  - 1. Color: Provide color or color matches indicated, or, if not otherwise indicated, as selected by Architect and Resident Engineer from manufacturer's standard colors.
  - 2. Preparation: Clean surfaces of dirt, grease, and loose rust or mill scale.
  - 3. Field-Paintable Factory Finish: Immediately after cleaning and pretreatment, apply to surfaces indicated below, manufacturer's standard factory-applied paint system which is suitable, after deglossing, as an undercoat for field-applied paint system specified in Section 09 91 23 "Interior Painting."
    - a. Exterior of cabinet except for those surfaces indicated to receive another finish.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

### **3.2 INSTALLATION**

- A. General: Follow manufacturer's printed instructions for installation.
- B. Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
  - 1. Fasten cabinets to structure, square and plumb.

### **3.3 ADJUSTING AND CLEANING**

- A. Adjust cabinet doors to operate freely without binding. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.
- B. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

**END OF SECTION 10 44 00**

**SECTION 11 31 00 - RESIDENTIAL APPLIANCES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Ranges.
  - 2. Microwave ovens.
  - 3. Range hoods.
  - 4. Refrigerator/freezers.
  - 5. Dishwashers.
  - 6. Clothes washers and dryers.
  
- B. Related Requirements:
  - 1. Division 22 Sections for natural gas, water distribution, drainage, and vent piping and plumbing fixtures.
  - 2. Division 26 Sections for electrical services and connections to residential appliances.

**1.2 ACTION SUBMITTALS**

- A. Product Data: Submit product data and roughing in diagrams for each type of appliance required indicating compliance with requirements. Include complete operating characteristics, dimensions of individual appliances, finishes for each appliance, and maintenance instructions for each appliance.
  
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
  
- B. Warranties: Sample of special warranties specified in this Section.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of residential appliance from single manufacturer.

**1.6 DELIVERY**

- A. Deliver appliances only after utility rough-in is complete and construction in spaces to receive appliances is substantially complete and ready for installation.

**1.7 WARRANTY**

- A. Range: Limited warranty including parts and labor for first year and parts thereafter for on-site service on surface-burner elements.
  - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Microwave Oven: Limited warranty including parts and labor for first year and parts thereafter for on-site service .
  - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Refrigerator/Freezer, Sealed System: Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product.
  - 1. Warranty Period for Sealed Refrigeration System: Two years from date of Substantial Completion.
  - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
- D. Dishwasher: Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product.
  - 1. Warranty Period for Deterioration of Tub and Metal Door Liner: Five years from date of Substantial Completion.
  - 2. Warranty Period for Other Components: Two years from date of Substantial Completion.
- E. Clothes Washer: Limited warranty including parts and labor for first year and parts thereafter for on-site service on the product.
  - 1. Warranty Period: Two years from date of Substantial Completion.
  - 2. Clothes Washer: 10 -year limited warranty for in-home service on inner wash basket and outer tub, and 5 -year limited warranty for in-home service on balance suspension system and drive transmission.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
- B. Basis-of-Design Product: The design for each residential appliance is based on the product named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Dacor, Inc.
2. General Electric Company (GE).
3. LG Appliances.
4. Sears Brands LLC (Kenmore).
5. Whirlpool Corporation.
6. Summit Appliance.
7. Or approved equal

## **2.2 RESIDENTIAL APPLIANCES**

- A. Provide product listed in Equipment Schedules and on the Drawings.
- B. Refrigerator (R-1 & R-2): GE GFE24JSKSS Energy Star 23.8 cu ft French door refrigerator with freezer below, ADA compliant, stainless steel, or equal.
- C. Under Counter Refrigerator (R-3): Summit Appliance AL54CSSTB ADA under counter refrigerator or equal.
- D. Dishwasher (DW-1): Kenmore 13473 dishwasher with power wave spray arm/ultra wash HE system, stainless exterior with grey plastic tub or equal. For ADA counter heights in Kitchen 103 and Manager Suite 114, provide GE GLDT696JSS or equal.
- E. Range/Stove (ST-1): Kenmore 75123 5.8 cuft gas range with true convection, stainless steel, ADA compliant, with Kenmore 51840 30" convertible range hood stainless steel or equal. Provide horizontal vented hood.
- F. Microwave (M-1): Kenmore 75653 1.2 cuft microwave oven stainless steel, ADA compliant or equal.
- G. Dryer (D-1): GE GFD45GSSMWW 7.5 cu ft capacity front load gas dryer with steam, ADA compliant, white or equal.
- H. Washer (W-1): GE GFW480SSKWW energy star, 4.9 cu ft, front load washer with steam, ADA compliant, white or equal.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.
- C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION, GENERAL**

- A. General: Comply with manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.
- E. Utilities: Refer to the Drawings and Divisions 22 and 26 for plumbing and electrical requirements.
- F.

**3.3 ADJUSTING AND CLEANING**

- A. Test each item of appliances to verify proper operation. Make necessary adjustments.
- B. Verify that accessories required have been furnished and installed.
- C. Remove packing material from appliances and leave units in clean condition, ready for operation.

**END OF SECTION 11 31 00**



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SECTION 12 93 00

SITE FURNISHINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Include all services, labor, materials, transportation, tools and equipment necessary to perform the work indicated on the Drawings and specified herein as required to properly complete the work in this contract.
- B. Related Sections include the following:
  - 1. 03 33 10 Landscape Site Concrete Walls
  - 2. 12 93 00 Site Furnishings
  - 3. 32 13 16 Decorative Concrete Paving
  - 4. 32 31 13 Chainlink Fences and Gates
  - 5. 32 84 00 Landscape Irrigation
  - 6. 32 93 16 Exterior Plants

1.2 SUBMITTALS

- A. Submit the following:
  - 1. Manufacturer's Data: Include manufacturer's data sheets, and shop drawings for all furnishing items
  - 2. Representative samples of colors and finish
  - 3. Manufacturer's instructions, maintenance recommendations, and warranty

1.3 SITE CONDITIONS

- B. Prior to commencing with work, review on site grading conditions, including sub grade conditions, verify the elevations, and dimensions, and notify the Owner's Representative of unsatisfactory conditions. Proceeding with the work constitutes acceptance of existing or corrected conditions.

PART 2 - PRODUCTS

2.1 FURNISHINGS

- A. Trash and Recycling Receptacle: (NIC) See Drawings for type.
- B. Tables and Chairs: (NIC) See Drawings for type.
- C. Bicycle Racks: See drawings for type.
- D. Bike Locker: See drawing for type.
- E. Community Table: (NIC) See Drawings for type.

## Palm Ave Transitional Housing

- a. 100% recycled plastic wood and cast iron, treated with electro-coated anti-corrosion treatment and finished with powder coating electrostatically.
- F. Veggie Box: Galvanized Stock Tank. See detail for size and type.
- G. Bench: (NIC) See Drawings for type.
- H. Outdoor Ashtray: (NIC) See Drawings for type.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Verify exact locations for all furnishings coordinate installation and equipment with the Owner's Representative.
- B. Trash/Ash Receptacle, Recycling Receptacle, Bench, Moveable Tables and Chairs, Umbrellas: Place furnishings as directed in the field. In security cable and surface mounted per manufacturer's recommendations.
- C. Bicycle Racks: Surface mount per manufacturer's specifications at location indicated.
- D. Exercise care so as not to damage finishes. Repair all damaged surfaces, or replace as directed by the Owner's Representative.

#### 3.2 ACCEPTANCE

- A. Review and acceptance of the placement and installation shall be performed by the Owner's Representative. Provide notification at least forty-eight (48) hours prior requested inspection time and date.

#### 3.3 CLEAN-UP

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from the site all excess materials, debris, and equipment.

END OF SECTION 12 93 00

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

1.2 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.3 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included as required.

1.4 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
  1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  2. Sprinkler Occupancy Hazard Classifications:
    - a. Building Service Areas: Ordinary Hazard, Group 1.
    - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.

- c. General Storage Areas: Ordinary Hazard, Group 1.
  - d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
  - e. Office and Public Areas: Light Hazard.
  - f. Restaurant Service Areas: Ordinary Hazard, Group 1.
3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
  4. Minimum Density for Deluge-Sprinkler Piping Design:
    - a. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over entire area.
  5. Maximum Protection Area per Sprinkler: Per UL listing.
  6. Maximum Protection Area per Sprinkler:
    - a. Office Spaces: 120 sq. ft.
    - b. Storage Areas: 130 sq. ft.
    - c. Mechanical Equipment Rooms: 130 sq. ft.
    - d. Electrical Equipment Rooms: 130 sq. ft.
    - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
  7. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
    - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
    - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

## 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. LEED Submittal:
  1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content and chemical components.
- C. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
  1. Wiring Diagrams: For power, signal, and control wiring.
- D. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. HVAC refrigerant piping.
  - 3. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- F. Qualification Data: For qualified Installer and professional engineer.
- G. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- H. Welding certificates.
- I. Fire-hydrant flow test report.
- J. Field Test Reports and Certificates: 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."
- K. Field quality-control reports.
- L. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

## 1.6 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 ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."

2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

#### 1.7 PROJECT CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
  1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sprinkler service.
  2. Do not proceed with interruption of sprinkler service without Architect's and Resident Engineer's Construction Manager's written permission.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

#### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Uncoated, Steel Couplings: ASTM A 865, threaded.
- E. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- F. Malleable- or 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.
- I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Shurjoint Piping Products.
    - c. Victaulic Company.
    - d. Or approved equal
  - 2. Pressure Rating: 175 psig minimum.
  - 3. Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

### 2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- D. 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.
- E. Grooved-Joint, Copper-Tube Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Shurjoint Piping Products.
    - c. Victaulic Company.



- d. Or approved equal.
- 2. Grooved-End, Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze castings.
- 3. Grooved-End-Tube Couplings: To fit copper-tube dimensions, with design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for hot and cold water, and bolts and nuts.

**2.4 PIPING JOINING MATERIALS**

- A. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free.
  - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
  - 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

**2.5 LISTED FIRE-PROTECTION VALVES**

- A. General Requirements:
  - 1. Valves shall be UL listed or FM approved.
  - 2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
  - 3. Minimum Pressure Rating for High-Pressure Piping: 250 psig.
- B. Ball Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Victaulic Company.
    - c. Or approved equal.
  - 2. Standard: UL 1091 except with ball instead of disc.
  - 3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  - 4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
  - 5. Valves NPS 3: Ductile-iron body with grooved ends.
- C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fivalco Inc.
  - b. Global Safety Products, Inc.
  - c. Milwaukee Valve Company.
  - d. Or approved equal.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

**D. Iron Butterfly Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. NIBCO INC.
  - c. Shurjoint Piping Products.
  - d. Victaulic Company.
  - e. Or approved equal.
2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. Style: Lug or wafer.
6. End Connections: Grooved.

**E. Check Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. NIBCO INC.
  - c. Shurjoint Piping Products.
  - d. Victaulic Company.
  - e. Or approved equal.
2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

**F. Bronze OS&Y Gate Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Milwaukee Valve Company.
  - c. NIBCO INC.
  - d. Or approved equal.
2. Standard: UL 262.
  3. Pressure Rating: 175 psig.
  4. Body Material: Bronze.
  5. End Connections: Threaded.
- G. Iron OS&Y Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. NIBCO INC.
    - c. Shurjoint Piping Products.
    - d. Or approved equal.
  2. Standard: UL 262.
  3. Pressure Rating: 250 psig minimum.
  4. Body Material: Cast or ductile iron.
  5. End Connections: Flanged or grooved.
- H. NRS Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Stockham Division.
    - b. Mueller Co.; Water Products Division.
    - c. NIBCO INC.
    - d. Or approved equal.
  2. Standard: UL 262.
  3. Pressure Rating: 250 psig minimum.
  4. Body Material: Cast iron with indicator post flange.
  5. Stem: Nonrising.
  6. End Connections: Flanged or grooved.
- I. Indicator Posts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Stockham Division.
    - b. Mueller Co.; Water Products Division.
    - c. NIBCO INC.
    - d. Or approved equal.
  2. Standard: UL 789.

3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Wrench.

**2.6 TRIM AND DRAIN VALVES**

**A. General Requirements:**

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

**B. Angle Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.
  - c. Or approved equal.

**C. Ball Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. Conbraco Industries, Inc.; Apollo Valves.
  - c. Kitz Corporation.
  - d. NIBCO INC.
  - e. Victaulic Company.
  - f. Or approved equal.

**D. Globe Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.
  - c. Or approved equal.

**2.7 SPECIALTY VALVES**

**A. General Requirements:**

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

- a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
- b. High-Pressure Piping Specialty Valves: 250 psig minimum.
  
- 3. Body Material: Cast or ductile iron.
- 4. Size: Same as connected piping.
- 5. End Connections: Flanged or grooved.

**B. Alarm Valves:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Reliable Automatic Sprinkler Co., Inc.
  - b. Victaulic Company.
  - c. Viking Corporation.
  - d. Or approved equal.
  
- 2. Standard: UL 193.
- 3. Design: For horizontal or vertical installation.
- 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
- 5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
- 6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

**2.8 FIRE-DEPARTMENT CONNECTIONS**

**A. Exposed-Type, Fire-Department Connection:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Guardian Fire Equipment, Inc.
  - c. Tyco Fire & Building Products LP.
  - d. Or approved equal.
  
- 2. Standard: UL 405.
- 3. Type: Exposed, projecting, for wall mounting.
- 4. Pressure Rating: 175 psig minimum.
- 5. Body Material: Corrosion-resistant metal.
- 6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
- 7. Caps: Brass, lugged type, with gasket and chain.
- 8. Escutcheon Plate: Round, brass, wall type.
- 9. Outlet: Back, with pipe threads.
- 10. Number of Inlets: Two.
- 11. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
- 12. Finish: Rough brass or bronze.
- 13. Outlet Size: NPS 6.

**B. Yard-Type, Fire-Department Connection:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire Protection Products, Inc.
  - c. Guardian Fire Equipment, Inc.
  - d. Or approved equal.
2. Standard: UL 405.
3. Type: Exposed, freestanding.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, floor type.
9. Outlet: Bottom, with pipe threads.
10. Number of Inlets: Two.
11. Sleeve: Brass.
12. Sleeve Height: 18 inches.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."
14. Finish: Rough brass or bronze.
15. Outlet Size: NPS 6.

**2.9 SPRINKLER SPECIALTY PIPE FITTINGS**

**A. Branch Outlet Fittings:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International, Inc.
  - b. Shurjoint Piping Products.
  - c. Victaulic Company.
  - d. Or approved equal.
2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

**B. Flow Detection and Test Assemblies:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Reliable Automatic Sprinkler Co., Inc.
  - b. Tyco Fire & Building Products LP.
  - c. Victaulic Company.
  - d. Or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

**C. Branch Line Testers:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.
  - c. Potter Roemer.
  - d. Or approved equal.
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

**D. Sprinkler Inspector's Test Fittings:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Tyco Fire & Building Products LP.
  - b. Victaulic Company.
  - c. Viking Corporation.
  - d. Or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum 300 psig.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

**2.10 SPRINKLERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Globe Fire Sprinkler Corporation.
  - 2. Reliable Automatic Sprinkler Co., Inc.
  - 3. Viking Corporation.
  - 4. Or approved equal.
  
- B. General Requirements:
  - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
  - 3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
  - 4. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.
  
- C. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Early-Suppression, Fast-Response Applications: UL 1767.
  - 2. Nonresidential Applications: UL 199.
  - 3. Residential Applications: UL 1626.
  - 4. 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.
  
- D. Sprinkler Finishes:
  - 1. Chrome plated.
  - 2. Bronze.
  - 3. Painted.
  
- E. Special Coatings:
  - 1. Wax.
  - 2. Corrosion-resistant paint.
  
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
  
- G. Sprinkler Guards:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.



- c. Victaulic Company.
  - d. Viking Corporation.
  - e. Or approved equal.
- 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.

**2.11 ALARM DEVICES**

**A. Alarm-device types shall match piping and equipment connections.**

**B. Water-Motor-Operated Alarm:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Globe Fire Sprinkler Corporation.
  - b. Victaulic Company.
  - c. Viking Corporation.
  - d. Or approved equal.
- 2. Standard: UL 753.
- 3. Type: Mechanically operated, with Pelton wheel.
- 4. Alarm Gong: Cast aluminum with red-enamel factory finish.
- 5. Size: 10-inch diameter.
- 6. Components: Shaft length, bearings, and sleeve to suit wall construction.
- 7. Inlet: NPS 3/4.
- 8. Outlet: NPS 1 drain connection.

**C. Electrically Operated Alarm Bell:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Fire-Lite Alarms, Inc.; a Honeywell company.
  - b. Notifier; a Honeywell company.
  - c. Potter Electric Signal Company.
  - d. Or approved equal.
- 2. Standard: UL 464.
- 3. Type: Vibrating, metal alarm bell.
- 4. Size: 6-inch minimum- diameter.
- 5. Finish: Red-enamel factory finish, suitable for outdoor use.

**D. Water-Flow Indicators:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. McDonnell & Miller; ITT Industries.
  - b. Potter Electric Signal Company.

- c. System Sensor; a Honeywell company.
  - d. Or approved equal.
- 2. Standard: UL 346.
  - 3. Water-Flow Detector: Electrically supervised.
  - 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
  - 5. Type: Paddle operated.
  - 6. Pressure Rating: 250 psig.
  - 7. Design Installation: Horizontal or vertical.
- E. Pressure Switches:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Potter Electric Signal Company.
    - b. System Sensor; a Honeywell company.
    - c. United Electric Controls Co.
    - d. Viking Corporation.
    - e. Or approved equal.
  - 2. Standard: UL 346.
  - 3. Type: Electrically supervised water-flow switch with retard feature.
  - 4. Components: Single-pole, double-throw switch with normally closed contacts.
  - 5. Design Operation: Rising pressure signals water flow.
- F. Valve Supervisory Switches:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fire-Lite Alarms, Inc.; a Honeywell company.
    - b. Potter Electric Signal Company.
    - c. System Sensor; a Honeywell company.
    - d. Or approved equal.
  - 2. Standard: UL 346.
  - 3. Type: Electrically supervised.
  - 4. Components: Single-pole, double-throw switch with normally closed contacts.
  - 5. Design: Signals that controlled valve is in other than fully open position.
- G. Indicator-Post Supervisory Switches:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Potter Electric Signal Company.
    - b. System Sensor; a Honeywell company.
    - c. Or approved equal.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.12 MANUAL CONTROL STATIONS

- A. Description: UL listed or FM approved, hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve. Include metal enclosure labeled "MANUAL CONTROL STATION" with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.13 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. AMETEK; U.S. Gauge Division.
  2. Ashcroft, Inc.
  3. WIKA Instrument Corporation.
  4. Or approved equal.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 300 psig.

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. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping. Comply with requirements for backflow preventers in Section 22 11 19 "Domestic Water Piping Specialities".
- B. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

**3.3 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors.
- O. Install sleeve seals for piping penetrations of concrete walls and slabs.
- P. 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 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. 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. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- L. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

**3.5 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING**

- A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and with NFPA 13 or NFPA 13R for supports.

**3.6 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. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
  - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

**3.7 SPRINKLER INSTALLATION**

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

**3.8 FIRE-DEPARTMENT CONNECTION INSTALLATION**

- A. Install yard-type, fire-department connections in concrete slab support. Comply with requirements for concrete in Section 03 30 00 "Cast-in-Place Concrete."
  - 1. Install two protective pipe bollards around fire-department connection. Comply with requirements for bollards in Section 05 50 00 "Metal Fabrications."

**3.9 IDENTIFICATION**

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals.

**3.10 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.

- B. Tests and Inspections:
  - 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.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

### 3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

### 3.13 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded grooved ends joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller shall be the following:
  - 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be 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- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 3. Thinwall Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
  - 4. Type L, hard copper tube with plain ends; cast- or wrought-copper solder-joint fittings; and brazed joints.

5. Type L, hard copper tube with roll-grooved ends; copper, grooved-end fittings; grooved-end-tube couplings; and grooved joints.
- E. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be the following:
1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
  2. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
- F. High-pressure, wet-pipe sprinkler system, NPS 4 and smaller, shall be the following:
1. Standard-weight black-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
- G. High-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be the following:
1. Standard-weight black-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
  2. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

### 3.14 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Concealed sprinklers.
  3. Wall Mounting: Sidewall sprinklers.
  4. Spaces Subject to Freezing: Upright sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
  3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  4. Residential Sprinklers: Dull chrome.
  5. Upright and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13



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**SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Stack-sleeve fittings.
  - 3. Sleeve-seal systems.
  - 4. Sleeve-seal fittings.
  - 5. Grout.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

**2.2 STACK-SLEEVE FITTINGS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Smith, Jay R. Mfg. Co.
2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
3. Or approved equal.

B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

### 2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CALPICO, Inc.
2. Metraflex Company (The).
3. Pipeline Seal and Insulator, Inc.
4. Proco Products, Inc.
5. Or approved equal.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel .
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, Stainless steel of length required to secure pressure plates to sealing elements.

### 2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Presealed Systems.
2. Or approved equal.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

### 2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

**3.2 STACK-SLEEVE-FITTING INSTALLATION**

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
  - 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
  - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using grout, seal the space around outside of stack-sleeve fittings.

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

### 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Cast-iron wall sleeves Galvanized-steel wall sleeves Galvanized-steel-pipe.
    - b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe wall sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Galvanized steel pipe wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe wall sleeves with sleeve-seal system.
  - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6 (DN 150): Galvanized steel pipe wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: PVC-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6 (DN 150): PVC-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17

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**SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed and exposed-rivet hinge, and spring-clip fasteners.

**2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:



- a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
  - b. Insulated Piping: One-piece, stamped-steel type with exposed-rivet hinge.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces split-casting brass type with polished, chrome-plated finish.
  - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
  - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
  - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
2. Escutcheons for Existing Piping:
- a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
  - b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge.
  - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
  - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
  - e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated finish.
  - f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One-piece, floor-plate type.
  - 2. Existing Piping: Split-casting, floor-plate type.

### 3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

**SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Bronze lift check valves.
5. Bronze swing check valves.
6. Bronze globe valves.
7. Lubricated plug valves.

**B. Related Sections:**

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

**1.2 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of valve indicated.

1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.

- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.

- G. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hammond Valve.
  - b. Milwaukee Valve Company.
  - c. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded.
  - e. Stem and Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron

- B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Valve, Inc.
  - b. Watts.
  - c. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded.

- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron

**C. Class 150, Bronze Angle Valves with Bronze Disc:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Stockham Division.
  - b. Kitz Corporation.
  - c. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 300 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem and Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron

**D. Class 150, Bronze Angle Valves with Nonmetallic Disc:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Milwaukee Valve Company.
  - e. Watts.
  - f. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 300 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem: Bronze.
  - f. Disc: PTFE or TFE.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron

**2.3 BRASS BALL VALVES**

**A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Kitz Corporation.
  - d. Watts.
  - e. Or approved equal.
  
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Forged brass.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Brass.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

**B. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Kitz Corporation.
  - d. Milwaukee Valve Company.
  - e. Or approved equal.
  
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Forged brass.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

**C. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kitz Corporation.

- b. Red-White Valve Corporation.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- d. Or approved equal.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

D. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Jomar International, LTD.
- b. Kitz Corporation.
- c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- d. Or approved equal.

2. Description:

- a. Standard: MSS SP-110.
- b. SWP Rating: 150 psig.
- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Forged brass.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.4 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.; Apollo Valves.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Milwaukee Valve Company.
- d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

- e. Or approved equal.
2. Description:
- a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.
- B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - d. Or approved equal.
2. Description:
- a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.
- C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. Red-White Valve Corporation.
  - d. Or approved equal.
2. Description:
- a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.



- c. CWP Rating: 600 psig.
- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

**D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.; Apollo Valves.
  - b. Milwaukee Valve Company.
  - c. Watts.
  - d. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Three piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

**2.5 BRONZE LIFT CHECK VALVES**

**A. Class 125, Lift Check Valves with Bronze Disc:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Vertical flow.
  - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
  - e. Ends: Threaded.

- f. Disc: Bronze.

## 2.6 BRONZE SWING CHECK VALVES

### A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Kitz Corporation.
  - e. Milwaukee Valve Company.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - g. Or approved equal.
2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.

### B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Kitz Corporation.
  - e. Milwaukee Valve Company.
  - f. Or approved equal.
2. Description:
  - a. Standard: MSS SP-80, Type 3.
  - b. CWP Rating: 300 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: Bronze.

## 2.7 BRONZE GLOBE VALVES

### A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Stockham Division.
  - c. Kitz Corporation.
  - d. Milwaukee Valve Company.
  - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - f. Or approved equal.
  
2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
  - d. Ends: Threaded or solder joint.
  - e. Stem and Disc: Bronze.
  - f. Packing: Asbestos free.
  - g. Handwheel: Malleable iron, bronze, or aluminum.

**2.8 LUBRICATED PLUG VALVES**

**A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Nordstrom Valves, Inc.
  - b. Or approved equal.
  
2. Description:
  - a. Standard: MSS SP-78, Type II.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short
  - e. Plug: Cast iron or bronze with sealant groove.

**B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Nordstrom Valves, Inc.
  - b. Or approved equal.
  
2. Description:
  - a. Standard: MSS SP-78, Type II.
  - b. CWP Rating: 200 psig.

- c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- d. Pattern: Regular or short
- e. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Homestead Valve; a division of Olson Technologies, Inc.
  - b. Milliken Valve Company.
  - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
  - d. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-78, Type IV.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short
  - e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Homestead Valve; a division of Olson Technologies, Inc.
  - b. Milliken Valve Company.
  - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
  - d. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-78, Type IV.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short
  - e. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Nordstrom Valves, Inc.
  - b. Or approved equal.
- 2. Description:

- a. Standard: MSS SP-78, Type II.
- b. CWP Rating: 400 psig.
- c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
- d. Pattern: Regular or short
- e. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Nordstrom Valves, Inc.
  - b. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-78, Type II.
  - b. CWP Rating: 400 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short
  - e. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Homestead Valve; a division of Olson Technologies, Inc.
  - b. Milliken Valve Company.
  - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
  - d. Or approved equal.
- 2. Description:
  - a. Standard: MSS SP-78, Type IV.
  - b. CWP Rating: 400 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short.
  - e. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Homestead Valve; a division of Olson Technologies, Inc.
  - b. Milliken Valve Company.
  - c. R & M Energy Systems; a unit of Robbins & Myers, Inc.
  - d. Or approved equal.

2. Description:
  - a. Standard: MSS SP-78, Type IV.
  - b. CWP Rating: 400 psig.
  - c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
  - d. Pattern: Regular or short.
  - e. Plug: Cast iron or bronze with sealant groove.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.
  2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.
  3. Lift Check Valves: With stem upright and plumb.

**3.3 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, or plug valves.
  - 2. Butterfly Valve Dead-End Service: Ball or single-flange (lug) type.
  - 3. Throttling Service: Globe valves.
  - 4. Pump-Discharge Check Valves:
    - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  - 7. For Grooved-End Steel Piping: Valve ends may be grooved.

**3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)**

- A. Pipe NPS 2 and Smaller as well as Pipe NPS 2-1/2 (DN 65) and Larger
  - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  - 2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
  - 3. Bronze Lift Check Valves: Class 125, bronze disc.
  - 4. Bronze Swing Check Valves: Class 125, bronze disc.

**3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG)**

- A. Pipe NPS 2 and Smaller as well as Pipe NPS 2-1/2 (DN 65) and Larger

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Two piece, full port, brass or bronze with brass trim.
3. Bronze Lift Check Valves: Class 125, bronze disc.  
Bronze Swing Check Valves: Class 125, bronze disc.

3.7 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller as well as Pipe NPS 2-1/2 (DN 65) and Larger:

1. Bronze and Brass Valves: May be provided with solder-joint ends or threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass or bronze trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Globe Valves: Class 125, bronze disc.

3.8 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Two piece, full port, brass or bronze with brass trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125, NRS.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.

END OF SECTION 22 05 23



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**SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

**B. Related Sections:**

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.

**1.2 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.**

**1.3 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.**
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.**
1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  3. Design seismic-restraint hangers and supports for piping and equipment.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Metal framing systems.
  - 3. Fiberglass strut systems.
  - 4. Pipe stands.
  - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.  
Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper B-Line, Inc.
  - b. Flex-Strut Inc.
  - c. Unistrut Corporation; Tyco International, Ltd.
  - d. Or approved equal.
- 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
- 3. Standard: MFMA-4.
- 4. Channels: Continuous slotted steel channel with inturred lips.
- 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- 7. Metallic Coating: Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anvil International; a subsidiary of Mueller Water Products Inc.
  - b. Empire Industries, Inc.
  - c. Haydon Corporation; H-Strut Division.
  - d. Watts.
  - e. Or approved equal.
- 2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
- 3. Standard: Comply with MFMA-4.
- 4. Channels: Continuous slotted steel channel with inturred lips.
- 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
- 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.  
Coating: Zinc.

**2.4 THERMAL-HANGER SHIELD INSERTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ERICO International Corporation.
  - 2. National Pipe Hanger Corporation.
  - 3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  - 4. Piping Technology & Products, Inc.
  - 5. Or approved equal.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

**2.5 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

**2.6 PIPE STANDS**

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece carbon-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
  - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 2. Base: carbon steel.
  - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

- E. High-Type, Multiple-Pipe Stand:
  - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 2. Bases: One or more; plastic.
  - 3. Vertical Members: Two or more protective-coated-steel channels.
  - 4. Horizontal Member: Protective-coated-steel channel.
  - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

## 2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

## 2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- 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. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 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: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.



- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, 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 noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
  - 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, 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 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, from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
  - 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  - 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 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 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
    2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
  - J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
    2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 piping installations.
  - K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
    2. 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.
    10. 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.
      - b. Medium (MSS Type 32): 1500 lb.
      - c. Heavy (MSS Type 33): 3000 lb.

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.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. 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.
  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 allow 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 allow 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 allow 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.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

- Q. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

**SECTION 22 07 19 - PLUMBING PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Domestic recirculating hot-water piping.
  - 3. Supplies and drains for handicap-accessible lavatories and sinks.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. LEED Submittals:
  - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.
- D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
  - 1. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
  - 2. Jacket Materials for Pipe: 12 inches long by NPS 2.
  - 3. Sheet Jacket Materials: 12 inches square.
  - 4. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.

- B. **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 and test methods employed.
- C. Field quality-control reports.

#### 1.4 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. **Surface-Burning Characteristics:** For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. **Insulation Installed Indoors:** Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. **Insulation Installed Outdoors:** Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. **Supply and Drain Protective Shielding Guards:** ICC A117.1.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Packaging:** Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Pittsburgh Corning Corporation; Foamglas.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.



K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following :
  - a. CertainTeed Corp.; SoftTouch Duct Wrap.
  - b. Johns Manville; Microlite.
  - c. Knauf Insulation; Friendly Feel Duct Wrap.
  - d. Manson Insulation Inc.; Alley Wrap.
  - e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Fibrex Insulations Inc.; Coreplus 1200.
  - b. Johns Manville; Micro-Lok.
  - c. Knauf Insulation; 1000-Degree Pipe Insulation.
  - d. Manson Insulation Inc.; Alley-K.  
Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.

1. Products: Subject to compliance with requirements, provide one of the following :
  - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
  - b. Or as specified by Manufacturer.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following :
  - a. Aeroflex USA, Inc.; Aero seal.

- b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
- 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**2.3 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

- b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following :
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  - 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    - b. Eagle Bridges - Marathon Industries; 550.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    - d. Mon-Eco Industries, Inc.; 55-50.  
Vimasco Corporation; WC-1/WC-5.
  - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

#### 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, provide one of the following :
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  4. Service Temperature Range: 0 to plus 180 deg F.
  5. Color: White.

#### 2.5 SEALANTS

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: Aluminum.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: White.
  6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas Number 10.

- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab.
    - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    - c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Factory cut and rolled to size.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - 3) Tee covers.
    - 4) Flange and union covers.
    - 5) End caps.
    - 6) Beveled collars.
    - 7) Valve covers.
    - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.11 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch or 3/4 inch wide with wing seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch or 3/4 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. C & F Wire.
  - b. Or approved equal.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Plumberex.
    - b. Truebro; a brand of IPS Corporation.
    - c. Or approved equal.
  2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Truebro; a brand of IPS Corporation.
    - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
    - c. Or approved equal.
  2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  1. Install insulation continuously through hangers and around anchor attachments.
  2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe

diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

**B. Insulation Installation on Pipe Flanges:**

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

**3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

**A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.**

**B. Insulation Installation on Pipe Flanges:**

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**3.8 INSTALLATION OF MINERAL-FIBER INSULATION**

**A. Insulation Installation on Straight Pipes and Tubes:**

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

**B. Insulation Installation on Pipe Flanges:**

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.9 INSTALLATION OF POLYOLEFIN INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.10 FIELD-APPLIED JACKET INSTALLATION

#### A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.



3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.11 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect and Resident Engineer. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

### 3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect and Resident Engineer, by removing field-applied jacket and insulation in layers in reverse order of

their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

**3.13 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

**3.14 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Hot and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 3/4 inch thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
    - d. Polyolefin: 3/4 inch (19 mm) thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
    - a. Cellular Glass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 1 inch thick.
    - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
    - d. Polyolefin: 1 inch (25 mm) thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1/2 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
    - c. Polyolefin: 1/2 inch thick.
- C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
  - a. Cellular Glass: 1-1/2 inches thick.
  - b. Flexible Elastomeric: 3/4 inch thick.
  - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - d. Polyolefin: 3/4 inch (19 mm) thick.

3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  1. None.
- D. Piping, Exposed:
  1. None.

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  1. Aluminum, Corrugated: 0.016 inch thick.
- D. Piping, Exposed:
  1. Aluminum, Corrugated: 0.016 inch thick.

END OF SECTION 22 07 19

**SECTION 22 11 16 - DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance:** Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

**1.3 ACTION SUBMITTALS**

**A. Product Data:** For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Water meters.
6. Backflow preventers and vacuum breakers.
7. Water penetration systems.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Water Samples:** Specified in "Cleaning" Article.
- B. Field quality-control reports.**

**1.5 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.**
- B. Comply with NSF 14 for plastic, potable domestic water piping and components.**
- C. Comply with NSF 61 for potable domestic water piping and components.**

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's written permission.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
  - 1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  - 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. Soft copper tube: ASTM B88, Type K (ASTM B88M, Type A) water tube, annealed temper.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Sheet or Tube.
- C. Material: LLDPE film of 0.008-inch minimum thickness.
- D. Color: Black or Natural.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cascade Waterworks Manufacturing.
    - b. Smith-Blair, Inc; a Sensus company.
    - c. Viking Johnson; c/o Mueller Co.
    - d. Or approved equal.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flex-Hose Co., Inc.
  - 2. Flexicraft Industries.
  - 3. Hyspan Precision Products, Inc.
  - 4. Metraflex, Inc.
  - 5. Or approved equal.

- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  - 1. Working-Pressure Rating: Minimum 200 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## 2.8 WATER METERS

- A. Turbine-Type Water Meters:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Company; Water Products Division.
    - b. Schlumberger Limited; Water Division.
    - c. Sensus Metering Systems.
    - d. Or approved equal.
  - 2. Description:
    - a. Standard: AWWA C701.
    - b. Pressure Rating: 150-psig working pressure.
    - c. Body Design: Turbine; totalization meter.
    - d. Registration: In gallons as required by utility company.
    - e. Case: Bronze.
    - f. End Connections for Meters NPS 2 and Smaller: Threaded.
    - g. End Connections for Meters NPS 2-1/2 and Larger: Flanged.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.

- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping adjacent to equipment and specialties to allow service and maintenance.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.
- T. Install thermometers on inlet and outlet piping from each water heater.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors.
- V. Install sleeve seals for piping penetrations of concrete walls and slabs.
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."



### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. 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.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. PEX Piping Joints: Join according to ASTM F 1807.
- G. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. 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 full port ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches. Provide hose bib end cap.
- D. 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. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. 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. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

**3.5 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

**3.6 FLEXIBLE CONNECTOR INSTALLATION**

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install stainless-steel-hose flexible connectors in steel domestic water piping.

**3.7 WATER METER INSTALLATION**

- A. Rough-in domestic water piping for water meter installation according to utility company's requirements.
- B. Water meters will be furnished and installed by utility company.

**3.8 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - 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.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

- D. 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.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.9 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; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
  - 3. 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.

### 3.10 IDENTIFICATION

- A. Label pressure piping with system operating pressure.

### 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  - 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 one day 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 tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

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 a 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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.12 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.
4. 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 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.

3.13 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures 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:
      - a) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 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.

3.14 PIPING SCHEDULE

- 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 and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be the following:
1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:
1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper push-on-joint fittings; and push-on joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; wrought- copper solder-joint fittings; and brazed joints.

### 3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use full port ball valves for piping NPS 2 and smaller. Use ball valves for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use Throttling valves for piping NPS 2 and smaller. Use ball valves for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated and Memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

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**SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose bibbs.
9. Wall hydrants.
10. Drain valves.
11. Water hammer arresters.
12. Trap-seal primer valves.
13. Trap-seal primer systems.

B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping" for water meters.

**1.2 PERFORMANCE REQUIREMENTS**

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

A. Field quality-control test reports.

**1.5 CLOSEOUT SUBMITTALS**

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.



1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Watts Industries, Inc.; Water Products Div.
  - b. Woodford Manufacturing Company.
  - c. Zurn Plumbing Products Group; Wilkins Div.
  - d. Or approved equal.
- 2. Standard: ASSE 1011.
- 3. Body: Bronze, nonremovable, with manual drain.
- 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- 5. Finish: Rough bronze.

B. Laboratory-Faucet Vacuum Breakers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Watts Industries, Inc.; Water Products Div.
  - c. Woodford Manufacturing Company.
  - d. Zurn Plumbing Products Group; Wilkins Div.
  - e. Or approved equal.
- 2. Standard: ASSE 1035.
- 3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
- 4. Body: Bronze.
- 5. End Connections: Threaded.
- 6. Finish: Chrome plated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers BP-1:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. FEBCO; SPX Valves & Controls.
  - b. Watts Industries, Inc.; Water Products Div.
  - c. Zurn Plumbing Products Group; Wilkins Div.
  - d. Or approved equal.
- 2. Standard: ASSE 1013.
  - 3. Operation: Continuous-pressure applications.
  - 4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
  - 5. Size: 2 NPS.
  - 6. Design Flow Rate: 100 gpm.
  - 7. Selected Unit Flow Range Limits: 200 gpm.
  - 8. Pressure Loss at Design Flow Rate: 10 psig for NPS 2 and smaller.
  - 9. Body: Bronze for NPS 2 and smaller and NPS 2-1/2 and larger.
  - 10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 11. Configuration: Designed for horizontal, straight through flow.
  - 12. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

**C. Backflow-Preventer Test Kits:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Div.
  - e. Or approved equal.
- 2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

**2.3 WATER PRESSURE-REDUCING VALVES**

**A. Water Regulators:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Watts Industries, Inc.; Water Products Div.
  - b. Zurn Plumbing Products Group; Wilkins Div.
  - c. Or approved equal.
- 2. Standard: ASSE 1003.
- 3. Pressure Rating: Initial working pressure of 150 psig.
- 4. Size: 4 NPS.
- 5. Design Flow Rate: 180 gpm.

6. Design Inlet Pressure: 110 psig.
7. Design Outlet Pressure Setting: 80 psig.
8. Body: Bronze for all pipe sizes. Valves for Booster Heater Water Supply: Include integral bypass.
9. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

**B. Water Control Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CLA-VAL Automatic Control Valves.  
Watts Industries, Inc.; Ames Fluid Control Systems.
  - b. Watts Industries, Inc.; Watts ACV.  
Zurn Plumbing Products Group; Wilkins Div.  
Or approved equal.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550, interior epoxy coating.
  - a. Size: 4 NPS.
  - b. Pattern: Globe-valve design.
  - c. Trim: Stainless steel.
5. Design Flow: 180 gpm.
6. Design Inlet Pressure: 110 psig.
7. Design Outlet Pressure Setting: 80 psig.
8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

**2.4 BALANCING VALVES**

**A. Copper-Alloy Calibrated Balancing Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Flo Fab Inc.
  - c. ITT Industries; Bell & Gossett Div.  
Watts Industries, Inc.; Water Products Div.
  - d. Or approved equal.
2. Type: Ball valve with two readout ports and memory setting indicator.
3. Body: Brass.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

**B. Cast-Iron Calibrated Balancing Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Flo Fab Inc.
  - c. ITT Industries; Bell & Gossett Div.
  - d. Watts Industries, Inc.; Water Products Div.
  - e. Or approved equal.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 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. Milwaukee Valve Company.
  - e. Or approved equal.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

## 2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Lawler Manufacturing Company, Inc.
  - b. Leonard Valve Company.
  - c. Powers; a Watts Industries Co.
  - d. Watts Industries, Inc.; Water Products Div.  
Zurn Plumbing Products Group; Wilkins Div.
  - e. Or approved equal.
2. Standard: ASSE 1016, thermostatically controlled water tempering valve.

3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 80 deg F.
9. Tempered-Water Design Flow Rate: 1.5 gpm.

## 2.6 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 or larger for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.033 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve.

## 2.7 OUTLET BOXES

### A. Icemaker/Supply Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. IPS Corporation.
  - c. LSP Products Group, Inc.
  - d. Oatey.
  - e. Or approved equal.
2. Mounting: Recessed.
3. Material and Finish: Plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 ball valve and NPS 1/2 copper, water tubing.

## 2.8 HOSE BIBBS

### A. Hose Bibbs HB-1:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.

3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.9 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.10 TRAP-SEAL PRIMER VALVES

### A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. PPP Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Watts Industries, Inc.; Water Products Div.
  - e. Or approved equal.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

**B. Drainage-Type, Trap-Seal Primer Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - b. Or approved equal.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

**2.11 INDUSTRIAL WATER FAUCETS**

- a. Industrial Water Faucet: deck mounted, 6-inch vacuum breaker gooseneck spout with outlet fittings as indicated above, 4-inch lever handles; Chicago 930-317SAM-GN2BVB-E7CP929CP-317- GN2AH13--E7JKCP, T&S Brass, or equal. Faucet should be placed center back of sink.
- b. Flow Controls for Laboratory Sinks, Faucets: Provide 2.0 gpm integral flow controls in aerators or base of faucet spouts.
- c. Faucet spout outlet fittings; provide interchangeable fittings for each sink: A non-aerator, laminar flow type; pressure compensating; low noise; non-splash; chrome plated brass; 2.0 gpm for sinks; Chicago E29; Chronomite "Omni" Series 200, Eco-Flow or equal.
- d. Serrated hose tip; 0.75 gpm flow control; chrome plated brass; Chicago E7-FC.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass piping with isolation valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves and bypass with ball valve. Install pressure gages on inlet and outlet.

- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install thermometers and water regulators if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump.
- H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated- blocking wall reinforcement between studs.
- I. Install water hammer arresters in water piping according to PDI-WH 201.
- J. Install air vents at high points of water piping.
- K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- L. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- M. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.



- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19

**SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Pipe, tube, and fittings.

**1.2 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.

**B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.**

**1.3 ACTION SUBMITTALS**

**A. Product Data: For each type of product indicated.**

**1.4 INFORMATIONAL SUBMITTALS**

**A. Seismic Qualification Certificates: For waste and vent piping, 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. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

**B. Field quality-control reports.**

**1.5 QUALITY ASSURANCE**

**A. Piping materials shall bear label, stamp, or other markings of specified testing agency.**

**B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.**

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Fernco Inc.
    - c. Matco-Norca, Inc.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Or approved equal.
  - 2. Standards: ASTM C 1277 and CISPI 310.
  - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Clamp-All Corp.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
    - d. Or approved equal.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MG Piping Products Company.
  - b. Or approved equal.
2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
  1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping.
- K. 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 two 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.
- L. 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.
- M. 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: 1 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- N. 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."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Install underground PVC piping according to ASTM D 2321.

- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### 3.2 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### 3.3 VALVE INSTALLATION

- A. General valve installation requirements are specified in Section 22 05 23 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
  - 1. Install shutoff valve on each sewage pump discharge.
  - 2. Install full-port ball valve for piping NPS 2 and smaller.
  - 3. Install full-port ball 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 backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
  - 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.
  - 4. Comply with requirements for backwater valve specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

**3.4 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
  - 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
  - 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 6. Install individual, straight, horizontal piping runs:
    - 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.
  - 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. 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 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
  - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

**3.5 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. Install horizontal backwater valves with cleanout cover flush with floor.
  6. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
  7. 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. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.

### 3.7 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.



2. 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.

### 3.8 CLEANING AND PROTECTION

- 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.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

### 3.9 PIPING SCHEDULE

- 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 the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 and smaller shall be the following:
  1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

- E. Aboveground, vent piping NPS 5 and larger shall be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
  - 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- G. Underground, soil and waste piping NPS 5 and larger shall be the following:
  - 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 22 13 16

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**SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Roof flashing assemblies.
5. Through-penetration firestop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.

**1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

**1.3 ACTION SUBMITTALS**

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  1. Wiring Diagrams: Power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

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.

B. Field quality-control test reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

#### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

### PART 2 - PRODUCTS

#### 2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
    - c. Tyler Pipe; Wade Div.
    - d. Watts Drainage Products Inc.
    - e. Zurn Plumbing Products Group; Specification Drainage Operation.
    - f. Or approved equal.
  2. Standard: ASME A112.14.1.

3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted access check valve.
6. End Connections: Hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

## 2.2 CLEANOUTS

### A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
  - f. Or approved equal.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Raised-head, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

### B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Zurn Plumbing Products Group; Light Commercial Operation.  
Zurn Plumbing Products Group; Specification Drainage Operation.
  - f. Or approved equal.
2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: Threaded.
8. Closure: Cast-iron plug.

9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Rough bronze.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Lighter Medium Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

**C. Cast-Iron Wall Cleanouts:**

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Tyler Pipe; Wade Div.
  - d. Watts Drainage Products Inc.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
  - f. Or approved equal.
2. Standard: ASME A112.36.2M. Include wall access.
  3. Size: Same as connected drainage piping.
  4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  5. Closure: Raised-head, cast-iron plug.
  6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
  8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

**2.3 FLOOR DRAINS**

**A. Cast-Iron Floor Drains FD-1:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  - h. Or approved equal.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Not required.
6. Anchor Flange: Required.
7. Clamping Device: Not required.
8. Outlet: Bottom.
9. Backwater Valve: Not required.

10. Coating on Interior and Exposed Exterior Surfaces: Not required.
11. Sediment Bucket: Not required.
12. Top or Strainer Material: Nickel bronze.
13. Top Shape: Round.
14. Dimensions of Top or Strainer:
15. Top Loading Classification: Medium Duty.
16. Funnel: Not required.
17. Inlet Fitting: Not required.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.
20. Trap Features: Trap-seal primer valve drain connection.

## 2.4 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Acorn Engineering Company; Elmdor/Stoneman Div.
- b. Thaler Metal Industries Ltd.
- c. Or approved equal.

- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

## 2.5 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

### A. Through-Penetration Firestop Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. ProSet Systems Inc.
- b. Or approved equal.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.



2.6 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch- minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

**2.7 FLASHING MATERIALS**

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
  - 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
  - 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Applications: 12 oz./sq. ft.
  - 2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

**2.8 MOTORS**

- A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Equipment Mounting: Install chemical neutralization tank on concrete equipment base(s). Comply with requirements for equipment bases specified in Division 03 Section
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct bases to withstand, without damage to equipment, seismic force required by code.
  3. Construct concrete bases 4 inches high and extend base not less than 6 inches in all directions beyond the maximum dimensions of the chemical neutralization tank, unless otherwise indicated or unless required for seismic anchor support.
  4. Minimum Compressive Strength: 3000 psi at 28 days.
  5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  6. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
  7. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  8. Install anchor bolts to elevations required for proper attachment to supported equipment.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.
- I. Assemble open drain fittings and install with top of hub 2 inches above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof in applicable climate zones. Maintain 1-inch clearance between vent pipe and roof substrate.
- O. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- P. Install wood-blocking reinforcement for wall-mounting-type specialties.
- Q. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Grease interceptors.
  2. Oil interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

**SECTION 22 41 00 - RESIDENTIAL PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Faucets.
  - 2. Lavatories.
  - 3. Kitchen sinks.
  - 4. Laundry trays.
  - 5. Dishwasher air-gap fittings.
  - 6. Disposers.
  - 7. Toilet seats.
  - 8. Supply fittings.
  - 9. Waste fittings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.
- B. Sample Warranty: For special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For plumbing fixtures and faucets to include in emergency, operation, and operation and maintenance manuals.
  - 1. Servicing and adjustments of whirlpool baths and walk-in baths.

PART 2 - PRODUCTS

2.1 LAVATORIES

- A. Lavatories: Oval, vitreous china, counter mounted.
  - 1. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.
    - b. Type: Self-rimming.
    - c. Oval Nominal Size: 20 by 17 inches (508 by 432 mm).
    - d. Faucet-Hole Punching: One hole.
    - e. Faucet-Hole Location: None.
    - f. Color: White.

2.2 LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Single-control mixing valve.
  - 1. Standard: ASME A112.18.1/CSA B125.1.
  - 2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
  - 3. Body Material: General-duty, copper or brass underbody with brass cover plate.
  - 4. Finish: Polished brass.
  - 5. Maximum Flow Rate: 2.2 gpm (8.3 L/min).
  - 6. Centers: Single hole.
  - 7. Mounting: Deck, exposed.
  - 8. Valve Handle(s): Lever.
  - 9. Inlet(s): NPS 3/8 (DN 10) tubing, with NPS 1/2 (DN 15) male adaptor.
  - 10. Spout: Rigid.
  - 11. Spout Outlet: Aerator Spray, 0.5 gpm (1.5 L/min.).
  - 12. Operation: Self-closing, metering.
  - 13. Drain: Pop up.

2.3 KITCHEN SINKS

- A. Kitchen Sinks: Two bowl, counter mounted, stainless steel.
  - 1. Stainless-Steel Kitchen Sinks:
  - 2. Fixture:
    - a. Standard: ASME A112.19.1/CSA B45.2 for enameled-steel kitchen sinks.
    - b. Standard: ANSI Z124.3 for PMMA kitchen sinks.
    - c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface kitchen sinks.
    - d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
    - e. Metal Thickness: 0.038 inch (1.0 mm).

- f. Left Bowl:
  - 1) Drain: 3-1/2-inch (89-mm) grid with offset waste outlet for disposer.
    - a) Location: Near back of bowl.
- g. Right Bowl:
  - 1) Drain: 3-1/2-inch (89-mm) grid.
    - a) Location: Near back of bowl.

3.

## 2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install counter-mounting fixtures in and attached to casework.
- C. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  - 1. Exception: Use ball or gate valves if supply stops are not specified with fixture.



- D. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- E.
- F. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes unless otherwise indicated.
- G. Install disposer in outlet of each sink indicated to have a disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- H. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.
- I. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."
- J. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- K. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

### 3.4 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 41 00

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**SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes basic requirements for factory-installed motors.

**1.2 DEFINITIONS**

- A. **Factory-Installed Motor:** A motor installed by motorized-equipment manufacturer as a component of equipment.
- B. **Field-Installed Motor:** A motor installed at Project site and not factory installed as an integral component of motorized equipment.

**1.3 SUBMITTALS**

- A. **Manufacturer Seismic Qualification Certification:** Submit certification that motors, accessories, and components will withstand seismic forces. Include the following:
  - 1. **Basis for Certification:** Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. 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."
  - 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.**
- B. **LEED Submittals:** Provide cost data breakdown, recycle content and manufacturer.
- C. **Qualification Data:** For testing agency.
- D. **Source quality-control test reports.**
- E. **Field quality-control test reports.**

**1.4 QUALITY ASSURANCE**

- A. **Testing Agency Qualifications:** An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain field-installed motors through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

### 1.5 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
  1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multi-speed controllers.
    - c. Reduced-voltage controllers.
  2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  3. Matched to torque and horsepower requirements of the load.
  4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

## PART 2 - PRODUCTS

### 2.1 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-and field-installed motors except as follows:
  1. Different ratings, performance, or characteristics for motor are specified in another Section.
  2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

**2.2 MOTOR CHARACTERISTICS**

- A. Motors 1/2 HP and Larger: Three phase.
- B. Motors Smaller Than 1/2 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open drip-proof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open drip-proof or totally enclosed.

**2.3 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.
- C. Stator: Copper windings, unless otherwise indicated.
  - 1. Multi-speed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  - 1. Finish: Gray enamel.

**2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS**

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Designed with critical vibration frequencies outside operating range of controller output.
  - 2. Temperature Rise: Matched to rating for Class B insulation.
  - 3. Insulation: Class H.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

**2.5 SINGLE-PHASE MOTORS**

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split-phase start, capacitor run.
  - 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine roughing-in for conduit systems to verify actual locations of conduit connections before motor installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION 23 05 13

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Sleeves.
  2. Sleeve-seal systems.
  3. Sleeve-seal fittings.
  4. Grout.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Advance Products & Systems, Inc.
  2. CALPICO, Inc.
  3. Metraflex Company (The).
  4. Pipeline Seal and Insulator, Inc.
  5. Proco Products, Inc.
  6. Thunderline Link Seal
  7. Or approved aqual.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  2. Pressure Plates: Stainless steel or carbon steel.
  3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or Stainless steel of length required to secure pressure plates to sealing elements.



**2.3 SLEEVE-SEAL FITTINGS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by the following:
  - 1. Presealed Systems.
  - 2. Or approved equal.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

**2.4 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 07 84 13 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

### 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6 galvanized steel wall sleeve, sleeve seal system or sleeve seal fittings.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:
  - a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6: Galvanized steel sleeve or Sleeve-seal fittings.
5. Interior Partitions:
  - a. Piping Smaller Than NPS 6: Galvanized steel sleeve.

END OF SECTION 23 05 17

**SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Pipe positioning systems.
  - 8. Equipment supports.
  
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 23 Section "Metal Ducts" for duct hangers and supports.

**1.2 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
  
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

- A. Product Data

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.
  - 3. Grinnell Corp.
  - 4. National Pipe Hanger Corporation.
  - 5. PHD Manufacturing, Inc.
  - 6. PHS Industries, Inc.
  - 7. Piping Technology and Products, Inc.
  - 8. Tolco, Inc.
  - 9. Or approved equal.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. Power-Strut Div.; Tyco International, Ltd.
  - 4. Unistrut Corp.; Tyco International, Ltd.
  - 5. Thomas & Betts Corporation
  - 6. Tolco, Inc.

7. Or approved equal.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

#### 2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. Pipe Shields, Inc.
3. Rilco Manufacturing Company, Inc.
4. Or approved equal.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

#### 2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

#### 2.6 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
  - 1. Base: Plastic.
  - 2. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
  - 3. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
  - 1. Bases: One or more plastic.
  - 2. Vertical Members: Two or more protective-coated-steel channels.
  - 3. Horizontal Member: Protective-coated-steel channel.
  - 4. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

## 2.7 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

## 2.8 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, 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 noninsulated stationary pipes, NPS 3/4 to NPS 8.
  - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  - 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  - 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, 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, 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, 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, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, 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, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. 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.
  10. 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.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  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.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.
- ### 3.2 HANGER AND SUPPORT INSTALLATION
- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified 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 D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Sections for roof accessories and curbs.
- G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Sections for plumbing fixtures.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- O. 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.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 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: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 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 overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

**3.4 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 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 Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

**3.6 PAINTING**

- A. Touch 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 minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

**SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes mechanical identification materials and devices.

**1.2 SUBMITTALS**

- A. Product Data: For identification materials and devices.
- B. Samples: Of color, lettering style, and graphic representation required for each identification material and device.

**1.3 QUALITY ASSURANCE**

- A. Comply with ASME A13.1, "Scheme for the Identification of Piping Systems" for lettering size, length of color field, colors, and viewing angles of identification devices.

**1.4 SEQUENCING AND SCHEDULING**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 - PRODUCTS**

**2.1 IDENTIFYING DEVICES AND LABELS**

- A. General: Products specified are for applications referenced in other Division 23 Sections. If more than single type is specified for listed applications, selection is Installer's option.
- B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.
  - 1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
  - 2. Location: Accessible and visible.
- C. Stencils: Standard stencils, prepared with letter sizes conforming to recommendations of ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Fiberboard or metal.
  2. Stencil Paint: Exterior, oil-based, alkyd gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
  3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.
- D. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive, vinyl type with permanent adhesive.
- F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.
- G. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers, at least 3 times letter height and of length required for label.
- H. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
1. Arrows: Either integrally with piping system service lettering, to accommodate both directions, or as separate unit, on each pipe marker to indicate direction of flow.
- I. Plastic Duct Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cold-air supply.
  2. Blue: Exhaust, return, and mixed air.
  3. Hazardous Material Exhausts: Use colors and designs recommended by ASME A13.1.
  4. Terminology: Include direction of airflow; duct service such as supply, return, and exhaust; duct origin, duct destination, and design flow.
- J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive, vinyl tape, at least 3 mils thick.
1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
  2. Color: Comply with ASME A13.1, unless otherwise indicated.
- K. Access Panel Markers: 1/16-inch- thick, engraved plastic-laminate markers, with abbreviated terms and numbers corresponding to concealed valve. Provide 1/8-inch center hole for attachment.
- L. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.

2. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  3. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- M. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:
1. Green: Cooling equipment and components.
  2. Yellow: Heating equipment and components.
  3. Blue: Equipment and components that do not meet criteria above.
  4. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
  5. Terminology: Match schedules as closely as possible. Include the following:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  6. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- N. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.
1. Size: 3-1/4 by 5-5/8 inches.
  2. Fasteners: Brass grommets and wire.
  3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- O. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of mechanical systems and equipment.
1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

## PART 3 - EXECUTION

### 3.1 LABELING AND IDENTIFYING PIPING SYSTEMS

- A. Install pipe markers on each system. Include arrows showing normal direction of flow.
- B. Marker Type: Stenciled markers complying with ASME A13.1.
- C. Marker Type: Plastic markers, with application systems. Install on pipe insulation segment where required for hot, noninsulated pipes.



- D. Fasten markers on pipes and insulated pipes smaller than 6 inches OD by one of following methods:
  - 1. Snap-on application of pretensioned, semirigid plastic pipe marker.
  - 2. Adhesive lap joint in pipe marker overlap.
  - 3. Laminated or bonded application of pipe marker to pipe or insulation.
  - 4. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 3/4 inch wide, lapped a minimum of 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
  
- E. Fasten markers on pipes and insulated pipes 6 inches in diameter and larger by one of following methods:
  - 1. Laminated or bonded application of pipe marker to pipe or insulation.
  - 2. Taped to pipe or insulation with color-coded plastic adhesive tape, not less than 1-1/2 inches wide, lapped a minimum of 3 inches at both ends of pipe marker, and covering full circumference of pipe.
  - 3. Strapped to pipe or insulation with manufacturer's standard stainless-steel bands.
  
- F. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations according to the following:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
  - 3. Near penetrations through walls, floors, ceilings, or nonaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at a maximum of 50-foot intervals along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

**3.2 EQUIPMENT SIGNS AND MARKERS**

- A. Install engraved plastic-laminate signs or equipment markers on or near each major item of mechanical equipment. Include signs for the following general categories of equipment:
  - 1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
  - 2. Fire department hose valves and hose stations.
  - 3. Meters, gages, thermometers, and similar units.
  - 4. Fuel-burning units, including boilers, and heaters.
  - 5. Pumps and similar motor-driven units.
  - 6. Coils, evaporators, and similar equipment.
  - 7. Fans, blowers, primary balancing dampers, and mixing boxes.
  - 8. Packaged central-station air handling units and zone-type units.
  - 9. Tanks and pressure vessels.

10. Strainers, filters, water-treatment systems, and similar equipment.
- B. Optional Sign Types: Stenciled signs may be provided instead of engraved plastic, at Installer's option, where lettering larger than 1-inch high is needed for proper identification because of distance from normal location of required identification.
1. Lettering Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Terms on Signs: Distinguish between multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- C. Plasticized Tags: Install within concealed space, to reduce amount of text in exposed sign outside concealment, if equipment to be identified is concealed above acoustical ceiling or similar concealment.
1. Identify operational valves and similar minor equipment items located in unoccupied spaces, including machine rooms, by installing plasticized tags.
- D. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows showing service and direction of flow.
1. Location: Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 05 53

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SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
  - 1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
  - 2. Adjusting total HVAC systems to provide indicated quantities.
  - 3. Measuring electrical performance of HVAC equipment.
  - 4. Setting quantitative performance of HVAC equipment.
  - 5. Verifying that automatic control devices are functioning properly.
  - 6. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
  - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
  - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.2 DEFINITIONS

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.
- F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
- G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
- H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

- I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- K. Test: A procedure to determine quantitative performance of a system or equipment.
- L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- M. AABC: Associated Air Balance Council.
- N. AMCA: Air Movement and Control Association.
- O. CTI: Cooling Tower Institute.
- P. NEBB: National Environmental Balancing Bureau.
- Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

### 1.3 SUBMITTALS

- A. Quality-Assurance Submittals: Submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Strategies and Procedures Plan: Submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.

### 1.4 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's and Resident Engineer's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the

participation of testing, adjusting, and balancing team members, HVAC controls Installer, and other support personnel.

1. Agenda Items: Include at least the following:
    - a. Submittal distribution requirements.
    - b. Contract Documents examination report.
    - c. Testing, adjusting, and balancing plan.
    - d. Work schedule and Project site access requirements.
    - e. Coordination and cooperation of trades and subcontractors.
    - f. Coordination of documentation and communication flow.
  - C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
    1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
    2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
  - D. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or AABC's National Standard for Testing, Adjusting and Balancing.
  - E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification" or AABC's national standards
  - F. Instrumentation Calibration: Calibrate instruments at least every year.
- 1.5 COORDINATION
- A. Coordinate the efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
  - B. Notice: Provide advance notice for each test. Include scheduled test dates and times.
  - C. Perform testing, adjusting, and balancing after leakage and pressure tests on air distribution systems have been satisfactorily completed.
- 1.6 COMMISSIONING
- A. Testing Adjusting and Balancing:
    1. Commissioning requires the participation of Division 23 Testing, Adjusting, and Balancing to ensure that all systems are operating in a manner consistent with the construction documents and the design intent. The general commissioning requirements and coordination are detailed in Division 1 and Division 23. Contractor shall be familiar with all parts of Division 1 and 23 and the commissioning plan issued

by the Commissioning Provider and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

2. The test and balance contractor is responsible for assisting the commissioning agent throughout the entire commissioning process. This includes assistance with reading airflows, water flows, taking pressure measurements, temperature measurements, and providing any other readings requested by the commissioning agent related to the commissioned equipment.
3. The test and balance work is not complete until the commissioning agent and the University have signed off on the commissioned systems.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
  1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
  2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Architect's and Resident Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- D. Examine equipment performance data, including fan curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- F. Examine system and equipment test reports.
- G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine fan coil units to verify that they are accessible and their controls are connected and functioning.
- K. Examine plenums, utilized for outside air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine equipment for installation and for properly operating safety interlocks and controls.
- N. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices operate by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions.
  - 4. Automatic modulating and shutoff valves are properly connected.
  - 5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to design values.
- O. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

### 3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Isolating and balancing valves are open and control valves are operational.
  - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.



7. Windows and doors can be closed so design conditions for system operations can be met.

### 3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards (or NEBB's "Procedural Standards for Testing Adjusting, and Balancing of Environmental Systems") and this Section.
- B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section or AABC's national standards and this section.
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- A. Prepare test reports for both fans and outlets. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- C. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- D. Check dampers for proper position to achieve desired airflow path.
- E. Check for airflow blockages.
- F. Check condensate drains for proper connections and functioning.

### 3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

- A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems. Additional procedures are required for variable-air-volume, and process exhaust-air systems. These additional procedures are specified in other articles in this Section.
- B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.
  1. Measure fan static pressures to determine actual static pressure as follows:

- a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
  - b. Measure static pressure directly at the fan outlet or through the flexible connection.
  - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
  - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Measure static pressure across each air-handling unit component.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage modes to determine the maximum.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- D. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
- E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.

### 3.6 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Nameplate and measured voltage, each phase.
5. Nameplate and measured amperage, each phase.
6. Starter thermal-protection-element rating.

3.7 TOLERANCES

- A. Set HVAC system airflow rates within the following tolerances:
1. Supply, Return and Exhaust Fans: 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.9 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
1. Fan curves.
  2. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
1. Title page.
  2. Name and address of testing, adjusting, and balancing Agent.
  3. Project name.

4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of testing, adjusting, and balancing Agent who certifies the report.
  10. Summary of contents, including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
  11. Nomenclature sheets for each item of equipment.
  12. Data for terminal units, including manufacturer, type size, and fittings.
  13. Notes to explain why certain final data in the body of reports vary from design values.
- E. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
  2. Duct, outlet, and inlet sizes.
  3. Pipe and valve sizes and locations.
  4. Balancing stations.
- F. Air-Handling Unit Test Reports: For air-handling and fan coil units with coils, include the following:
1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Sheave dimensions, center-to-center and amount of adjustments in inches.
    - j. Number of belts, make, and size.
    - k. Number of filters, type, and size.
  2. Motor Data: Include the following:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
  3. Test Data: Include design and actual values for the following:

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Cooling coil static-pressure differential in inches wg.
- g. Heating coil static-pressure differential in inches wg.
- h. Outside airflow in cfm.
- i. Return airflow in cfm.
- j. Outside-air damper position.
- k. Return-air damper position.

**G. Fan Test Reports:** For supply and exhaust fans, include the following:

- 1. Fan Data: Include the following:
  - a. System identification.
  - b. Location.
  - c. Make and type.
  - d. Model number and size.
  - e. Manufacturer's serial number.
  - f. Arrangement and class.
  - g. Sheave make, size in inches, and bore.
  - h. Sheave dimensions, center-to-center and amount of adjustments in inches.
- 2. Motor Data: Include the following:
  - a. Make and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
  - g. Number of belts, make, and size.
- 3. Test Data: Include design and actual values for the following:
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.

**H. Round, Flat-Oval, and Rectangular Duct Traverse Reports:** Include a diagram with a grid representing the duct cross-section and record the following:

- 1. Report Data: Include the following:
  - a. System and air-handling unit number.
  - b. Location and zone.
  - c. Traverse air temperature in deg F.

- d. Duct static pressure in inches wg.
  - e. Duct size in inches.
  - f. Duct area in sq. ft.
  - g. Design airflow rate in cfm.
  - h. Design velocity in fpm.
  - i. Actual airflow rate in cfm.
  - j. Actual average velocity in fpm.
- I. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, include the following:
- 1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Unit make and model number.
    - d. Manufacturer's compressor serial numbers.
    - e. Compressor make.
    - f. Compressor model and serial numbers.
    - g. Refrigerant weight in lb.
    - h. Low ambient temperature cutoff in deg F.
  - 2. Test Data: Include design and actual values for the following:
    - a. Entering-air, dry-bulb temperature in deg F.
    - b. Leaving-air, dry-bulb temperature in deg F.
    - c. Control settings.
    - d. Unloader set points.
    - e. Low-pressure-cutout set point in psig.
    - f. High-pressure-cutout set point in psig.
    - g. Suction pressure in psig.
    - h. Suction temperature in deg F.
    - i. Condenser refrigerant pressure in psig.
    - j. Condenser refrigerant temperature in deg F.
    - k. Oil pressure in psig.
    - l. Oil temperature in deg F.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. The kW input.
    - p. Crankcase heater kW.
    - q. Number of fans.
    - r. Condenser fan rpm.
    - s. Condenser fan airflow rate in cfm.
    - t. Condenser fan motor make, frame size, rpm, and horsepower.
    - u. Condenser fan motor voltage at each connection.
    - v. Condenser fan motor amperage for each phase.
- J. Instrument Calibration Reports: For instrument calibration, include the following:
- 1. Report Data: Include the following:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

END OF SECTION 23 05 93

**SECTION 23 07 13 - DUCT INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes semirigid and flexible duct, and plenum, insulation; insulating cements; accessories and attachments; and sealing compounds.

**1.2 SUBMITTALS**

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

**1.3 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.
- B. 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.

**1.4 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.

**1.5 COORDINATION**

- A. Coordinate clearance requirements with duct Installer for insulation application.

**1.6 SCHEDULING**

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

**PART 2 - PRODUCTS**



**2.1 MANUFACTURERS**

- A. 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.
    - e. Or approved equal.

**2.2 INSULATION MATERIALS**

- A. 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.

**2.3 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.
  - 1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
  - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
  - 2. Galvanized Steel: 0.005 inch thick.
  - 3. Nickel-Copper Alloy: 0.005 inch thick.
- C. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
- D. 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 and plenums; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.

**2.4 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.

**3.3 GENERAL APPLICATION REQUIREMENTS**

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. **Hangers and Anchors:** Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. **Insulation Terminations:** For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
  2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
  3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
  2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.
- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
1. Seal penetrations with vapor-retarder mastic.
  2. Apply insulation for exterior applications tightly joined to interior insulation ends.
  3. Seal insulation to roof flashing with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

### 3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

- d. Do not overcompress insulation during installation.
4. Impale insulation over anchors and attach speed washers.
5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

### 3.5 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 09 Painting Sections.
- B. Color: Final color as selected by Architect and Resident Engineer. Vary first and second coats to allow visual inspection of the completed Work.

### 3.6 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
  1. Indoor concealed supply-, return-, and outside-air ductwork.
  2. Indoor exposed supply-, return-, and outside-air ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  1. Fibrous-glass ducts.
  2. Metal ducts with duct liner.
  3. Factory-insulated flexible ducts.

4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
5. Flexible connectors.
6. Vibration-control devices.
7. Testing agency labels and stamps.
8. Nameplates and data plates.
9. Access panels and doors in air-distribution systems.

**3.7 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE**

- A. Service: Round, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.
- B. Service: Round, return-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 1 inch.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.
- C. Service: Rectangular, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.
- D. Service: Rectangular, return-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 1 inch.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.
- E. Service: Round, supply-air ducts, exposed, in non-conditioned room.
1. Material: Mineral-fiber blanket.
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.
- F. Service: Round, return-air ducts, exposed, in non-conditioned room.
1. Material: Mineral-fiber blanket.
  2. Thickness: 1 inch.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.

G. Service: Rectangular, supply-air ducts, exposed, in non-conditioned room.

1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches.
3. Number of Layers: One.
4. Vapor Retarder Required: Yes.

H. Service: Rectangular, return-air ducts, exposed, in non-conditioned room.

1. Material: Mineral-fiber blanket.
2. Thickness: 1 inch.
3. Number of Layers: One.
4. Vapor Retarder Required: No.

END OF SECTION 23 07 13

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**SECTION 23 07 19 - HVAC PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
  - 1. Refrigerant suction and hot-gas piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section 23 07 13 "Duct Insulation."

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

**1.3 INFORMATIONAL SUBMITTALS**

- A. 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 and test methods employed.

**1.4 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.



1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. CertainTeed Corp.; SoftTouch Duct Wrap.
  - b. Johns Manville; Microlite.
  - c. Knauf Insulation; Friendly Feel Duct Wrap.
  - d. Manson Insulation Inc.; Alley Wrap.
  - e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fibrex Insulations Inc.; Coreplus 1200.
  - b. Johns Manville; Micro-Lok.
  - c. Knauf Insulation; 1000-Degree Pipe Insulation.
  - d. Manson Insulation Inc.; Alley-K.
  - e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
  - b. Eagle Bridges - Marathon Industries; 225.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
  - d. Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    - b. Eagle Bridges - Marathon Industries; 501.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    - d. Mon-Eco Industries, Inc.; 55-10.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F.
  4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    - b. Eagle Bridges - Marathon Industries; 570.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
  2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F.
  4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    - b. Eagle Bridges - Marathon Industries; 550.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    - d. Mon-Eco Industries, Inc.; 55-50.
    - e. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: 60 percent by volume and 66 percent by weight.

5. Color: White.

## 2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
  4. Service Temperature Range: 0 to plus 180 deg F.
  5. Color: White.

## 2.6 SEALANTS

- A. Joint Sealants:
  1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
  2. Joint Sealants for Polystyrene Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-70.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F.
6. Color: White or gray.
7. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
8. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**B. FSK and Metal Jacket Flashing Sealants:**

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:**

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
3. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.



2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Pittsburgh Corning Corporation; Pittwrap.
    - b. Polyguard Products, Inc.; Insulrap No Torch 125.
- E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Polyguard Products, Inc.; Alumaguard 60.
- F. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film.
- G. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Chemical Company (The); Saran 560 Vapor Retarder Film.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ABI, Ideal Tape Division; 488 AWF.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
  - c. Compac Corporation; 120.
  - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 6 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C & F Wire.
    - b. Or approved equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches 4 inches o.c.

- a. For below-ambient services, apply vapor-barrier mastic over staples.
- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Manholes.
  - 5. Handholes.
  - 6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

- install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and

replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:



1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**3.7 INSTALLATION OF MINERAL-FIBER INSULATION**

**A. Insulation Installation on Straight Pipes and Tubes:**

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

**B. Insulation Installation on Pipe Flanges:**

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presizes jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

### 3.9 FINISHES

- A. Pipe Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
  1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect and Resident Engineer. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect and Resident Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe,

three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

**3.11 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

**3.12 INDOOR PIPING INSULATION SCHEDULE**

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Refrigerant Suction and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 3/4 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

**3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Refrigerant Suction and Hot-Gas Piping:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. PVC: 30 mils thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 23 07 19

**SECTION 23 08 00 - MECHANICAL SYSTEMS COMMISSIONING**

**PART 1 - GENERAL**

**1.1 RESPONSIBILITIES**

- A. Mechanical, Controls, and Test and Balance (TAB) subcontractors: The commissioning responsibilities applicable to each of the subcontractors are as follows (all references apply to commissioned equipment only):
1. Attend a commissioning kickoff meeting and other meetings necessary to facilitate the commissioning process.
  2. Provide the commissioning agent with normal cut sheets and submittals of commissioned equipment.
  3. Provide additional requested documentation, prior to normal O&M manual submittals, to the commissioning agent for development of start-up and functional testing procedures.
  4. Provide a copy of the O&M manuals and submittals of commissioned equipment to the commissioning agent for review.
  5. Sub-Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
  6. Sub-Contractors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
  7. Execute the mechanical and electrical-related portions of the pre-functional checklists for all commissioned equipment.
  8. Perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the commissioning agent.
  9. Address current Engineer of Record punch list items before functional testing. TAB shall be completed with discrepancies and problems remedied before functional testing.
  10. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests for sufficient duration to complete the necessary tests, adjustments and problem-solving.
  11. Correct deficiencies identified by the commissioning agent, Owner's Representative and Engineer of Record and retest the equipment.
  12. Prepare O&M manuals according to the Contract Documents.
  13. Provide training of the Owners Representative's operating staff.
  14. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- B. Mechanical Contractor. The responsibilities of the mechanical contractor, during construction and acceptance phases in addition to those listed in the above Section (A) are:
1. Provide startup for all HVAC equipment.
  2. Assist and cooperate with the TAB contractor and commissioning agent by:
    - a. Putting all HVAC equipment and systems into operation as required.
    - b. Including cost of sheaves and belts that may be required by TAB.

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- c. Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Provide an approved plug.
    - d. Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.
  3. Prepare a preliminary schedule for Division 23 pipe system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the commissioning agent. Update the schedule as appropriate.
  4. Notify the Owner's Representative when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur.
  5. Assist with functional testing on locally controlled equipment not part of the central building automation system.
- C. Controls Contractor. The commissioning responsibilities of the controls contractor, during construction and acceptance phases in addition to those listed in the above Section (A) are:
  1. Sequences of Operation Submittals. The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications.
  2. Control Drawings Submittal.
    - a. The control drawings shall have a key to all abbreviations.
    - b. The control drawings shall contain graphic schematic depictions of the systems and each component.
    - c. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
    - d. Provide a full control points list
    - e. The Controls Contractor shall keep the commissioning agent informed of all changes to this list during programming and setup.
  3. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M manual submittal.
  4. Assist and cooperate with the Testing, Adjusting and Balancing (TAB) contractor in the following manner:
    - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB any needed unique instruments that may be needed.
    - b. For a given area, have all required pre-functional checklists, calibrations, startup and selected functional tests of the system completed and approved by the commissioning agent prior to TAB.
    - c. Provide a qualified technician to operate the controls to assist the TAB contractor.
  5. Assist and cooperate with the commissioning agent in the following manner:
    - a. Execute the functional testing of the controls system. Assist in the functional testing of all equipment to be commissioned. Provide two-way radios during the testing.
    - b. Execute all control system trend logs.

6. The controls contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing.
7. Provide a signed and dated certification to the commissioning agent and Owner's Representative upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Design Intent and Contract Documents, except functional testing requirements.
8. In addition to the control points necessary to execute all documented control sequences, provide monitoring, control and virtual points.
9. List and clearly identify on the as-built duct and piping drawings the locations of all static and differential pressure sensors (air, water and building pressure).
10. The controls contractor is responsible for assisting the commissioning agent throughout the entire commissioning process. The controls work is not complete until the commissioning agent and the University has signed off on the commissioned systems

D. TAB Contractor. The duties of the TAB contractor, in addition to those listed in the above Section (A) are:

1. Submit the outline of the TAB plan and approach for each system and component to the commissioning agent, Owner's Representative, and the controls contractor six weeks prior to starting the TAB.
2. The submitted plan shall include:
  - a. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and contractors to sufficiently understand the design intent for each system.
  - b. An explanation of the intended use of the building control system. The controls contractor will comment on feasibility of the plan.
  - c. All field checkout sheets and logs to be used that list each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
  - d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
  - e. Final test report forms to be used.
  - f. Detailed step-by-step procedures for TAB work for each system.
  - g. List of all measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
  - h. Details of how total flow will be determined.
  - i. The identification and types of measurement instruments to be used and their most recent calibration date.
  - j. Plan for hand-written field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
3. A running log of events and issues shall be kept by the TAB field technicians.
4. Communicate in writing to the General Contractor and the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB which affect the control system setup and operation.
5. The TAB shall mark on the drawings where all traverse and other critical measurements were taken and cross reference the location in the TAB report.



6. Provide the commissioning agent with any requested data, gathered, but not shown on the draft reports.
7. Provide calibrated instruments to assist commissioning agent in conducting calibration checks of sensors and any other devices requiring field checkout.
8. Provide a final TAB report for the commissioning agent with details.
9. Conduct functional performance tests and checks on the original TAB.
10. The test and balance contractor is responsible for assisting the commissioning agent throughout the entire commissioning process. This includes assistance with reading airflows, water flows, taking pressure measurements, temperature measurements, and providing any other readings requested by the commissioning agent related to the commissioned equipment.
11. The TAB work will not be complete until signed off by commissioning agent and Owner.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION**

**3.1 SUBMITTALS**

- A. Mechanical, Controls, and TAB Contractors shall provide submittal documentation relative to commissioning to the commissioning agent as requested by the commissioning agent.

**3.2 STARTUP**

- A. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the commissioning agent or Owner's Representative.
- B. Functional testing is intended to begin upon completion of a system.

**3.3 FUNCTIONAL TESTING**

- A. This section presents representative functional testing requirements for Division 22, 23 and 32 systems and equipment.
- B. Parties Responsible to Execute Functional Test
  1. Controls contractor shall operate the controls as needed.
  2. Test and balance contractor shall take readings and assist with set up of equipment.
  3. HVAC mechanical contractor or vendor shall assist in testing sequences as needed.
  4. Plumbing contractor or vendor shall assist in testing sequences as needed.
  5. CxA shall witness, direct and document testing.
- C. Testing and Acceptance criteria
  1. Test each sequence in the sequence of operations, and other significant modes and sequences not mentioned.
  2. Ability of system to maintain the temperature and humidity range within prescribed

- tolerance
- 3. All alarms
- 4. For the conditions, sequences and modes tested, the BAS, integral components and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice

**D. Required Monitoring**

- 1. All points requested by the CxA shall be trended by the controls contractor. The trending shall be for seven (7) days per week, 24 hours per day at five minute intervals or as requested by the CxA.

**E. BAS Functional Testing**

- 1. A significant part of the BAS functional testing requirements is the successful completion of the functional tests of equipment the BAS controls or interlocks with. Uncompleted equipment functional tests or outstanding deficiencies in those tests lend the required BAS functional testing incomplete.
- 2. Integral or stand-alone controls are functionally tested with the equipment they are attached to, including any interlocks with other equipment or systems.
- 3. In addition to the controlled equipment testing, the following tests are required for the BAS, where features have been specified. The following testing requirements are in addition to and do not replace any testing requirements elsewhere in the specifications.
  - a. All specified functions and features are set up, debugged and fully operable
  - b. Power failure and battery backup and power-up restart functions if applicable
  - c. Global commands features
  - d. Security and access codes
  - e. Occupant over-rides (manual, telephone, key, keypad, etc.)
  - f. O&M schedules and alarms if applicable
  - g. Scheduling features fully functional and setup, including holidays
  - h. Date and time setting in central computer and verify field panels read the same time
  - i. Demonstrate functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad
  - j. All graphic screens and value readouts completed
  - k. Set-point changing features and functions
  - l. Sensor calibrations
  - m. Final as-builts or redlines (per spec) control drawings, final points list, program code, set-points, schedules, warranties, etc. per specs, submitted for O&Ms.
  - n. Verify that points that are monitored only, having no control function, are checked for proper reporting to BAS.
  - o. Communication time between network controllers and field controllers.
  - p. Labeling of points.

**3.4 WRITTEN WORK PRODUCTS**

- A. Written work products will consist of the filled out start-up, initial checkout and pre-functional checklists.

END OF SECTION 23 08 00

**SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

**1.2 DEFINITIONS**

- A. **Finished Spaces:** Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. **Exposed, Interior Installations:** Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. **Exposed, Exterior Installations:** Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

**1.3 PERFORMANCE REQUIREMENTS**

**A. Minimum Operating-Pressure Ratings:**

1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).

- B. **Natural-Gas System Pressures within Buildings:** Two pressure ranges. Primary pressure is more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced to secondary pressure of 0.5 psig (3.45 kPa) or less.

- C. **Delegated Design:** Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Corrugated, stainless-steel tubing with associated components.
  - 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 4. Pressure regulators. Indicate pressure ratings and capacities.
  - 5. Service meters. Indicate pressure ratings and capacities.
  - 6. Dielectric fittings.
  
- B. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of seismic restraints.
  - 2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
  
- B. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
  
- C. Qualification Data: For qualified professional engineer.
  
- D. Welding certificates.
  
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
  
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

**1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

**1.9 PROJECT CONDITIONS**

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Owner no fewer than five days in advance of proposed interruption of natural-gas service.
  - 2. Do not proceed with interruption of natural-gas service without Owner's written permission.

**1.10 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

**PART 2 - PRODUCTS**

**2.1 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - a. Material Group: 1.1.
  - b. End Connections: Threaded or butt welding to match pipe.
  - c. Lapped Face: Not permitted underground.
  - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
  - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
  - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

## 2.2 PIPING SPECIALTIES

### A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches (1830 mm.)

### B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

### C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.3 JOINING MATERIALS

### A. Joint Compound and Tape: Suitable for natural gas.

### B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig (862 kPa).
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
  - 6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig (862 kPa).
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Homestead Valve; a division of Olson Technologies, Inc.
    - b. McDonald, A. Y. Mfg. Co.
    - c. Milliken Valve Company.
    - d. Or approved equal.
  - 2. Body: Cast iron, complying with ASTM A 126, Class B.
  - 3. Plug: Bronze or nickel-plated cast iron.
  - 4. Seat: Coated with thermoplastic.
  - 5. Stem Seal: Compatible with natural gas.
  - 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 7. Operator: Square head or lug type with tamperproof feature where indicated.
  - 8. Pressure Class: 125 psig (862 kPa).



9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Meter Company.
  - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - c. Invensys.
  - d. Or approved equal.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Meter Company.
  - b. Fisher Control Valves and Regulators; Division of Emerson Process Management.
  - c. Invensys.
  - d. Or approved equal.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 10 psig (69 kPa).

**D. Appliance Pressure Regulators: Comply with ANSI Z21.18.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Eaton Corporation; Controls Div.
  - b. Harper Wyman Co.
  - c. Maxitrol Company.
  - d. Or approved equal.
2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig (13.8 kPa).

**2.6 SERVICE METERS (BY GAS UTILITY COMPANY)**

**2.7 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

**B. Dielectric Unions:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. McDonald, A. Y. Mfg. Co.
  - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - c. Wilkins; a Zurn company.
  - d. Or approved equal.
  
2. Description:
  - a. Standard: ASSE 1079.
  - b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
  - c. End Connections: Solder-joint copper alloy and threaded ferrous.

**C. Dielectric Flanges:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Matco-Norca, Inc.
  - b. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - c. Wilkins; a Zurn company.
  - d. Or approved equal.
  
2. Description:
  - a. Standard: ASSE 1079.
  - b. Factory-fabricated, bolted, companion-flange assembly.
  - c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
  - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

**D. Dielectric-Flange Insulating Kits:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
  - e. Or approved equal.
  
2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig (1035 kPa).
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

2.8 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches (900 mm) below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
  - 1. If natural-gas piping is installed less than 36 inches (900 mm) below finished grade, install it in containment conduit.
- C. Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  - 3. Replace pipe having damaged PE coating with new pipe.
- D. Install fittings for changes in direction and branch connections.

- E. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 23 05 19 "Meters and Gages for HVAC Piping."

### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
  2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
  3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
  4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  5. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install pressure gage upstream and downstream from each line regulator.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION (BY GAS UTILITY COMPANY)

3.6 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- D. Install earthquake valves aboveground outside buildings according to listing.
- E. Install anode for metallic valves in underground PE piping.

3.7 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

**3.8 HANGER AND SUPPORT INSTALLATION**

- A. Install seismic restraints on piping.
- B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
  - 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
  - 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
  - 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod size, 1/2 inch (13 mm).
  - 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch (15.8 mm).
- D. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
  - 2. NPS 1/2 and NPS 5/8 (DN 15 and DN 18): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
  - 3. NPS 3/4 and NPS 7/8 (DN 20 and DN 22): Maximum span, 84 inches (2134 mm); minimum rod size, 3/8 inch (10 mm).
  - 4. NPS 1 (DN 25): Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).
- E. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/8 (DN 10): Maximum span, 48 inches (1220 mm); minimum rod size, 3/8 inch (10 mm).
  - 2. NPS 1/2 (DN 15): Maximum span, 72 inches (1830 mm); minimum rod size, 3/8 inch (10 mm).
  - 3. NPS 3/4 (DN 20) and Larger: Maximum span, 96 inches (2440 mm); minimum rod size, 3/8 inch (10 mm).



3.9 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

- A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.11 PAINTING

- A. Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (flat).
    - d. Color: Gray.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Interior latex matching topcoat.
    - c. Topcoat: Interior latex (flat).
    - d. Color: Gray.

- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.13 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

END OF SECTION 23 11 23

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**SECTION 23 23 00 - REFRIGERANT PIPING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes refrigerant piping used for air-conditioning applications.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerant R-410A:
  - 1. Suction Lines for Air-Conditioning Applications: 300 psig (2068 kPa).
  - 2. Suction Lines for Heat-Pump Applications: 535 psig (3689 kPa).
  - 3. Hot-Gas and Liquid Lines: 535 psig (3689 kPa).

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of valve and refrigerant piping specialty indicated.

**1.4 PRODUCT STORAGE AND HANDLING**

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

**1.5 COORDINATION**

- A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations.

**PART 2 - PRODUCTS**

**2.1 COPPER TUBE AND FITTINGS**

- A. Copper Tube: ASTM B 280, Type K or L (ASTM B 88M, Type A or B).
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch- (180-mm-) long assembly.
4. Pressure Rating: Factory test at minimum 500 psig (3450 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

2.2 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:

1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
3. Operator: Rising stem and hand wheel.
4. Seat: Nylon.
5. End Connections: Socket, union, or flanged.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 275 deg F (135 deg C).

B. Packed-Angle Valves:

1. Body and Bonnet: Forged brass or cast bronze.
2. Packing: Molded stem, back seating, and replaceable under pressure.
3. Operator: Rising stem.
4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
5. Seal Cap: Forged-brass or valox hex cap.
6. End Connections: Socket, union, threaded, or flanged.
7. Working Pressure Rating: 500 psig (3450 kPa).
8. Maximum Operating Temperature: 275 deg F (135 deg C).

C. Check Valves:

1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
3. Piston: Removable polytetrafluoroethylene seat.
4. Closing Spring: Stainless steel.
5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
6. End Connections: Socket, union, threaded, or flanged.
7. Maximum Opening Pressure: 0.50 psig (3.4 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 275 deg F (135 deg C).

D. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.

3. Seat: Polytetrafluoroethylene.
  4. End Connections: Copper spring or soldered.
  5. Working Pressure Rating: 500 psig (3450 kPa).
- E. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL.
1. Body and Bonnet: Plated steel, copper or brass.
  2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  3. Seat: Polytetrafluoroethylene.
  4. End Connections: Threaded or soldered.
  5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
  6. Working Pressure Rating: 400 psig (2760 kPa).
  7. Maximum Operating Temperature: 240 deg F (116 deg C).
  8. Manual operator.
- F. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Seat Disc: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Working Pressure Rating: 400 psig (2760 kPa).
  6. Maximum Operating Temperature: 240 deg F (116 deg C).
- G. Thermostatic Expansion Valves: Comply with ARI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  5. Suction Temperature: 40 deg F (4.4 deg C).
  6. Superheat: Adjustable.
  7. Reverse-flow option (for heat-pump applications).
  8. End Connections: Socket, flare, or threaded union.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  5. Seat: Polytetrafluoroethylene.
  6. Equalizer: Internal
  7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-V ac coil.
  8. End Connections: Socket.
  9. Throttling Range: Maximum 5 psig (34 kPa).
  10. Working Pressure Rating: 500 psig (3450 kPa).
  11. Maximum Operating Temperature: 240 deg F (116 deg C).

**I. Straight-Type Strainers:**

1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig (3450 kPa).
5. Maximum Operating Temperature: 275 deg F (135 deg C).

**J. Angle-Type Strainers:**

1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig (3450 kPa).
6. Maximum Operating Temperature: 275 deg F (135 deg C).

**K. Moisture/Liquid Indicators:**

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig (3450 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

**L. Replaceable-Core Filter Dryers: Comply with ARI 730.**

1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

**M. Permanent Filter Dryers: Comply with ARI 730.**

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement.

7. Maximum Pressure Loss: 2 psig (14 kPa).
8. Working Pressure Rating: 500 psig (3450 kPa).
9. Maximum Operating Temperature: 240 deg F (116 deg C).

N. Mufflers:

1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig (3450 kPa).
4. Maximum Operating Temperature: 275 deg F (135 deg C).

2.3 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
- B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or L (B), annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.



- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 08 31 13 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. Install refrigerant piping in protective conduit where installed belowground.
- M. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- N. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- O. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- P. Identify refrigerant piping and valves according to Section 23 05 53 "Identification for HVAC Piping and Equipment."
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."

### 3.3 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BA<sub>g</sub>, cadmium-free silver alloy for joining copper with bronze or steel.

### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).
  4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.

### 3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
  2. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
    - a. Fill system with nitrogen to the required test pressure.
    - b. System shall maintain test pressure at the manifold gage throughout duration of test.
    - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.6 SYSTEM CHARGING

- A. Charge system using the VRF manufacturers instructions:

### 3.7 ADJUSTING

- A. Perform adjustments before operating the refrigeration system, according to manufacturer's instructions.

END OF SECTION 23 23 00

**SECTION 23 31 13 - METAL DUCTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

**1.2 SUBMITTALS**

- A. Product Data: For duct liner and sealing materials.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

**PART 2 - PRODUCTS**

**2.1 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards—Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. 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 90A or NFPA 90B and NAIMA's "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers:
    - a. CertainTeed Corp.; Insulation Group.
    - b. Johns Manville International, Inc.
    - c. Knauf Fiber Glass GmbH.
    - d. Or approved equal.
- B. Materials: ASTM C 1071 with coated surface exposed to airstream to prevent erosion of glass fibers.
  - 1. Thickness: 1 inch (inside).
  - 2. Thickness: 1-1/2 inches (outdoors).
  - 3. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
  - 4. Fire-Hazard Classification: Maximum flame-spread rating of 25 and smoke-developed rating of 50, when tested according to ASTM C 411.
  - 5. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and ASTM C 916.
  - 6. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
    - a. Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
    - b. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
    - c. Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

**2.3 SEALANT MATERIALS**

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
  - 1. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
  - 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
  - 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
  - 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

**2.4 HANGERS AND SUPPORTS**

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for building materials.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
  - 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for 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 complying with ASTM A 36/A 36M.
  - 1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  - 3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

**2.5 RECTANGULAR DUCT FABRICATION**

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
  - 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness reinforcement size and spacing and joint reinforcement.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus, Inc.
    - c. Ward Industries, Inc.
    - d. Or approved equal.

- C. Formed-On Flanges: Construct according to SMACNA’s “HVAC Duct Construction Standards—Metal and Flexible,” Figure 1-4, using corner, bolt, cleat, and gasket details.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Lockformer.
    - c. Or approved equal.
- D. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
- E. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- F. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

**2.6 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 are prohibited.
- B. Apply 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 ensure butted-edge overlapping.
- E. Do not apply liners in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. 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.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profile or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - 1. Fan discharge.
  - 2. Intervals of lined duct preceding unlined duct.
  - 3. Upstream edges of transverse joints in ducts.
- I. 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 duct wall with bolts, screws, rivets, or welds. Terminate liner at fire dampers at connection to fire-damper sleeve.

**2.7 ROUND AND FLAT-OVAL DUCT FABRICATION**

- A. General: Diameter as applied to flat-oval ducts in this Article is the diameter of the size of round duct that has a circumference equal to perimeter of a given size of flat-oval duct.
- B. Round Longitudinal- and Spiral Lock Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- C. Flat-Oval, Longitudinal- and Spiral Lock Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Fabricate ducts larger than 72-inches in diameter with butt-welded longitudinal seams.

**2.8 ROUND AND FLAT-OVAL DUCT FITTING FABRICATION**

- A. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
- B. Ducts 21 to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
- C. Ducts Larger than 72-inches in Diameter: Companion angle flanges joints per SMACNA "HVAC Duct Construction Standards—Metal and Flexible," Figure 3-2.
- D. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
- E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- F. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.
- G. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
  - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  - 2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
    - a. Ducts 3 to 26 Inches in Diameter: 0.028 inch.
    - b. Ducts 27 to 36 Inches in Diameter: 0.034 inch.
    - c. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    - d. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    - e. Ducts 62 to 84 Inches in Diameter: 0.064 inch.



3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
  - a. Ducts 3 to 14 Inches in Diameter: 0.028 inch.
  - b. Ducts 15 to 26 Inches in Diameter: 0.034 inch.
  - c. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
  - d. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
  - e. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal seam flat-oval duct.
5. 90-Degree, Two-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 using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows, 8 Inches and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
7. Round Elbows, 9 through 14 Inches: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
8. Round Elbows, Larger Than 14 Inches, and All Flat-Oval Elbows: Fabricate gored elbows, unless space restrictions require a mitered elbow.
9. Die-Formed Elbows for Sizes through 8 Inches and All Pressures: 0.040 inch thick with two-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches and Pressures through 10-Inch wg: 0.022 inch.

## PART 3 - EXECUTION

### 3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
  1. Supply Ducts (after Air Terminal Units): 2-inch wg.
  2. Return Ducts (Negative Pressure): 2-inch wg.
  3. Exhaust Ducts (Negative Pressure): 2-inch wg.
- B. All ducts shall be galvanized steel.

**3.2 DUCT INSTALLATION**

- A. Construct and install ducts according to SMACNA’s “HVAC Duct Construction Standards—Metal and Flexible,” unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet, unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct.
- F. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through 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 metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.
- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Firestopping."
- N. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA’s “Seismic Restraint Manual: Guidelines for Mechanical Systems.”
- O. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA’s “Duct Cleanliness for New Construction”.

**3.3 SEAM AND JOINT SEALING**

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

- B. Pressure Classification Less Than 2-Inch wg: Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

### 3.4 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, and flat-oval metal duct with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- E. Install concrete inserts before placing concrete.
- F. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

### 3.5 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

### 3.6 FIELD QUALITY CONTROL

- A. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

### 3.7 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for detailed procedures.

END OF SECTION 23 31 13

**SECTION 23 33 00 - AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Manual-volume dampers.
  - 2. Turning vanes.
  - 3. Duct-mounted access doors and panels.
  - 4. Flexible ducts.
  - 5. Flexible connectors.
  - 6. Duct accessory hardware.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 SHEET METAL MATERIALS**

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Extruded Aluminum: ASTM B 221, Alloy 6063, Temper T6.
- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. 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 MANUAL-VOLUME DAMPERS**

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
  - 1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

- B. Low-Leakage Volume Dampers: Multiple- or single-blade, opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized, sheet steel.
  - 3. Blade Seals: Neoprene.
  - 4. Blade Axles: Galvanized steel.
  - 5. Tie Bars and Brackets: Galvanized steel.
- C. Jackshaft: 1-inch- diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.3 FIRE SMOKE DAMPERS

- A. General: Labeled to UL 555S. Combination fire and smoke dampers shall be labeled for one-and-one-half-hour rating to UL 555.
- B. Fusible Link: Replaceable, 165 or 212 deg F rated as indicated.
- C. Frame and Blades: 0.064-inch- thick, galvanized, sheet steel.
- D. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized, sheet steel; length to suit wall or floor application.
- E. Damper Motors: Provide for two-position action.
  - 1. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  - 4. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.

2.4 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- wide, curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.
- C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.5 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.6 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet.
- C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

- F. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
  - 1. Minimum Weight: 14 oz./sq. yd.
  - 2. Tensile Strength: 450 lbf/inch in the warp, and 340 lbf/inch in the filling.

## 2.7 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- thick, glass-fiber insulation around a continuous inner liner.
  - 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
  - 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
  - 3. Inner Liner: Polyethylene film.
- C. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

## 2.8 ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire smoke dampers according to manufacturer's UL-approved written instructions.

- E. Install fusible links in fire smoke dampers.
- F. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
  - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
  - 2. Install access panels on side of duct where adequate clearance is available.
- G. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment."
- H. Install turning vanes in 90° rectangular elbows.

### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 33 00



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**SECTION 23 34 23 - HVAC POWER VENTILATORS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Hooded Propeller Roof Fan.
2. In-line centrifugal fans.
3. Ceiling-Mounted Ventilators.
4. Centrifugal Upblast Fans.

**1.2 ACTION SUBMITTALS**

- A. Product Data:** For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data:** For power ventilators to include in emergency, operation, and maintenance manuals.

**1.4 QUALITY ASSURANCE**

- A. AMCA Compliance:** Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

**1.5 UL Standards:** Power ventilators shall comply with UL 705

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.**

**PART 2 - PRODUCTS**

**2.1 HOODED PROPELLER ROOF FAN**

**A. General Description:**

1. Fan arrangement is reversing, move air in both exhaust and supply modes
2. Roof mounted applications
3. Performance capabilities up to 45,000 cubic feet per minute (cfm) and static pressure to 0.5 inches of water gauge

4. Fans are available in five sizes with nominal wheel diameters ranging from 24 inches through 54 inches (24 - 54 unit sizes)
5. Maximum continuous operating temperature 130 Fahrenheit (54.4 Celsius)
6. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

**B. Wheel:**

1. Constructed of cast aluminum, airfoil, reversible blades and hubs
2. Securely attached to fan shaft
3. Statically and dynamically balanced in accordance with AMCA Standard 204-05
4. The propeller and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency

**C. Motors:**

1. Motor enclosures: Open dripproof
2. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase
3. Propeller is securely attached to motor shaft by square key, and set screws or tapered lock bushing
4. Accessible for maintenance

**D. Drive Frame:**

1. Drive frame assemblies shall be galvanized steel
2. Formed channels and fan panels shall have a deep formed one piece inlet venturi

**E. Fan Base and Hood:**

1. Material type: Galvanized Steel
2. Hood panels are arched with interlocking standing seams for weather protection
3. Supporting members are galvanized steel angles
4. Base height is standard 12 inches with pre-punched mounting holes for installation

**F. Fan Panels:**

1. Constructed of heavy gauge steel with formed flanges and a deep spun venturi

**G. Birdscreen:**

1. Constructed of ½ inch galvanized steel mesh
2. Mounted horizontally across the discharge/intake area of the hood

**H. Options/Accessories:**

1. Roof Curbs:
  - a. Types: GPIP
  - b. Material: Aluminum
  - c. Insulation thickness: 1 inches

**2.2 IN-LINE CENTRIFUGAL FANS (EXHAUST)**

- A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- D. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
  - 3. Companion Flanges: For inlet and outlet duct connections.
  - 4. Fan Guards: 1/2- by 1-inch (13- by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  - 5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.
  - 6. Backdraft dampers: Counterbalanced, parallel blade, mounted in-line of outlet; factory set to close when fan stops.
- E. Characteristics:
  - 1. Wheel Type: Backward inclined, forward curved or airfoil.
  - 2. Class: I.
  - 3. Vibration Isolators:
    - a. Type: Elastomeric hangers.
    - b. Static Deflection: 1 inch (25 mm).
  - 4. Spark Arrestance Class: C.

**2.3 CEILING-MOUNTED VENTILATORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Greenheck Fan Corporation.
  - 2. Loren Cook Company.
  - 3. Twin City Fan & Blower.
  - 4. Or approved equal.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Filter: Washable aluminum to fit between fan and grille.
7. Isolation: Rubber-in-shear vibration isolators.
8. Manufacturer's standard roof jack or wall cap, and transition fittings.

## 2.4 CENTRIFUGAL UPBLAST ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. Twin City Fan & Blower.
4. Or approved equal.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain drains.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
  - 1. Configuration: Self-flashing without a cant strip, with mounting flange.
  - 2. Sound Curb: Curb with sound-absorbing insulation.
  - 3. Pitch Mounting: Manufacture curb for roof slope.
  - 4. Metal Liner: Galvanized steel.
  - 5. Burglar Bars: 1/2-inch-thick steel bars welded in place to form 6-inch squares.
  - 6. Mounting Pedestal: Galvanized steel with removable access panel.
  - 7. Vented Curb: Unlined with louvered vents in vertical sides.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
- D. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch (25 mm).

#### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

#### 3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 23 34 23

**SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
  - 2. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for balancing diffusers, registers, and grilles.

**1.2 DEFINITIONS**

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

**1.3 SUBMITTALS**

- A. Product Data: For each model indicated, include the following:
  - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
  - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURED UNITS**

- A. Diffusers, registers, and grilles are scheduled at the end of this Section.



2.2 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Engineer for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 DIFFUSER, REGISTER AND GRILLE SCHEDULE

- A. Lay in Ceiling Diffuser:
  - 1. Products: Subject to compliance with requirements, modular removable core, 4 core, provide one of the following:
    - a. Price.
    - b. Krueger.
    - c. Anemostat Products; Dynamics Corp. of America.
    - d. Titus.
    - e. Or equal.

2. Material: Steel.
  3. Finish: Baked enamel, white.
  4. Duct Connection: Round. or Square.
  5. Duct Connection Size: As shown on drawings.
  6. Face Size: 24” x 24.”
  7. Maximum Noise-Criterion Rating: NC20.
  8. Face Style: Square. Perforated.
  9. Mounting: Lay in.
  10. Pattern: Adjustable.
  11. Dampers: Opposed blade.
- B. Hard Ceiling or Duct Mount Diffusers: Is the same as lay in ceiling diffusers except:
1. Face Size: Frame size required for duct connection size.
  2. Face Style: Square.
  3. Mounting: Surface mount.
  4. Accessories: Provide fames style to match mounting style.
- C. Sidewall Supply Register:
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Price.
    - b. Krueger
    - c. Anemostat Products; Dynamics Corp. of America.
    - d. Titus.
    - e. Price.
  2. Material: Steel.
  3. Finish: Baked enamel, white.
  4. Face Blade Arrangement: Adjustable vertical.
  5. Rear Blade Arrangement: Adjustable horizontal.
  6. Frame: 1 inch wide.
  7. Mounting: Concealed.
  8. Damper Type: Adjustable opposed-blade assembly.
  9. Accessories: Provide frame style to match mounting surface.
- D. Sidewall/Hard Ceiling: Return or Exhaust register is the same as sidewall supply register except square or rectangular face style and fixed horizontal single face blade.
- E. Lay-in ceiling return or exhaust register is same as lay in ceiling diffuser except without adjustable pattern and removable core.

END OF SECTION 23 37 13

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**SECTION 23 81 13.11 - PACKAGED TERMINAL AIR-CONDITIONERS, THROUGH-WALL UNITS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes packaged, terminal, through-the-wall air conditioners.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Product Test Reports: For packaged, terminal air conditioners, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For packaged, terminal air conditioners to include in emergency, operation, and maintenance manuals.

**1.5 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, terminal air conditioners that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
  - 2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
  - 3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Amana; a division of Whirlpool Corporation.
  - 2. Or approved equal.

2.2 MANUFACTURED UNITS

- A. Description: Factory-assembled and -tested, self-contained, packaged, terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with cord-connected wireless chassis.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."
- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- E. ASHRAE Thermal Comfort: Applicable requirements in ASHRAE 55.
- F. UL listed and ETL performance certified.

2.3 CHASSIS

- A. Cabinet: Minimum 0.052-inch- (1.3-mm-) thick galvanized steel with removable front panel with concealed latches.
  - 1. Mounting: Wall with wall sleeve.
  - 2. Top: Angled.
  - 3. Discharge Grille: Punched-louver discharge grille allowing four-way discharge-air pattern, tamperproof, and carrying a flame test rating in accordance with UL standard 494.
  - 4. Louvers: Extruded aluminum with enamel finish; match existing color.
  - 5. Finish: Epoxy coating.
  - 6. Access Door: Hinged door in top of cabinet for access to controls.
  - 7. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
  - 8. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - 9. Electrical Subbase: Enameled steel with four adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
  - 10. Wall Sleeves: Galvanized steel with powder-coated paint and with seacoast protection.

- B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor and hermetically sealed scroll compressor with vibration isolation and overload protection.
  - 1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil and seacoast protection.
  - 2. Accumulator.
  - 3. Constant-pressure expansion valve.
  - 4. Reversing valve.
  - 5. Charge: R-410A.
- C. Indoor Fan: Forward curved, centrifugal; with two-speed motor and positive-pressure ventilation damper with concealed manual operator.
- D. Filters: Washable polyurethane in molded plastic frame.
- E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation.
  - 1. Comply with ASHRAE 62.1 for drain pan construction and connections.
- F. Outdoor Fan: Propeller type with separate motor.
  - 1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
    - a. Fan Motors: Permanently lubricated split capacitor.
    - b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
    - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.4 HEATING

- A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

2.5 CONTROLS

- A. Control Module: Wireless thermostat with digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:
  - 1. Low-Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F (5 deg C) outdoor air temperature.
  - 2. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F (5 deg C) and to supplemental heating below plus 25 deg F (minus 4 deg C).
  - 3. Temperature-Limit Control: Prevents occupant from exceeding preset setback or setup temperature.
- B. Outdoor Air: Manual intake damper.

2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."
- B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.
- B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Section 07 92 00 "Joint Sealants."
- C. Install and anchor wall sleeves to withstand, without damage to equipment and structure, seismic forces required by building code.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
  - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
  - 2. After installing packaged, terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
  - 3. Unit is level on base and is flashed in exterior wall.
  - 4. Unit casing has no visible damage.
  - 5. Compressor, air-cooled condenser coil, and fans have no visible damage.
  - 6. Labels are clearly visible.
  - 7. Controls are connected and operable.
  - 8. Shipping bolts, blocks, and tie-down straps are removed.
  - 9. Filters are installed and clean.
  - 10. Drain pan and drain line are installed correctly.
  - 11. Electrical wiring installation complies with manufacturer's submittal and installation requirements in electrical Sections.
  - 12. Installation: Perform startup checks according to manufacturer's written instructions, including the following:
    - a. Lubricate bearings on fan.
    - b. Check fan-wheel rotation for correct direction without vibration and binding.

13. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
14. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. After operational test, change filters.

E. Packaged, terminal air conditioners will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

### 3.3 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

### 3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain packaged, terminal air conditioners, and how to operate the wireless control systems.

END OF SECTION 23 81 13.11



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**SECTION 23 81 26 – SPLIT-SYSTEM AIR-CONDITIONERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

**1.2 ACTION SUBMITTALS**

- A. **Product Data:** For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. **Shop Drawings:** Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. **Wiring Diagrams:** For power, signal, and control wiring.
- C. **Samples for Initial Selection:** For units with factory-applied color finishes.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. **Warranty:** Sample of special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. **Operation and Maintenance Data:** For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

**1.5 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. **Filters:** One set(s) for each air-handling unit.
  - 2. **Gaskets:** One set(s) for each access door.
  - 3. **Fan Belts:** One set(s) for each air-handling unit fan.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. "ASHRAE Compliance" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED Prerequisite IEQ 1 requires compliance with requirements in ASHRAE 62.1. In addition to establishing minimum ventilation rates, ASHRAE 62.1 includes requirements for controls, surfaces in contact with the airstream, particulate and gaseous filtration, humidification and dehumidification, drain-pan construction and connection, finned-tube coil selection and cleaning, and equipment access. See "LEED Rating System" Article in the Evaluations for discussion on this prerequisite. Verify, with manufacturers, availability of units with components and features that comply with these requirements.
  - 3. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
  - 4. "ASHRAE/IESNA" Compliance Paragraph below may be required to comply with Project requirements or authorities having jurisdiction. LEED Prerequisite EA 2 requires minimum efficiency equal to requirements in ASHRAE/IESNA 90.1. See "LEED Rating System" Article in the Evaluations for discussion on this prerequisite.
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

- A. When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
- C. Verify available warranties and warranty periods for units and components with manufacturers listed in Part 2.

1. Warranty Period:
  - a. For Compressor: One year(s) from date of Substantial Completion.
  - b. For Parts: One year(s) from date of Substantial Completion.
  - c. For Labor: One year(s) from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Carrier.
- B. Trane.
- C. Or approved equal.

**2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)**

- A. Concealed Evaporator-Fan Components:
  1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
  2. Insulation: Faced, glass-fiber duct liner.
  3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
  4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm); leak tested to 300 psig (2070 kPa) underwater; with a two-position control valve.
  5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
  6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
  7. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
  8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  9. Filters: Permanent, cleanable.
  10. Condensate Drain Pans:
    - a. First option in first subparagraph below is minimum slope in ASHRAE 62.1.

- b. Fabricated with one or two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
  - 1) ASHRAE compliance option in "Length" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain option in first subparagraph to comply with LEED Prerequisite IEQ 1; otherwise, insert distance.
  - 2) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
  - 3) Depth: A minimum of 2 inches (50 mm) deep.
- c. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
- d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
- e. Minimum Connection Size: NPS 1 (DN 25).
- f. Pan-Top Surface Coating: Asphaltic waterproofing compound.
- g. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

**B. Wall-Mounted, Evaporator-Fan Components:**

- 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect and Resident Engineer, and discharge drain pans with drain connection.
- 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
- 3. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
- 4. Fan: Direct drive, centrifugal.
- 5. Fan Motors:
  - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
  - c. Retain first subparagraph below if enclosure is not open-dripproof type. Retain second subparagraph for premium efficiency.
  - d. Enclosure Type: Totally enclosed, fan cooled.
  - e. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
  - f. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
  - g. Mount unit-mounted disconnect switches on exterior or interior of unit.
- 6. ASHRAE compliance in "Airstream Surfaces" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain first subparagraph to comply with LEED Prerequisite IEQ 1.
- 7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

8. Condensate Drain Pans:
  - a. Fabricated with one ortwo percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
    - 1) ASHRAE compliance option in "Length" Subparagraph below may be required to comply with Project requirements or authorities having jurisdiction. Retain option in first subparagraph to comply with LEED Prerequisite IEQ 1; otherwise, insert distance.
    - 2) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
    - 3) Depth: A minimum of 1 inch (25 mm) deep.
  - b. Double-wall, stainless steel sheet with space between walls filled with foam insulation and moisture-tight seal.
  - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
    - 1) Minimum Connection Size: NPS 1 (DN 25).
  - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
9. Air Filtration Section:
  - a. General Requirements for Air Filtration Section:
    - 1) Comply with NFPA 90A.
    - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
    - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
  - b. Disposable Panel Filters:
    - 1) Factory-fabricated, viscous-coated, flat-panel type.
    - 2) Thickness: 1 inch (25 mm).
    - 3) Arrestance according to ASHRAE 52.1: 80.
    - 4) Merv according to ASHRAE 52.2: 8.
    - 5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
    - 6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.
  - c. Extended-Surface, Disposable Panel Filters:
    - 1) Factory-fabricated, dry, extended-surface type.
    - 2) Thickness: 1 inch (25 mm).
    - 3) Arrestance according to ASHRAE 52.1: 90.
    - 4) Merv according to ASHRAE 52.2: 8.
    - 5) Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
    - 6) Mounting Frames: Welded, galvanized steel, with gaskets and fasteners; suitable for bolting together into built-up filter banks.

**2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)**

**A. Air-Cooled, Compressor-Condenser Components:**

1. Casing: Steel, finished with baked enamel in color selected by Architect and Resident Engineer, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
  - a. Compressor Type: Scroll.
  - b. Feature in first subparagraph below is not available from all manufacturers.
  - c. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
  - d. LEED Credit EA 4 awards a single point if all HVAC&R equipment has HCFC-free refrigerants. R-407C and R-410A are HCFC-free refrigerants.
  - e. Refrigerant Charge: R-407C or R-410A.
  - f. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F (7 deg C).
7. Mounting Base: Polyethylene.

**2.4 ACCESSORIES**

- A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
  1. Compressor time delay.
  2. 24-hour time control of system stop and start.
  3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
  4. Fan-speed selection including auto setting.
- C. Automatic-reset timer to prevent rapid cycling of compressor.
- D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- E. Drain Hose: For condensate.
- F. LEED-NC and LEED for Schools Credit EA 5, LEED-CI Credit EA 3, and LEED-CS Credit EA 5.1 require continuous metering equipment for monitoring building

energy consumption performance over time. Retain paragraph below if required to comply with requirements for this credit. Verify availability of control features with unit manufacturers or if required by Project requirements or authorities having jurisdiction.

G. Additional Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:
  1. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
  2. Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

**3.2 CONNECTIONS**

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.
- B. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  1. Water Coil Connections: Connect hydronic piping to supply and return coil connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- C. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.



- D. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

**SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 EXPLANATION OF DRAWINGS**

- A. These construction documents are intended to be diagrammatic and reflect the scope, quality, and character of the work to be performed; all miscellaneous materials and work required for a complete and operational system, though not specifically mentioned, shall be furnished and installed by the Contractor.
- B. The Contractor shall confirm sizes, dimensions, weights and locations of all devices, light fixtures, and equipment prior to installation. Dimensioned architectural drawings shall take precedence over diagrammatic layouts shown on these contract documents.
- C. The specifications and the drawings are an integral document and shall be considered complementary to each other. In the case of a conflict between the specifications and the drawings, the more constricting condition shall be enforced.
- D. The Contractor shall be responsible for reporting any discrepancies, errors, or omissions noted prior to bid.
- E. It is the intent of the drawings to indicate schematic routing and placement of devices, fixtures, equipment and conduit. Equipment or devices requiring a precise location shall be dimensioned on other trade documents (architectural, mechanical, etc.). Offsets, elbows, or extensions shall be furnished and installed by the Contractor as necessary to avoid structure, piping, and clearances and to provide a complete and workmanlike installation.

**1.2 QUALITY ASSURANCE**

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications and supplements, of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)

12. Underwriters' Laboratories, Inc. (UL)
13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the Contractor.

### 1.3 SUBMITTALS

- A. Shop drawings for materials, equipment, devices, fixtures, and systems shall be submitted by the Contractor for review within 30 days after award of the contract. In addition to the requirements for submittals stated herein, the Contractor shall be responsible for compliance with the requirements of Division 1.
- B. The Contractor shall bear the responsibility for any materials installed which were not submitted for review or not installed in compliance with the review comments and the contract documents.
- C. Verbal modification of submittal documents or changes to the requirements of the contract documents shall not be acceptable. All submittal material must be documented in a written format.
- D. All submittal packages must be submitted at one time and in accordance with the specification section appropriate for the material. All packages must be identical and clearly labeled indicating the specification section, project name, submittal date, Contractor's name, Engineer's name, preparer's name and submission version (first submission, resubmittal #1, etc.).
- E. Product catalog cutsheets and descriptive literature shall be cross-referenced to the specification section by paragraph.
- F. All submittal packages shall be permanently bound in brochure or booklet format. A minimum quantity of six (6) submittal booklets shall be provided by the Contractor; additional printed copies may be required if so noted. Electronic copies of completed submittal packages, furnished on a CD-ROM in pdf format, may be furnished in lieu of printed copies.
- G. Materials which bear a certification or approval of a testing agency, performance criteria, society, agency, of other organization shall be submitted with all labels identified.

- H. The submittal shall be complete and with catalog data and information properly marked to show, among other things, materials, capacity and performance data to meet the specified requirements.
- I. Incomplete submittals will be rejected at the discretion of the reviewing Engineer.
- J. Review of the submittal is only for general conformance with the contract documents. The Contractor is responsible for confirmation and coordination of dimensions, quantities, sizes, fabrication, installation methods, and for coordination of work of other trades with electrical work.
- K. Detailed working drawings shall be prepared and submitted showing items which are to be fabricated including transformer mounting racks, unistrut mounting frames, equipment room layouts, pull boxes, splice boxes, gutters, etc.
- L. Minimum scale for submitted drawings shall be 1/8". Details shall be drawn to 1/4" scale. All drawings shall be 8.5"x11" or larger.
- M. Submittal brochures shall be complete and descriptive of the type, make, manufacturer, application, quantity, performance, capacity, ratings, options, dimensions, clearances, weights, nameplate data, special installation requirements, mounting method, NEMA type, NEMA class, environmental restrictions, layout requirements or other information as may be necessary for review of the material.
- N. Submittal brochures for switchgear shall include, as a minimum, the following: singleline diagrams; fault current ratings of buses and devices; device identification, ratings, layout and characteristics; dimensions; circuit identification; identification label type and method of affixing; mounting; conduit entry point and quantities; NEMA enclosure type; and additional data as required for a complete review.
- O. Submittal brochures for lighting systems shall include, as a minimum, the following: manufacturer; detailed drawing or photograph; dimensions; lamp data; ballast data; certified photometric data from a third-party testing agency; U.L. label listing; fixture number or identification from the drawings; finish color and material; mounting equipment; socket type and rating; environmental ratings (damp location, watertight, explosion-proof, etc.); voltage; input wattage; and additional information as necessary for a complete review.
- P. The Contractor shall be responsible for all aspects of substitutions of material including any additional cost or delay incurred as a result of the substitution. The Contractor shall coordinate all substitutions with other trades, verify code compliance, verify clearances, photometric performance, appearance, suitability, constructability, and availability of the material prior to submitting the substitution for review. The Contractor shall bear the responsibility of any increased costs to other trades which are directly related to the substitution.

#### 1.4 MATERIAL HANDLING

- A. The Contractor shall deliver all equipment and material to the site in the manufacturer's original packaging without seals broken.
- B. The Contractor shall handle, store, protect, and unpack all equipment and materials in accordance with the manufacturer's recommendations.

- C. The Contractor shall inspect the equipment and materials in a timely manner to ensure the completeness and appropriateness of the shipment.
- D. The Contractor shall immediately replace damaged or defective equipment or materials with identical new equipment or material at no cost, inconvenience, or delay to the Owner.

1.5 EXISTING CONDITIONS

- A. The Contractor shall verify all existing conditions prior to bid and include all costs associated with the existing conditions in bid.
- B. The Contractor shall match the finish and appearance of all existing conditions where constructing new work adjacent to existing surfaces or equipment.
- C. Coordinate with the Owner's Representative for all ongoing projects or the work of other trades which may affect the Contractor's work. Verify Owner schedule requirements for special or standard events which may impact the Contractor's work.
- D. Coordinate work to be performed in occupied areas and comply with the Owner's requirements such that the Owner's work or ongoing activities are not disrupted by the Contractor. Verify the need for work to be performed during premium hours, evenings, weekends, or holidays prior to bid and include all costs in bid. Bring to the Owner's attention the need and locations for all disruptive work prior to commencement of work.

1.6 UTILITY COMPANY REQUIREMENTS

- A. The contractor shall contact the serving utility company for all utility system requirements prior to commencement of work. Utility work shall include electric power, telephone, data, fiber optic cable, cable television or other utilities as may require connections as a part of this contract. Coordinate and comply with all serving utility company requirements, designs, and schedules.
- B. The utility information depicted on the contract documents is for bidding purposes only and shall not be used for construction purposes. All construction shall be performed according to engineered documents provided by the serving utility company. The Contractor shall obtain and coordinate with utility company requirements as a part of this contract and furnish and install all work as a part of this contract.
- C. Verify all connection points, routing, and requirements with the serving utility company prior to commencement of work and coordinate final requirements with other trades.
- D. The Contractor shall be responsible for all costs associated with failure to contact or coordinate with utility company requirements.

1.7 TEMPORARY CONSTRUCTION UTILITY REQUIREMENTS

- A. Power, telephone or other temporary construction utility services required by the Contractor shall be the responsibility of the Contractor.

- B. Arrangements for temporary construction utility services shall be made by the Contractor in coordination with the Owner's Representative and the serving utility company.

#### 1.8 CONTINUITY OF SERVICE

- A. The Contractor shall coordinate all shutdowns, outages, and service interruptions with the Owner's Representative. Electrical shutdowns shall be kept to the minimum number necessary to complete the work.
- B. The Contractor shall coordinate all work done on overtime or premium time with Owner's Representative prior to commencement of work.
- C. All work performed in or through occupied spaces, or other work disruptive to existing occupants shall be considered as performed during premium time or as overtime for the purposes of the bid; include all costs in bid.
- D. The Contractor shall notify Owner's Representative of all shutdowns or disruptive work a minimum of 72 hours prior to commencement of work. The Contractor shall obtain written approval from the Owner's Representative prior to commencement of work.
- E. The Contractor shall provide all necessary temporary power, including temporary power generation, to accommodate shutdowns and minimize disruption of the Owner's activities.
- F. The Owner reserves the right to provide emergency repairs or temporary power to maintain service continuity at the Contractor's cost in the event Contractor fails to provide adequate service continuity.

#### 1.9 RECORD DOCUMENTS

- A. The Contractor shall prepare as-built documents depicting all revisions to branch circuits, conduit routing, equipment, panel schedules, lighting control schedules, or materials. Drawings shall be in AutoCAD .dwg format and Adobe .pdf formats. Contractor shall provide (1) full-size hard copy print and (1) CD-ROM of all as-built drawings and files. Hand-drawn or "red-line" drawings shall not be accepted. Drawings shall be legible, reproducible, and properly identified such they may be used as a reference for maintenance or construction.
- B. The Contractor shall provide a minimum of three copies of the operation and maintenance manuals to the Owner's Representative at the completion of the project. Each copy shall be bound in a three-ring binder and labeled indicating: the project name; system name; Contractor's name, telephone number, and contact person; and Owner's name. The Contractor shall provide the following minimum information within each manual:
  - 1. List of the Subcontractors performing work on the system including contact names, telephone numbers, and email addresses.
  - 2. Routine and emergency service contact names, telephone numbers, and email addresses for each system.
  - 3. Description of system operation.
  - 4. Single line diagrams and control wiring diagrams.
  - 5. Detailed product literature with technical information.
  - 6. Local factory representative contact name, telephone number, and email address.

7. Sequence of starting, shutdown and operation.
8. Installation instructions and safety requirements.
9. Maintenance schedule, testing instructions and performance parameters.
10. Parts list including recommended spare parts.

1.10 GUARANTEE

- A. All electrical work, materials and equipment provided under this contract shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner. Any failures, problems, or deficiencies experienced during this period due to defective materials or faulty workmanship shall be immediately corrected by the Contractor without cost to the Owner. The Contractor shall be responsible for all damages to the Owner's facility, production, or work product due to deficiencies in the electrical system. Equipment guarantees in excess of one year shall not be superseded by this guarantee.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall be new, of prime quality, listed as suitable for the application, and bear factory-applied U.L. labels.
- B. Materials shall be currently in production and shall be supported by spare parts, repair service, maintenance, and factory technical support.
- C. Materials of one assembly (switchboards, substations, motor control centers, etc.) shall be of one manufacturer unless specifically stated otherwise in the contract documents.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

- A. All work shall conform to National Electrical Contractors Association standards of installation and the requirements of the manufacturer, and the Owner's Representative.
- B. The Contractor shall field-verify all dimensions and coordinate dimensions with equipment sizes and locations.
- C. The Contractor shall coordinate and install all penetrations, openings, slots, chases, or sleeves as necessary for the routing and installation of raceways, conductors, or equipment. The Contractor shall provide approved fire sealant to maintain fire ratings at all penetrations.
- D. The Contractor shall coordinate the placement and sequence of installation of all mounting bolts, conduits, sleeves, etc. which are to be set in poured-in-place concrete slabs, concrete walls, and post-tension slabs per the structural drawings.

- E. The Contractor shall verify and coordinate all equipment points of connection, voltages, wiring requirements, disconnecting means, fuse sizes, overcurrent protection, etc. with the equipment supplier. The Contractor shall immediately notify the Engineer of any discrepancies with the construction documents.
- F. The Contractor shall install access panels in walls or ceilings in coordination with the Architect and Resident Engineer for all junction boxes or electrical equipment that require access.
- G. All equipment shall be installed plumb, parallel, or orthogonal to structure and in a neat orderly fashion. All material shall be accessible for maintenance, inspection, servicing or replacement.
- H. Verify final locations of devices, equipment, and fixtures during the rough-in phase with dimensioned architectural drawings, fabrication drawings, or other space planning requirements included in the contract documents.
- I. The Contractor shall coordinate and arrange for the proper sequence of construction including scheduling of long-lead items, shutdowns, work of other trades, and Owner-scheduled events.
- J. The Contractor shall provide adequate and qualified supervision for the work performed; no work shall be performed without the supervision of a representative of the Contractor.
- K. The Contractor shall coordinate and cooperate with all other trades for a successful completion of the project.

### 3.2 SEISMIC BRACING

- A. The Contractor shall seismically brace all equipment in accordance with requirements of the California Code of Regulations, Title 24, Seismic Design Category D and provide certification of seismic compliance upon request, including structural calculations as required.

### 3.3 CUTTING AND PATCHING

- A. The Contractor shall provide cutting and patching as required to install the electrical system in this contract.
- B. Coordinate the schedule of all cutting such that the work may be performed in an expeditious manner with minimum inconvenience to the Owner.
- C. Remove or cut structures or materials as necessary for demolition prior to the installation of new electrical work.
- D. The Contractor shall protect all surfaces, structure, furnishings, and finishes not directly affected by cutting or patching.
- E. Provide dust and moisture barriers as required during cutting and prior to patching openings.
- F. All penetrations through roofs shall be performed per architectural requirements, including compliance with the roofing manufacturers' requirements.



- G. Patching shall be performed with materials which exactly match the adjacent surfaces in color, texture, character, and appearance.
- H. All patches must maintain the fire ratings of the original surface and shall be sealed with a U.L. listed and Fire Marshal approved sealant.

### 3.4 COMMISSIONING

- A. The Contractor shall initiate start up of all electrical equipment including operation of all devices, switches, generators, transfer switches, overcurrent protection, disconnect switches, etc. to verify normal operation of all moving parts and electrical performance.
- B. The Contractor shall test, adjust, aim, align, label, clean and complete all systems prior to acceptance by the Owner's Representative.
- C. The Contractor shall demonstrate that all systems operate within the manufacturer's recommended performance characteristics, the electrical construction documents, system requirements, and Owner requirements.
- D. The Contractor shall test each system per the manufacturer's requirements and shall perform the following system tests:
  - 1. Inspect cables for physical damage and proper connection.
  - 2. Torque test cable connection and tighten in accordance with termination manufacturers recommendations.
  - 3. Infrared scan all connections under loaded conditions and provided color printed images.
  - 4. Insulation resistance test of each cable.
  - 5. Inspect ground system connections.
  - 6. Voltage drop tests on the main grounding electrode of system.
  - 7. Determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral points.
  - 8. Check rated voltage and phase balance at all equipment, motors and selected devices at full load conditions. Measure no load voltage conditions at each location.
  - 9. Furnish all material, equipment, instruments and labor as required to complete testing.
  - 10. Provide all test results properly bound in a three-ring binder.

### 3.5 TRAINING

- A. Furnish at least one copy operating instructions from the manufacturer for all electrical equipment to the Owner's Representative. Instructions shall be clean, legible, and properly bound in a three-ring binder.
- B. The Contractor shall provide training for the Owner's staff as directed by the Owner's Representative for a minimum of one man-day (eight hours).
- C. Provide classroom training by a qualified instructor for the operation, installation, and maintenance of designated equipment or systems including, but not limited to, generation systems, transfer switches, uninterruptible power supplies, energy management systems, lighting control systems, power distributions systems, and other systems which may require instruction.

3.6 CLEANING

- A. Contractor shall clean all equipment, panelboard interiors, conduit interiors, fixtures, devices, etc. of all extraneous paint, drywall mud, overspray, dust, dirt, debris, trash, grease or markings. All cleaning shall be performed by the Contractor in accordance with the appropriate manufacturer's recommendations.

END OF SECTION 26 05 00

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SECTION 26 05 19 - WIRE AND CABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriter's Laboratories, Inc.(UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

### 1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Conductor materials and stranding.
  - 2. Connector and termination materials.
  - 3. Installation materials and methods.
  - 4. Termination materials and methods.

## PART 2 - PRODUCTS

- 2.1 Conductors shall be copper; conductors size #12AWG and smaller shall be solid, conductors size #10AWG and larger shall be stranded. Conductors shall be minimum size #12AWG for power and lighting circuits; control circuits shall use a minimum conductor size of #14AWG.
- 2.2 Insulation shall be type THW or THHN/THWN for all branch circuits up to and including size #2AWG. Insulation for conductors over size #2AWG shall be XHHW.
- 2.3 Jackets shall be nylon or PVC material.
- 2.4 All cables shall be UL listed for the application.
- 2.5 All conductors shall be installed in conduit in the field, unless specifically noted otherwise in these documents. Type AC and type NM cable is not acceptable; type MC cable may be used where specifically noted for purposes of flexibility, maintenance, or ease of installation but shall not be used without explicit permission and direction of the Engineer.
- 2.6 Multi-conductor flexible cords shall be types SO, SJO, STO, or SJTO.
- 2.7 Electrical connectors shall be UL listed and suitable for the conductor material being connected and rated appropriately. Connectors shall be solderless helical metal spring pressure type for conductors #10AWG and smaller. Connectors shall be compression type for conductors #8AWG and larger.

## PART 3 - EXECUTION

- 3.1 All wiring methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Conductors shall be installed in clean raceways using nylon cord, polypropylene cord, hemp rope, or other material which will not damage the conductors or conduit. Do not use metal fish tape to pull conductors. Use a listed cable pulling lubricant when necessary for pulling.
- 3.3 Conductors shall be pulled into conduit simultaneously so as to not damage conductors during

pulling.

- 3.4 Conductors installed at outlets and switches shall have a minimum of 6" pigtail left in the box for future connections. All conductors not connected to devices shall be terminated with splice caps and tape.
- 3.5 Conductors shall be terminated such that no copper material is exposed. Conductors shall be trained and labeled at terminations in a neat and workmanlike manner.
- 3.6 All terminations shall be mechanically sound, featuring helical twisting of the terminating conductors prior to the application of an electrical connector. The electrical connector shall not be used for the mechanical connection of the conductors.
- 3.7 All terminations shall comply with the manufacturer's installation and torquing requirements.
- 3.8 Splices on conductors #10AWG and smaller shall be made with splice caps twisted onto the conductors. Tape all splices.
- 3.9 Splices on conductors #8AWG and larger shall be made with pressure connectors and terminal lugs. Where exposed to water, damp air, or moisture splices shall be watertight.
- 3.10 Splices shall be not be made in feeders; splices to branch circuits shall not be made within panelboards or similar enclosures.
- 3.11 When combining homeruns, the Contractor shall derate all conductors per NEC requirements including reducing the conductor ampacity and using high temperature insulation where necessary. Conduit sizes shall be adjusted by the Contractor, per NEC requirements, for any conductor revisions.
- 3.12 The Contractor shall provide a code-sized insulated grounding conductor, in addition to the feeder conductors indicated on the drawings, for all feeder circuits.
- 3.13 Conductors shall be color-coded as follows:

208Y/120V	Phase	480Y/277V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

- 3.14 Where tape or labels are used for color-coding, apply material at each end of the conductor, at all splices, within all boxes, and at all terminations.
- 3.15 One neutral for every one circuit pulled. No sharing on neutral wires anywhere.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. Permanently and effectively ground conduit systems, supports, cabinets, switchboards, equipment cases, motor frames, lighting standards, landscape lighting, etc., and system neutral conductors per National Electrical Code.
- B. Grounding details, symbols and singlelines shown on plans are schematic only. If additional equipment, such as ground rods, clamps, conductors, etc., is required per National Electrical Code furnish and install without additional cost to Owner.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of standards listed below form an integral part of this specification.
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriters' Laboratories, Inc. (UL)
  - 13. International Building Code (IBC)
- B. Furnish products listed by Underwriters Laboratories, Inc. as suitable for purposes specified and shown.

1.4 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review.



- B. Manufacturer's data on grounding and bonding products and associated accessories.

1.5 ACCEPTABLE MANUFACTURERS

- A. Burndy Corporation
- B. Cadweld Division
- C. Crouse-Hinds
- D. Thomas and Betts Corporation
- E. Okonite Company
- F. Tecto Weld
- G. Or Approved Equal

PART 2 - PRODUCTS

2.1 GROUNDING MATERIAL

- A. Rod Electrode: Material to be copper clad steel rod, 3/4 inch diameter with minimum 10 feet length.
- B. Mechanical Connectors: Material shall be copper and of sound continuity when installed.
- C. Exothermic Connectors: Material shall be of low emission, electric-start type and of sound continuity when installed.
- D. Bare Ground Conductors
  - 1. Conductor shall be 7-strand annealed copper.
  - 2. Individual members of stranded conductor shall meet the requirements of ASTM B-3.
  - 3. Stranded conductors shall be assembled in accordance with the requirements of ASTM B-8.
- E. Insulated Conductor (Equipment grounding conductor)
  - 1. Size in accordance with NEC Article 250-95 unless otherwise shown as oversize.
- F. Grounding Well Components
  - 1. Well Pipe: Material shall be 8 inch diameter by 24 inch long concrete pipe with belled end.
  - 2. Well Cover: Material shall be cast iron with the text "GROUND" embossed on cover.
- G. Ground Bus Bar
  - 1. ASTM B187, 98% conductivity copper bus bar, size 4 inches wide by 1/4inch thick by 24 inches long.

- H. Terminal Lugs
  - 1. For 4/0 AWG and smaller conductors: Copper compression lugs.
  - 2. For 250kcmil and larger: Aluminum mechanical lugs.
- I. Bonding Plates, Connectors, Terminals and Clamps
  - 1. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.
- J. Jumpers
  - 1. Copper braided or leaf-type flexible jumper, size as necessary.
- K. Bus Bar Insulators
  - 1. Fiberglass reinforced polyester insulator with 2 inch diameter threaded holes at both ends for bus bar installation.
- L. Electrical Grounding Connection Accessories
  - 1. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service indicated.
- M. Field Welding
  - 1. Field Welding: Comply with AWS Code for procedures, appearance, and quality of welds; and for methods used in correction welding work. Provide welded connections where grounding conductors connect to underground grounding and plate electrodes.
- N. Grounding Resistors
  - 1. Provide a low-resistance grounding resistor in compliance with the latest IEEE-32 standard.
  - 2. Temperature rise shall not exceed 760 degrees C above an ambient temperature of 30 degrees C for a ten-second duration.
  - 3. Neutral grounding relays shall be set to protect the resistor and clear the fault within ten-seconds.
  - 4. For resistors above 600V, an applied high potential test shall be performed equal to 2.25 times the rated voltage, plus 2000 volts.
  - 5. Grounding resistors shall be UL or CSA listed and labeled.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's Standard of Installation, and in accordance with recognized industry practices to ensure that products comply with requirements.

- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Ground each separately-derived system neutral to nearest cold water piping, service entrance equipment grounding electrodes, and electrically continuous building steel.
- D. Connect together system neutral, service equipment enclosures, electrically continuous building steel, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- E. Apply corrosion-resistant finish to field-connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.
- F. All raceways will include a full size green insulated ground wire terminated at each outlet box, device enclosure, etc. and connected back at the panelboards, switchboard, or cabinet on the appropriate ground bus.

### 3.2 GROUND INSTALLATION

- A. Equipment Grounding Conductor
  - 1. Provide separate, insulated conductor within each feeder and branch circuit raceway including lighting circuits.
  - 2. Terminate each end on suitable lug, bus, bushing, or device.
- B. Motors or equipment rated at 480V shall have bonded ground jumpers from feeder conduit to motor frame.
- C. Grounding bushing shall be used wherever conduits are grounded.
- D. Ground the electrical service system neutral at service entrance equipment to the grounding electrode system.
- E. Install rod electrodes at locations indicated.
- F. Provide grounding well pipe with cover at rod locations where indicated. Install well pipe top flush with finished grade.
- G. Install products in accordance with manufacturers' instructions.
- H. Use mechanical connections in above ground and accessible locations and use exothermic connectors in underground and inaccessible locations.
- I. Provide bonding to meet Regulatory Requirements. Include bonding of metallic gas and sprinkler piping systems.
- J. Install ground clamps specifically designed for grounding purposes. Where grounded conductor is in conduit, use ground clamp which grounds both conductor and conduit. Strap metal is not acceptable for grounding and bonding.

3.3 ISOLATED GROUND INSTALLATION

- A. Provide isolated grounding conductor for circuits supplying isolated ground receptacles. Ground conductor will be sized per NEC unless otherwise noted to be of larger size.
- B. Isolated ground conductor shall be routed through panel and to transformer ground for 208V or 120V systems. Isolated ground shall be routed to distributed rod electrode for 480V or 277V systems.

3.4 GROUND RESISTANCE TESTING

- A. Grounding electrode resistance testing shall be accomplished with a ground resistance direct reading single test meter utilizing the fall-of-potential method and two reference electrodes. Perform test prior to interconnection to other grounding systems. Orient the concrete-encased ground electrode to be tested and the two reference electrodes in a straight line spaced fifty (50) feet apart. Drive the two reference electrodes five (5) feet apart.
- B. Maximum grounding system resistance to be 5 ohms for secondary systems. Install additional ground rods as needed to achieve a resistance of 5 ohms.
- C. Test results shall be provided in writing and shall show temperature, humidity and condition of the soil at the time of the tests.

END OF SECTION 26 05 26

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**SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

**1.2 QUALITY ASSURANCE AND STANDARDS**

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriter's Laboratories, Inc. (UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

### 1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Support materials
  - 2. Attachment and anchor materials
  - 3. Installation materials and methods

## PART 2 - PRODUCTS

### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cooper B-Line, Inc.; a division of Cooper Industries.
    - b. Thomas & Betts Corporation.
    - c. Unistrut; Tyco International, Ltd.
  - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 6. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following and shall be compatible with all building surfaces and materials:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 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) Hilti Inc.
    - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
    - 3) Or Approved Equal
2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
  - 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) Hilti Inc.
    - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
    - 3) Or Approved Equal
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and GRC as required by the NEC. Minimum rod size shall be 3/8 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.



- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriter's Laboratories, Inc. (UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements,

instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Raceway materials
  - 2. Fitting materials
  - 3. Installation materials and methods

PART 2 - PRODUCTS

2.1 RIGID GALVANIZED STEEL (RGS) CONDUIT

- A. Continuous hot-dipped galvanized manufactured per UL and ANSI requirement.
- B. Rigid aluminum conduit is not acceptable.
- C. Conduit bodies for use with steel conduit, rigid or flexible, shall be manufactured per UL requirements and shall be cast metal with gasketed closures.
- D. Fittings for RGS conduit shall be malleable iron or forged steel with cadmium or zinc coating.
- E. Union couplings for joining rigid conduit at intermediate runs shall be of the same material as the conduit. Couplings shall be threaded concrete-tight to permit completing conduit runs when neither conduit can be turned and to permit breaking the conduit run at the union.
- F. Set screw connectors or threadless type are not acceptable.
- G. Minimum raceway size shall not be less than 3/4".
- H. All conduits exposed below 4 feet of finish grade on walls shall be rigid conduit.

2.2 ELECTRICAL METALLIC TUBING (EMT)

- A. Conduit shall be cold rolled zinc coated steel and manufactured per UL and ANSI requirements.
- B. Fittings for EMT shall be watertight steel or malleable gripping ring compression type.
- C. Pressure cast material for nuts of compression ring type fittings and set-screw connections are not acceptable.
- D. Minimum raceway size shall be 3/4".

2.3 ELECTRICAL NON-METALLIC TUBING (ENT)

- A. Conduit shall be manufactured in accordance with NEMA TC13 standards and shall be UL listed.

- B. Fittings for ENT shall be snap-on type threaded male adapters and locknuts.
- C. Minimum raceway size shall be ¾”.

2.4 FLEXIBLE METALLIC CONDUIT

- A. Flexible conduit shall bear the UL label and be zinc coated steel.
- B. Fittings for flexible metallic conduit shall be steel or malleable iron. Fittings shall clamp to conduit securely.
- C. Screw in type, sheet metal or set-screw type fittings are not acceptable.
- D. Minimum raceway size shall not be less than ¾”.
- E. All E.M.T. connector, coupling, and other fittings will be non-cast steel compression type.

2.5 LIQUID TIGHT FLEXIBLE CONDUIT

- A. Conduit shall be manufactured in accordance with UL and ANSI requirements. Conduit shall be approved for grounding and compatible with approved fittings. Flexible steel conduit shall be hot dipped galvanized with extruded PVC covering manufactured per UL requirements.
- B. Fittings shall be liquid tight type with body and gland nut of steel or malleable iron with provisions for grounding flexible conduit to fittings.
- C. Minimum raceway size shall be ¾”.

2.6 POLYVINYL CHLORIDE (PVC) CONDUIT

- A. PVC shall be constructed of a virgin homopolymer PVC compound and be manufactured according to NEMA and UL specifications. PVC conduit shall be Schedule 40 or 80.
- B. All conduits in the ground will be P.V.C. schedule #40, (minimum) ¾ inch or larger in diameter.

PART 3 - EXECUTION

3.1 RIGID GALVANIZED STEEL (RGS) CONDUIT

- A. RGS shall be used where exposed to weather or where subject to physical damage in exposed areas below 8'0" above finished floor.
- B. RGS shall be used in NEC classified hazardous locations with seal connections per NEC requirements.
- C. RGS will be neatly grouped and installed parallel to the building lines. Support for conduit shall be rubber sleepers with unistrut on top.

**3.2 ELECTRICAL METALLIC TUBING (EMT)**

- A. EMT shall be run indoors concealed in drywall type construction, above suspended ceilings, and exposed indoors not less than 8'0" above finished floor in unfinished areas.
- B. EMT shall not be installed underground, outdoors, or embedded in concrete.

**3.3 ELECTRICAL NON-METALLIC TUBING (ENT)**

- A. ENT shall be run indoors concealed in drywall type construction where permissible by Code and by the local authority. ENT shall not be installed in any exposed areas.
- B. ENT to be installed embedded in concrete shall be approved by the Structural Engineer prior to installation. All embedded installations shall comply with the installation requirements provided by the Structural Engineer.

**3.4 FLEXIBLE METALLIC CONDUIT**

- A. Flexible conduit shall be used for indoor lighting connections in suspended ceiling areas and shall not exceed 6'0" in length.
- B. Flexible conduit shall be used for final connection to control equipment and not to exceed 2'0" in length.
- C. The conduit grounding system shall be continuous as recommended by the manufacturer and UL approved.
- D. Flexible conduits will have a green ground wire. It will only be used for motor connections, fixture tails, or used in existing walls (6" or less). Non-metallic or sealtite will be used in damp locations and machinery rooms.

**3.5 LIQUID TIGHT FLEXIBLE CONDUIT**

- A. Liquid tight flexible conduit shall be used for final connection to machines, motors, transformers and equipment that requires vibration isolation.
- B. Liquid tight flexible conduit shall be used for final connection to equipment in wet or damp locations or where exposed to grease, water, dust, dirt, vapors, or chemicals.
- C. The conduit grounding system shall be continuous as recommended by the manufacturer and UL requirements.

**3.6 POLYVINYL CHLORIDE (PVC) CONDUIT**

- A. All sweeps, bends, and risers shall be concrete encased Schedule 80.
- B. All underground high voltage conduit, telephone conduit, service entrance conduit and feeders 100A and over shall have 3" of red mixed concrete cover and a metallic locating tape installed 6" above the top of the conduit.
- C. All PVC conduit feeders shall contain a copper green grounding conductor sized per NEC

requirements and continuity shall be maintained throughout conduit runs and pullboxes.

- D. All P.V.C. will be buried below ground level and below slab. P.V.C. shall not be installed within a concrete slab or concrete floor with the exception of penetrations or stub-ups.
- E. All stub-ups in P.V.C. will be changed to E.M.T. in walls, with the exception of exterior block walls.

### 3.7 CONDUIT INSTALLATION

- A. All conduit installation methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- B. All conduit installations shall comply with the manufacturer's installation requirements.
- C. All spare conduit shall be cleaned, mandrelled, and provided with a pullwire.
- D. Conduit run above suspended ceilings will be supported from the building structure independently and will be run with sufficient clearance from the ceiling system to permit the tiles to be removed and to allow full access to the space above.
- E. Home runs will be a minimum of 3/4" conduit. 1/2" can be used to supply a single termination (e.g. conduit going from switch box to single light fixture).

END OF SECTION 26 05 33

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SECTION 26 05 34 - BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:

- 1. American Disabilities Act (ADA)
- 2. American National Standards Institute (ANSI)
- 3. American Society for Testing and Materials (ASTM)
- 4. Institute of Cable Engineers Association (ICEA)
- 5. Institute of Electrical and Electronic Engineers (IEEE)
- 6. Local Code Enforcement Agency Requirements
- 7. National Electrical Code (NEC)
- 8. National Electrical Contractor's Association (NECA)
- 9. National Electrical Manufacturer's Association (NEMA)
- 10. National Electrical Testing Association (NETA)
- 11. National Fire Protection Association (NFPA)
- 12. Underwriters' Laboratories, Inc. (UL)
- 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements,



instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.3 SUBMITTALS

A. Submit shop drawings per Section 26 05 00 for review including the following:

1. Box materials
2. Accessory materials

PART 2 - PRODUCTS

- 2.1 Boxes shall be flat rolled steel sized as required by code and as suitable for the application. Boxes shall have mounting holes and knock-outs in sides and back. Grounding shall be accommodated by means of threaded holes.
- 2.2 Provide accessories, extension rings, gaskets, supports, trim rings, hangers, straps, and other material as necessary for a complete code complying installation.
- 2.3 Boxes installed outdoors shall be weathertight, dusttight, and corrosion resistant. Provide gaskets and conduit hubs.
- 2.4 Provide type FS boxes for surface mounted applications.
- 2.5 Provide additional support for boxes as necessary when mounting fixtures or devices from boxes.
- 2.6 Provide ganged boxes for multiple switches and devices; provide barriers for boxes served by separate voltages.
- 2.7 Acceptable manufacturers shall be Appleton, Crouse Hinds, Steel City, Raco, or approved equal.
- 2.8 Inside wiring device boxes and junction boxes will be at least 4" square by 1 1/8 inch deep.
- 2.9 Electrical, phone, and data floor boxes will be brass type (RFP style Walker) with tamper-proof screw cap only. All brass covers will be flush with the floor. Floor monuments are not acceptable.
- 2.10 Junction and switch boxes shall be a minimum of 4" square in size and a minimum of 2-1/8" deep.

PART 3 - EXECUTION

- 3.1 All box installation methods shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Install all boxes plumb, square, and securely fastened to structure.

- 3.3 Boxes shall be placed such that they are readily accessible.
- 3.4 Cover or plug all unused openings in boxes where knockout blanks have been removed.
- 3.5 Install boxes such that they are flush with the finished surface of the wall or surface within which they are mounted.
- 3.6 Install all boxes at mounting heights per architectural plans, NEC requirements, and ADA requirements.
- 3.7 Boxes shall not be mounted back to back in walls. Minimum offset shall be 12”.
- 3.8 Boxes in sealed environments shall be sealed with an approved sealant suitable for the application.
- 3.9 Boxes penetrating fire rated walls or surfaces shall be sealed with a Fire Marshal approved fire sealant to maintain the fire rating of the wall or surface.
- 3.10 Boxes located above inaccessible ceilings shall be made accessible by means of access doors or hatches in the ceiling.
- 3.11 Install all boxes per manufacturer’s recommendations and requirements.
- 3.12 Provide for ground continuity at all boxes.
- 3.13 All outdoor outlets will be installed in a recessed stainless steel box with a flush, lockable cover with a 20 amp G.F.C.I. receptacle and on a separate circuit. For gazebos and outside public areas.

END OF SECTION 26 05 34

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SECTION 26 05 75 - ACCEPTANCE TESTING

PART 1 - GENERAL

- 1.1 It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.
- 1.2 The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.
- 1.3 Items that shall be checked, inspected, and tested include, but are not limited to, the following:
  - A. SF6 switches and overcurrent protection devices
  - B. Relays
  - C. Ammeters
  - D. Voltmeter
  - E. Wattmeters
  - F. Varmeters
  - G. Voltage transducer
  - H. Current transducers
  - I. Watt transducers
  - J. Var transducers
  - K. AUX compartment with control power transformer
  - L. AUX compartment with potential transformer
  - M. AUX compartment with batteries and rectifier
  - N. Sets of Current Transformers
  - O. Surge arrestors
  - P. Grounding system
  - Q. Power/Lighting panelboards
  - R. 15kV rated cable
  - S. 600V rated cable
  - T. Substations and distribution switchgear
  - U. Automatic Transfer Switches
- 1.4 APPLICABLE CODES
  - A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.
    1. National Electrical Code - NEC 2005 Edition.

2. National Electrical Manufacturer's Association - NEMA.
3. American Society for Testing and Materials - ASTM.
4. Institute of Electrical and Electronic Engineers - IEEE.
5. National Electrical Testing Association - NETA.
6. American National Standards Institute - ANSI:
  - a. C2, National Electrical Safety Code
  - b. Z244-1, American National Standard for Personnel Protection
7. State Codes and Ordinances.
8. Insulated Cable Engineers Association - ICEA.
9. Association of Edison Illuminating Companies - AEIC.
10. Occupational Safety and Health Administration:
  - a. Part 1910, Subpart S, 1910.308
  - b. Part 1926, Subpart V, 1926.950 through 1926.960
11. National Fire Protection Association - NFPA:
  - a. ANSI/NFPA 70B, Electrical Equipment Maintenance
  - b. NFPA 70E, Electrical Safety Requirements for Employee Workplaces
  - c. ANSI/NFPA 70, National Electrical Code 2005 Edition
  - d. ANSI/NFPA 78, Lightning Protection Code
  - e. ANSI/NFPA 101, Life Safety Code
12. All inspections and tests shall utilize the following references:
  - a. Project Design Specification.
  - b. Project Design Drawings.
  - c. Manufacturer's instruction manuals applicable to each particular apparatus.

#### 1.5 QUALIFICATIONS OF TESTING AGENCY

- A. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
- B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
- C. The testing firm shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936. Full membership in the National Electrical Testing Association constitutes proof of such criteria.
- D. The lead, on site, technical person shall be currently certified by the National Electrical Testing Associate (NETA) in Electrical Power Distribution System Testing.
- E. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians may assist, but may not perform testing and/or inspection services.
- F. The testing firm shall submit proof of the above qualifications.

- G. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the National Electrical Testing Association.
- H. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments. (See Section 1.7 of this specification).
- I. The terms used herewith such as Test Agency, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.

#### 1.6 RESPONSIBILITIES

- A. The Contractor shall notify the Owner's Representative prior to commencement of any testing.
- B. Any system, material or workmanship which is found defective on the basis of acceptance tests shall be reported.
- C. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
- D. A stable source of 60 hertz power shall be provided for testing purposes by the Contractor. All tests shall be witnessed by Owner's Representative and a minimum of 14 days notice shall be provided.

#### 1.7 TEST EQUIPMENT

- A. Test Instrument Calibration
  - 1. The testing firm shall have a calibration program which assures that all applicable test instrumentation are maintained within rated accuracy.
  - 2. The accuracy shall be directly traceable to the National Bureau of Standards.
  - 3. Instruments shall be calibrated in accordance with the following frequency schedule:
    - a. Field instruments:           Analog - 6 months maximum  
  Digital - 12 months maximum
    - b. Laboratory Instruments - 2months
    - c. Leased specialty equipment - 12 months (where accuracy is guaranteed by lessor)
  - 4. Dated calibration labels shall be visible on all test equipment.
  - 5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.
  - 6. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.
  - 7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

#### 1.8 TEST REPORTS

- A. The test report shall include the following:
  - 1. Summary of project.
  - 2. Description of equipment/device tested.
  - 3. Description of test, including date, time, and duration of test.

4. Test results.
5. Conclusions and recommendations.
6. Appendix, including appropriate test forms.
7. Identification of test equipment used.
8. Signature of responsible test organization authority.
9. Signature of the person witnessing the tests.
10. Furnish five copies of the complete report to the Owner's Representative no later than thirty (30) days after completion of project unless otherwise directed.

## 1.9 SAFETY AND PRECAUTIONS

- A. Safety practices shall include, but are not limited to, the following requirements:
  1. Occupational Safety and Health Act of 1970 - OSHA.
  2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
  3. Applicable State safety operating procedures.
  4. NETA Safety/Accident Prevention Program.
  5. Owner's safety practices.
  6. National Fire Protection Association - NFPA 70E.
  7. ANSI Z244.1 American National Standards for Personnel Protection.
- B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.
- C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

## PART 2 - PROTECTIVE DEVICE COORDINATION STUDY

- 2.1 A protective coordination study shall be performed using SKM's Dapper or equal software to select or check the selection of power fuse ratings, protective relay characteristics and settings, ratios, and characteristics of associated voltage breaker trip characteristics and settings.
- 2.2 The coordination study shall include all voltage classes of equipment from the Owner's main incoming line and down to and including panelboards. The entire electrical system shall be included in the coordination study including all emergency feeders. Verify characteristics and settings of existing devices in the field and from the manufacturer.
- 2.3 The time-current characteristics of the specified protective devices shall be plotted on the appropriate log-log paper. The plots shall include complete titles, representative one-line diagrams of both buildings and legends, associated relays or fuse characteristics, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves, and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Separate coordination plots for phase and ground protective devices shall be provided on a system basis. Separate curves shall be used to clearly indicate the coordination achieved for feeder breakers with downstream fuses and circuit breakers in switchgear and substations. There shall be a maximum of six protective

devices per plot.

- 2.4 The selection and setting of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. Discrepancies, problem areas, or inadequacies shall be promptly brought to the project Owner's Representative's attention.
- 2.5 Five copies of coordination curves and tabulated data indicating selection and settings of protective devices shall be submitted to the Owner's Representative for approval.

### PART 3 - EQUIPMENT VERIFICATIONS, TESTS, AND CALIBRATIONS

#### 3.1 GENERAL

- A. As part of the contract, the Contractor shall perform tests of installed work as herein specified and specified in other Sections of these Specifications.
- B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.
- C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NETA), and applicable codes and standards.
- D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.
- E. The test and inspections shall determine suitability for continued reliable operation.
- F. All tests shall be conducted in the presence of the Owner's Representative. Provide a minimum of two weeks notice to the Owner's Representative.
- G. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, SF6 switches, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

#### 3.2 SWITCHGEAR, SUBSTATIONS, DISTRIBUTION BOARDS, AND EMERGENCY SYSTEM-GENERAL

- A. Visual and mechanical inspection:
  - 1. Inspect for physical damage and code violations.
  - 2. Clean interior and exterior surfaces.
  - 3. Inspect for proper alignment, anchorage, and grounding.
  - 4. Check tightness of accessible bolted bus joints by torque wrench method. Tighten connections in accordance with industry standard torque levels.
  - 5. Make closure attempt on locked open devices. Make opening attempt on locked closed devices.



6. Make exchange with devices operated in off-normal positions.

B. Electrical tests:

1. Measure insulation resistance of each bus section phase-to-phase and phase-to-ground.
2. Inspect all accessible bus joints and cable connections by infrared scanner to detect loose or high-resistance connections and other circuit anomalies.
3. Inspect correctness of control wiring.

3.3 MEDIUM VOLTAGE SF6 SWITCHES AND OVERCURRENT PROTECTION

A. Visual and mechanical inspection:

1. Inspect for physical condition.
2. Inspect alignment and grounding.
3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer's instructions.
4. Perform insulation resistance test on control wiring.
5. Clean mechanism, insulating surfaces and contacts.
6. Check pressure of all SF6 containers if applicable.

B. Electrical Tests

1. Measure contact resistance.
2. Trip overcurrent protective device by operation of each protective device.
3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.
6. Test all SF6 pressure alarm and trip relays.

3.4 SURGE ARRESTERS

A. Visual and mechanical inspection:

1. Inspect for physical damage such as chipped or fractured porcelain.
2. Inspect ground and discharge counter connections for integrity.

B. Electrical tests:

1. Perform a 60Hz sparkover test.
2. Perform a radio influence voltage (RIV) test.
3. Perform an insulation power factor test.
4. Perform ground continuity test to ground grid system.

3.5 BATTERY SYSTEM

A. Visual and mechanical inspection:

1. Inspect for physical damage, anchorage, electrolyte leakage and level.

2. Check intercell bus link and cable connection integrity for tightness and corrosion.

B. Electrical tests:

1. Measure system charging voltage and each individual cell voltage.
2. Measure electrolyte specific gravity.
3. Perform infrared scan of the intracell links cable connections under current discharge conditions.

3.6 INSTRUMENT TRANSFORMER

A. Visual and mechanical inspection:

1. Inspect for physical damage and connection tightness.
2. Check transformer nameplate with singleline diagram.
3. Check proper operation of grounding or shorting devices.

B. Electrical tests:

1. Measure current transformer ratio by primary current injection.
2. Measure potential transformer ratio.
3. Measure insulation resistance primary-to-ground, secondary-to-ground and primary-to-secondary.
4. Verify secondary wiring connections by secondary current injection.
5. Verify transformer polarity markings.
6. Perform current transformer saturation test. Plot transformer voltage current curve.

3.7 METERING AND INSTRUMENTATION

A. Visual and mechanical inspection:

1. Check all devices for physical damage and connection tightness.
2. Verify meter nameplate designation.

B. Electrical tests:

1. Check calibration of all panel meters at zero, midscale and full scale deflections by transfer standard.
2. Test Digital Instrumentation Package per manufacturer's requirements.
3. Verify all instrument multipliers and scale factors.
4. Check polarities and correct rotations.

3.8 CONTROL POWER TRANSFORMERS - ENCAPSULATED TYPE

A. Visual and mechanical inspection:

1. Inspect for physical damage, proper installation, anchorage, and grounding.
2. Clean interior and all bushing and insulator surfaces.
3. Verify proper auxiliary device operation such as fans and indicators.
4. Check tightness of accessible bolted electrical joints. Tighten connections in accordance with industry standards.

- B. Electrical tests:
  - 1. Perform insulation resistance tests winding-to-winding and winding-to-ground. Apply appropriate guard circuit over all bushings.
  - 2. Perform dielectric absorption test winding-to-winding and winding-to ground for ten (10) minutes. Compute the polarization index.
  - 3. Perform turns ratio test between windings for all top positions.
  - 4. Perform insulation power factor tests on all high and low-voltage windings.
  - 5. Check output voltages.

### 3.9 PROTECTIVE RELAYS

- A. Visual and mechanical inspection:
  - 1. Inspect relays for physical damage, presence of foreign material, moisture, condition of spiral spring, disc clearance and corrosion.
  - 2. Clean cover glass interior and relay components.
  - 3. Check for freedom of movement, proper travel and alignment, and tightness of mounting hardware and top screws.
- B. Electrical test:
  - 1. Perform insulation resistance tests on each circuit branch to frame.
  - 2. Perform the following tests at the settings specified by Owner's Representative:
    - a. Pickup parameters on each operating element.
    - b. Timing at three (3) points on time dial curve.
    - c. Pickup target and seal in units.
    - d. Special test as required to check operation of restraint, and other elements per manufacturer's instructions.
  - 3. Perform phase angle and magnitude contribution tests on all differential type relays after energization to vectorially prove proper polarity and connection.
  - 4. Check polarity and correctness of control wiring.
- C. Relay calibration and tests:
  - 1. Two relay wiring tests shall be made.
    - a. Primary circuit polarity test shall include a DC test from the current transformer to each terminal block and relay terminal.
    - b. Relay and circuit breaker operation test by application of power from the portable relay test set.
- D. Relay testing shall be accomplished after completion of the switchgear installation, using standard portable test set equipment and the relay manufacturer's testing directions and parameters to determine conformance of the relay to the time-overcurrent information given in the manufacturer's performance curves and the tap settings provided by coordination study. Overcurrent relay testing shall include:
  - 1. Zero set tests.
  - 2. Pickup tests.
  - 3. Time-current characteristic (operation at currents 3 and 4 times the directed tap settings),

- and instantaneous at the directed tap setting.
- 4. Target and seal-in operation.
- E. Target differential relays shall be tested similarly, except for the following additional tests:
  - 1. Low voltage “through-currents” of approximately “full load” and “fault” magnitudes shall be circulated in HV busses. Bus differential relays shall not trip.
  - 2. Low voltage currents shall be circulated within the differential zones of “low-fault” and “high-fault” magnitudes. Bus differential relays shall initiate tripping momentarily.

**3.10 CABLES 15kV**

- A. Visual and mechanical inspections:
  - 1. Inspect exposed section for tracking corona, and physical damage.
  - 2. Clean all creepage from surfaces of termination.
- B. Inspect shield grounding, cable support, and termination.
  - 1. Perform infrared scan of all connections under loaded conditions.
- C. Electrical tests:
  - 1. Perform shield and conductor continuity test by ohmmeter method. Record ohmic value.
  - 2. Perform insulation-resistance test of each cable with respect to ground and adjacent cables.
  - 3. Perform DC hypotential test:
    - a. Test each conductor individually with all other conductors grounded. All shields to be grounded.
    - b. Corona at terminations will be suppressed with guard rings, field reduction spheres, or other suitable methods.
    - c. Apply DC hypotential in at least eight (8) equal increments until maximum test voltage is reached. Record DC leakage current at each step after a constant stabilization time, consistent with system charging current decay. Plot leakage current (X axis) versus voltage (Y axis) at each increment.
    - d. Raise the test conductor to a maximum test voltage and hold for a total of ten (10) minutes. Record readings of leakage current (Y axis) versus time (X axis) and plot on thirty (30) second intervals for the first two (2) minutes and every minute thereafter. Perform maximum voltage decrement test by reducing the applied voltage to zero and monitoring voltage decay versus time. Apply grounds upon completion to drain all absorpic potential to zero.
    - e. Test each conductor in accordance with Section E of AEIC C56.

**3.11 LOW VOLTAGE CIRCUIT BREAKERS**

- A. Visual and mechanical inspection:
  - 1. Inspect for physical condition.
  - 2. Inspect alignment and grounding.
  - 3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer’s instructions.

4. Perform insulation resistance test on control wiring.
5. Clean mechanism, insulating surfaces and contacts.

B. Electrical tests:

1. Measure contact resistance.
2. Trip overcurrent protective device by operation of each protective device.
3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.
4. Perform insulation resistance test in accordance with Doble procedure.
5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

3.12 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)

A. Visual and mechanical inspections:

1. Inspect cables for physical damage and proper connection.
2. Torque test cable connection. Tighten connections in accordance with industry standards.
3. Perform infrared scan of all connections under loaded conditions.

B. Electrical tests:

1. Perform insulation resistance test of each cable with respect to ground and adjacent cables.

3.13 GROUNDING SYSTEMS

A. Visual and mechanical inspection:

1. Inspect ground system connections for completeness and adequacy.

B. Electrical tests:

1. Perform "fall of the potential" test per IEEE No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or derived neutral points.

3.14 INFRARED INSPECTION

A. All doors and cover shall be removed and upon completion of test be reinstalled by testing agency technicians.

B. A load bank shall be furnished to circulate low voltage currents of 400A magnitude through each bus, main breaker and feeder breaker. After two hours infrared scans shall be made of all bus joints. Problem area shall be photographed before and after corrections. After corrections, another current test of two hours duration shall be made. Again an infrared scan shall be made to confirm correct operation.

C. Upon completion, the switchgear shall be energized at 12kV. After 4 hours, infrared scans shall

## **Palm Ave Transitional Housing**

be made to determine areas of excessive corona. Problem area shall be treated the same as under B., above.

- D. Upon completion of infrared scans, all covers and doors shall be reinstalled.

END OF SECTION 26 05 75

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**SECTION 26 09 23 - OCCUPANCY SENSORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

**1.2 SCOPE**

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

**1.3 EQUIPMENT QUALIFICATION**

- A. Products supplied shall be from a single manufacturer. Mixing of manufacturers shall not be allowed.
- B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
- C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.
- D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

**1.4 SYSTEM DESCRIPTION**

- A. The objective of this section is to require the proper installation of the occupancy sensor based lighting control system such that lighting is turned off automatically after a reasonable time delay when a room or area is vacated.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.
- C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or



non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.5 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement, including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Electrical and Electronic Engineers (IEEE)
  - 5. Local Code Enforcement Agency Requirements
  - 6. National Electrical Code (NEC)
  - 7. National Electrical Contractor's Association (NECA)
  - 8. National Electrical Manufacturer's Association (NEMA)
  - 9. National Electrical Testing Association (NETA)
  - 10. National Fire Protection Association (NFPA)
  - 11. Underwriter's Laboratories, Inc. (UL)
  - 12. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.
- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.6 SUBMITTALS

- A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.
- B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

- C. Submit any interconnection diagrams per major subsystem showing proper wiring.
- D. Submit standard catalog literature, which includes performance specifications indicating compliance to the specification.
- E. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.7 SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system, or;
- B. Factory Startup: It shall be the contractor's responsibility to engage a factory-authorized representative to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Occupancy sensor manufacturer shall Wattstopper, or approved equal.

2.2 PRODUCTS

- A. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300SF, and gross motion up to 1000SF.
- B. Wall switch sensors shall accommodate loads from 1 to 800 watts at 120V; 1 to 1200W at 277V and shall have 180 degree coverage capability.
- C. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- D. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
- E. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- F. Were specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
- G. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
- H. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
- I. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier

configuration, with grooves-in to eliminate dust and residue build-up.

- J. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.
- K. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
- L. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- M. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- N. Ultrasonic operating frequency shall be crystal controlled at 25kHz within +/- 0.005% tolerance, 32kHz within +/- 0.002% tolerance, or 40kHz +/- 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- O. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- P. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- Q. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- R. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- S. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- T. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- U. All sensors shall have UL rated, 94V-0 plastic enclosures.

### 2.3 CIRCUIT CONTROL HARDWARE –CU

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.

- B. Relay Contracts shall have ratings of:
  - 1. 13A - 120 VAC Tungsten
  - 2. 20A - 120 VAC Ballast
  - 3. 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or teflon jacketed cable suitable for use in plenums, were applicable.
- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensor in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION 26 09 23

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SECTION 26 09 36 - MODULAR DIMMING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. This Section includes the following:
  - 1. Manual modular dimming controls.
  - 2. Integrated, multi-preset modular dimming controls.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of the standards listed below form an integral part of this specification:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Electrical and Electronic Engineers (IEEE)
  - 5. Local Code Enforcement Agency Requirements
  - 6. National Electrical Code (NEC)
  - 7. National Electrical Contractors Association (NECA)
  - 8. National Electrical Manufacturer's Association (NEMA)
  - 9. National Electrical Testing Association (NETA)
  - 10. National Fire Protection Association (NFPA)
  - 11. Underwriters' Laboratories, Inc. (UL)
  - 12. International Building Code (IBC)
  - 13. Illuminating Engineering Society of North America (IESNA)
  - 14. Certified Ballast Manufacturers (CBM)

1.4 DEFINITIONS

- A. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

- C. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
- D. SCR: Silicon-controlled rectifier.
- E. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

#### 1.5 SUBMITTALS

- A. Shop drawings for all dimming equipment and components shall be submitted and reviewed prior to fabrication. Any material produced prior to the review of shop drawings or samples, and not in conformance with the Contract Documents, may be rejected with the Contractor bearing full responsibility and cost. Submit shop drawings per Section 26 05 00 for review, include the following:
  - 1. Product Data: For each type of product indicated.
    - a. For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.
    - b. Device plates and plate color and material.
    - c. Ballasts and lamp combinations compatible with dimmers.
    - d. Wiring Diagrams: Power, signal, and control wiring.
  - 2. Samples for Initial Selection: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features. Provide samples only if requested.
  - 3. Samples for Verification: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features. Provide samples only if requested.

#### 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. Materials and equipment as well as workmanship provided under this section shall be new and shall conform to the highest commercial standards, and as specified and as indicated on the drawings. Dimming system parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion, thermal and mechanical stresses encountered in the normal application and function of the device.

#### 1.7 COORDINATION

- A. Coordinate features and capabilities of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

PART 2 - PRODUCTS

2.1 GENERAL DIMMING DEVICE REQUIREMENTS

- A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
- B. Dimmers and Dimmer Modules: Comply with UL 508.
  - 1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
  - 2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

2.2 MANUAL MODULAR MULTISCENE DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Lutron, Wattstopper, or Approved Equal.
- B. Description: Factory-fabricated equipment providing manual modular dimming control consisting of a wall-box-mounted, master-scene controller and indicated number of wall-box zone stations. Controls and dimmers shall be integrated for mounting in one-, two-, three-, or four-gang wall box under a single wall plate. Each zone station shall be adjustable to indicated number of scenes, which shall be recorded on the zone controller.
- C. Operation: Automatically change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
- D. Each manual modular multiscene dimming controller shall include a master control and remote controls.
- E. Each zone shall be configurable to control the following:
  - 1. Fluorescent lamps with electronic ballasts.
  - 2. Incandescent lamps.
  - 3. Low-voltage incandescent lamps.
  - 4. LED light engines.
  - 5. Blackout shade motors or switchable devices up to 500W.
- F. Memory: Retain preset scenes through power failures for at least seven (7) days.
- G. Device Plates: Style, material, and color shall comply with Division 26 Section "Wiring Devices and Connectors".
- H. Master-Scene Controller: Suitable for mounting in a single flush wall box.
  - 1. Switches: Master off, group dim, group bright, and selectors for each scene.



2. LED indicator lights, one associated with each scene switch, and one for the master off switch.
- I. Fluorescent Zone Dimmer: Suitable for operating lighting fixtures and ballasts specified in Division 26 Section "Interior Lighting," and arranged to dim number of scenes indicated for the master-scene controller. Scene selection is at the master-scene controller for setting light levels of each zone associated with scene.
  1. Switch: Slider style for setting the light level for each scene.
  2. LED indicator lights, one associated with each scene.
  3. Electrical Rating: 1000VA, 120 V.
  4. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
- J. Incandescent Zone Dimmer: Suitable for operating incandescent lamps at line-voltage or low-voltage lamps connected to a transformer and arranged to dim number of scenes indicated for the master-scene controller. Scene selection shall be at the master-scene controller for setting light levels of each zone associated with scene.
  1. Switch: Slider style for setting the light level for each scene.
  2. LED indicator lights, one associated with each scene.
  3. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
  4. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.

### 2.3 INTEGRATED, MULTIPRESET MODULAR DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Lutron Electronics, Inc.
- B. Indicate number of wall-box, remote-control stations.
- C. Description: Factory-fabricated, microprocessor-based, solid-state controls providing manual dimming control consisting of a master station and multiple wall-box, remote-control stations.
- D. Operation: Automatically changes variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
- E. Each zone shall be configurable to control the following:
  1. Fluorescent lamps with electronic ballasts.
  2. Incandescent lamps.
  3. Low-voltage incandescent lamps.
  4. LED light engines.
  5. Blackout shade motors or switchable devices up to 500W.
- F. Memory: Retain preset scenes and fade settings through power failures by retaining physical settings of controls.
- G. Master Station:

1. Contains control panel and multiple control and dimmer modules.
2. Controls and commands adjustment of each dimmer-zone setting for each scene change from one preset scene to another.
  - a. Master zone raises and lowers lighting level.
  - b. Adjustable fade rate for each scene from 1 to 60 seconds.
3. Rear-illuminated, scene-select buttons.
4. Lighting-level setting and fade-rate setting shall be graphically shown using LEDs or backlighted bar-graph indicator.
5. Mounting: Flush wall box, 3 ½" deep, with manufacturer's standard faceplate.

H. Remote-Control Stations:

1. Numbered push buttons to select scenes.
2. Off switch to turn master station off.
3. On switch turns all scenes of master station to full bright.
4. Control Wiring: NFPA 70, Class 2.
5. Mounting: Single flush wall box, 3 ½" deep, with manufacturer's standard faceplate.

I. Infrared Remote-Control Station: Same functions as for standard remote-control station, except that functions are input by a hand-held infrared transmitter.

J. Dimmers: Modular, plug-in type for each branch circuit.

1. Dimming Circuit: Two SCR dimmers, in inverse parallel configuration.
2. Dimming Curve: Modified "square law" as specified in IESNA's "IESNA Lighting Handbook"; control voltage is 0- to 10-V dc.
3. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
4. Voltage Regulation: Dimmer shall maintain a constant light level, with no visible flicker, when the source voltage varies plus or minus 2 percent in RMS voltage.
5. Short-Circuit Rating: 10 kA for 120 V, 14 kA for 277 V.

## 2.4 CONDUCTORS AND CABLES

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Wire and Cable."
- B. Class 2 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Wire and Cable".

## PART 3 - EXECUTION

### 3.1 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Comply with requirements in Division 26 Section "Wire and Cable." Minimum conduit size shall be 1/2 inch.

- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors and boxes according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Electrical Identification" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation. Coordinate all labeling with the Architect, Resident Engineer, or Owner.
- C. Label each scene control button with approved scene description. Coordinate all labeling with the Architect, Resident Engineer, or Owner.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Continuity tests of circuits.
  - 2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    - a. Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
  - 3. Remove and replace malfunctioning modular dimming control components and retest as specified above.
  - 4. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
  - 5. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

### 3.4 DEMONSTRATION

## **Palm Ave Transitional Housing**

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls for a minimum of four (4) hours. Laptop portable computer shall be used in training.
- B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Lighting Controls."

END OF SECTION 26 09 36

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**SECTION 26 09 43 - DLM LIGHTING CONTROLS**

**PART 1 – GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Digital Lighting Controls
2. Relay Panels
3. Emergency Lighting Control (if applicable)

**B. Related Sections:**

1. Section 265100 – Interior Lighting Fixtures, Lamps, and LED drivers:
2. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section
3. Electrical Sections, including wiring devices, apply to the work of this Section.

**C. Control Intent – Control Intent includes, but is not limited to:**

1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
2. Initial sensor and switching zones
3. Initial time switch settings
4. Task lighting and receptacle controls
5. Emergency Lighting control (if applicable)

**1.2 REFERENCES**

- A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)
- B. Underwriter Laboratories of Canada (ULC)
- C. International Electrotechnical Commission (IEC)
- D. International Organization for Standardization (ISO)
- E. National Electrical Manufacturers Association (NEMA)
- F. WD1 (R2005) - General Color Requirements for Wiring Devices.
- G. Underwriters Laboratories, Inc. (UL)
  1. 20 – Plug Load Controls
  2. 508– Industrial Controls
  3. 916 – Energy Management Equipment.
  4. 924 – Emergency Lighting

**1.3 SYSTEM DESCRIPTION & OPERATION**

- A. The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
2. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
3. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.
4. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
5. Digital Plug-Load Controllers – Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
6. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow bi-directional communication of room variables and occupancy sensor settings. Computer software also customizes room settings.
7. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
8. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded,) to connect multiple DLM local networks for centralized control
9. Network Bridge – provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
10. Segment Manager – provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
11. Programming and Configuration software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
12. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

#### 1.4 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
  1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON

occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

2. Bi-Level Lighting – Provide multi-level controls in all spaces except toilet rooms, storerooms, library stacks, or applications where variable dimming is used.
3. Task Lighting / Plug Loads – Provide automatic shut off of non-essential plug loads and task lighting in all spaces except toilet rooms and storerooms. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
4. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
  - a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
  - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
  - c. Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.
  - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four (4) pre-set lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to extinguish all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

## 1.5 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
- B. Shop Drawings:
  1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
  2. Show exact location of all digital devices, including at minimum sensors, room controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)
  3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
  4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of



connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.
2. Prove that the sensor is suitable for the proposed application.

## 1.6 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.

## 1.7 WARRANTY

A. Provide a five year limited manufacturer's warranty on all room control devices and panels.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. WattStopper, or Approved Equal.
  - a. System: Digital Lighting Management (DLM)
  - b. Basis of design product: WattStopper Digital Lighting Management (DLM) or subject to compliance and prior approval with specified requirements of this section, one of the following (or approved equal):
    - i Cooper
    - ii Leviton.

B. Substitutions:

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
2. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design highlighted for review and approval prior to rough-in.

### 2.2 DIGITAL LIGHTING CONTROLS

A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

**2.3 DIGITAL WALL SWITCH OCCUPANCY SENSORS**

- A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.
- B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
  - 1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity – 0-100% in 10% increments
    - b. Time delay – 1-30 minutes in 1 minute increments
    - c. Test mode – Five second time delay
    - d. Detection technology – PIR, Dual Technology activation and/or re-activation.
    - e. Walk-through mode
    - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  - 2. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - i Ultrasonic and Passive Infrared
      - ii Ultrasonic or Passive Infrared
      - iii Ultrasonic only
      - iv Passive Infrared only
  - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  - 4. Two RJ-45 ports for connection to DLM local network.
  - 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
  - 6. Device Status LEDs including:
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode

- d. Load binding
  7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  8. Assignment of local buttons to specific loads within the room without wiring or special tools
  9. Manual override of controlled loads.
  10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- C. BACnet object information shall be available for the following objects:
  1. Detection state
  2. Occupancy sensor time delay
  3. Occupancy sensor sensitivity, PIR and Ultrasonic
  4. Button state
  5. Switch lock control
  6. Switch lock status
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room controller, shall operate in the following sequence as a factory default:
  1. Left button
    - a. Press and release - Turn load on
    - b. Press and hold - Raise dimming load
  2. Right button
    - a. Press and release - Turn load off
    - b. Press and hold - Lower dimming load
- G. Low voltage momentary pushbuttons shall include the following features:
  1. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  2. The following button attributes may be changed or selected using a wireless configuration tool:
    - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
    - b. Individual button function may be configured to Toggle, On only or Off only.
    - c. Individual scenes may be locked to prevent unauthorized change.

- d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
- e. Ramp rate may be adjusted for each dimmer switch.
- f. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

**2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR**

- A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
  - 1. Digital calibration and pushbutton configuration for the following variables:
    - a. Sensitivity – 0-100% in 10% increments
    - b. Time delay – 1-30 minutes in 1 minute increments
    - c. Test mode – Five second time delay
    - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode
    - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
  - 2. Programmable control functionality including:
    - a. Each sensor may be programmed to control specific loads within a local network.
    - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
    - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
    - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
      - i Ultrasonic and Passive Infrared
      - ii Ultrasonic or Passive Infrared
      - iii Ultrasonic only
      - iv Passive Infrared only
  - 3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
  - 4. One or two RJ-45 port(s) for connection to DLM local network.

5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
  6. Device Status LEDs, which may be disabled for selected applications, including:
    - a. PIR detection
    - b. Ultrasonic detection
    - c. Configuration mode
    - d. Load binding
  7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
  8. Manual override of controlled loads. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- C. BACnet object information shall be available for the following objects:
1. Detection state
  2. Occupancy sensor time delay
  3. Occupancy sensor sensitivity, PIR and Ultrasonic
- D. Units shall not have any dip switches or potentiometers for field settings.
- E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

## 2.5 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
  2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  3. Configuration LED on each switch that blinks to indicate data transmission
  4. Load/Scene Status LED on each switch button with the following characteristics:
    - a. Bi-level LED
    - b. Dim locator level indicates power to switch
    - c. Bright status level indicates that load or scene is active
  5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
  6. Programmable control functionality including:
    - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

- b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
- 7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
  - 1. Button state
  - 2. Switch lock control
  - 3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- E. The following switch attributes may be changed or selected using a wireless configuration tool:
  - 1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
  - 2. Individual button function may be configured to Toggle, On only or Off only.
  - 3. Individual scenes may be locked to prevent unauthorized change.
  - 4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
  - 5. Ramp rate may be adjusted for each dimmer switch.
  - 6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

## 2.6 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with room controllers to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to a room controller. Daylighting sensors shall be interchangeable without the need for rewiring.
  - 1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
  - 2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
  - 3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.
- B. Digital daylighting sensors shall include the following features:
  - 1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or

infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell’s settings:
  - a. Light level
  - b. Day and night setpoints
  - c. Off time delay
  - d. On and off setpoints
  - e. Up to three zone setpoints
  - f. Operating mode – on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62” thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62”-1.25” thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

16. Any load or group of loads in the room can be assigned to a daylighting zone
  17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
  18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
  2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
  3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
  4. WattStopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
  2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
  3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
  4. WattStopper Product Number: LMLS-500, LMLS-500-L.
- E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
  2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
  3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
  4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.



5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.

## 2.7 DIGITAL ROOM CONTROLLERS AND PLUG-LOAD CONTROLLERS

A. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
4. Device Status LEDs to indicate:
  - a. Data transmission
  - b. Device has power
  - c. Status for each load
  - d. Configuration status
5. Quick installation features including:
  - a. Standard junction box mounting
  - b. Quick low voltage connections using standard RJ-45 patch cable

2.8 Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

- a. Turn on to 100%
  - b. Remain off
  - c. Turn on to last level
2. Each load shall be configurable to operate in the following sequences based on occupancy:
    - a. Auto-on/Auto-off (Follow on and off)
    - b. Manual-on/Auto-off (Follow off only)
  3. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
  4. BACnet object information shall be available for the following objects:

- a. Load status
  - b. Electrical current
  - c. Total watts per controller
  - d. Schedule state – normal or after-hours
  - e. Demand response control and cap level
  - f. Room occupancy status
  - g. Total room lighting and plug loads watts
  - h. Total room watts/sq ft
  - i. Force on/off all loads
5. UL 2043 plenum rated
  6. Manual override and LED indication for each load
  7. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
  8. Zero cross circuitry for each load
  9. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- B. On/Off Room Controllers shall include:
1. One or two relay configuration
  2. Efficient 150 mA switching power supply
  3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
  4. WattStopper product numbers: LMRC-101, LMRC-102
- C. On/Off/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
  2. Multiple relay configurations
- 2.9 One, two or three relays (LMRC-21x series)
- 2.10 One or two relays (LMRC-22x series)
1. Efficient 250 mA switching power supply
  2. Four RJ-45 DLM local network ports with integral strain relief and dust cover
  3. One dimming output per relay
    - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
    - b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward

phase compatible ELV, neon/cold cathode and incandescent loads.  
(LMRC-22x series)

- c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
  - d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
  - e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
  - f. Calibration and trim levels must be set per output channel.
  - g. Devices that set calibration or trim levels per controller are not acceptable.
  - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
4. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
  5. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
  6. The following dimming attributes may be changed or selected using a wireless configuration tool:
    - a. Establish preset level for each load from 0-100%
    - b. Set high and low trim for each load
    - c. Set lamp burn in time for each load up to 100 hours
  7. Override button for each load provides the following functions:
    - a. Press and release for on/off control
    - b. Press and hold for dimming control

**B. Plug Load Room Controllers shall include:**

1. One relay configuration with additional connection for unswitched load
2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
3. Factory default operation is Auto-on/Auto-off, based on occupancy
4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
5. Efficient switching power supply
  - a. 150mA (LMPL-101)
  - b. 250mA (LMPL-201)

6. RJ-45 DLM local network ports
  - a. Three RJ-45 ports (LMPL-101)
  - b. Four RJ-45 ports (LMPL-201)

#### 2.11 DLM LOCAL NETWORK (Room Network)

- A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
- B. Features of the DLM local network include:
  1. Plug n' Go® automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
  3. Push n' Learn® configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
  4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
- D. If manufacture's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

#### 2.12 DLM SEGMENT NETWORK (Room to Room Network)

- A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
  1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
  2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
  3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
  4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
  5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-

approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.

6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERS, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

### 2.13 CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
  1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
  2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
  3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
  4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
  5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
  6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
  7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
  8. Verify status of building level network devices.

### 2.14 NETWORK BRIDGE

- A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
  1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
  2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
  3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting

control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:

- a. Read/write the normal or after hours schedule state for the room
- b. Read the detection state of each occupancy sensor
- c. Read the aggregate occupancy state of the room
- d. Read/write the On/Off state of loads
- e. Read/write the dimmed light level of loads
- f. Read the button states of switches
- g. Read total current in amps, and total power in watts through the room controller
- h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- i. Activate a preset scene for the room
- j. Read/write daylight sensor fade time and day and night setpoints
- k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- l. Set daylight sensor operating mode
- m. Read/write wall switch lock status
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

#### 2.15 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
  1. 120 volts, 60 Hz, 20 amp driver rating
  2. Push to test button
  3. Auxiliary contact for remote test or fire alarm system interface

### PART 3 – EXECUTION

#### 3.1 CONTRACTOR INSTALLATION AND SERVICES

- A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.
- B. Contractor to install all room/area devices using manufacturer’s factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufacturer with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer’s specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

- C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.
  - D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
    - 1. Adjust time delay so that controlled area remains lighted while occupied.
  - E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
    - 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
    - 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
    - 3. Load Parameters (e.g. blink warning, etc.)
  - F. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect, Resident Engineer, and Owner of post start-up activity.
- 3.2 FACTORY SERVICES
- A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.
  - B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.
  - C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION 26 09 43

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriter's Laboratories, Inc.(UL)
  - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Architect, Resident Engineer, and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the U.L. label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.



- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Switchboards
  - 2. Overcurrent protection
  - 3. Instrumentation
  - 4. Dimensions, weights, ratings, and layouts
  - 5. Device settings and trip ratings

PART 2 - PRODUCTS

- 2.1 Switchboards shall be factory assembled, dead-front, metal enclosed, self-supporting floor standing sections as noted in the construction documents.
- 2.2 Vertical sections shall contain overcurrent protective devices including circuit breakers and fuses and shall be nominally 90" in height.
- 2.3 Switchboard finish shall be baked enamel factory paint of manufacturer's standard color.
- 2.4 Provide front accessibility for wireways on each side of overcurrent protective devices for entire height of section. Provide welded steel framework with screw covers removable from the front; covers may be hinged.
- 2.5 All bussing shall be silver-coated copper (maximum 1000A/square inch current density) with ratings as indicated in the construction documents.
- 2.6 Switchboard, bussing, and devices shall be fully-rated for the available short circuit current as determined by the Contractor's short circuit study (see 2.16 below), inclusive of all motor contribution and utility contribution. The minimum AIC ratings of the equipment may exceed those indicated on the construction documents, due to the results of the Contractor's short circuit study. The Contractor shall include all study costs and resultant equipment costs during bidding. The Contractor may provide series-rated equipment, fully compliant with all NEC requirements and the short circuit study, but shall not provide series-rated equipment without explicit written permission from the Engineer.
- 2.7 Switchboards shall be equipped with lifting eyes.
- 2.8 Switchboards shall be suitable for the environment in which they are located and shall be NEMA 1, indoor, and rated for Seismic Design Category D, unless noted otherwise on the construction documents.
- 2.9 Main circuit breakers shall be provided and shall be insulated case solid-state (LSIG) trip type with ratings as noted. Main breakers shall be 100% rated devices.
- 2.10 Main circuit breaker shall be individually mounted, unless noted otherwise.

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- 2.11 Main circuit breaker shall have maximum closing time of five (5) cycles, three (3) cycles upon opening.
- 2.12 Main circuit breaker shall have field-replaceable trip plugs.
- 2.13 Distribution circuit breakers shall be molded case type. All circuit breakers shall be bolt-on type.
- 2.14 Cross bussing shall be fully rated (maximum 1000A/square inch current density) for the length of the switchboard.
- 2.15 Instrumentation shall be provided where noted. Utility company metering shall be provided in accordance with the serving utility company requirements.
- 2.16 The Contractor shall contract a California Registered Professional Electrical Engineer to furnish and submit a coordination/short circuit study and ARC Flash Study (using SKM “Power Tools” software or equal) for the entire system provided including long time, short time, instantaneous, and ground fault settings.
- 2.17 Provide permanently adhered “bakelite” labels indicating the identification of each device on the switchboard adjacent to the device and visible on the enclosure exterior.
- 2.18 Provide a ground bus in each switchboard section with connecting ground bonds between sections. Ground bus shall be rated at 30% of the incoming capacity.
- 2.19 Rodent-proof ventilation as required to maintain allowable temperature rise at rated capacity.
- 2.20 Acceptable manufacturers shall be Siemens, Eaton, or approved equal.
- 2.21 Furnish and install a minimum size of 1” high and 3” wide by 3/32” thick matte white (for normal power) and red (for emergency power) laminated phenolic nameplates with ¼” white characters engraved in the plastic for all items of electrical equipment including, but not limited to switchboards, panel boards, automatic transfer switches, motor control centers, feeder circuit breakers, relays, time switches, disconnect switches, exposed pull or junction boxes, and all control equipment. Name plates will be attached with 2 cadmium-plated screws. Adhesive attachment will not be acceptable. Punch strip tape type name plates with card holders in any form are prohibited.

### PART 3 - EXECUTION

- 3.1 Installation method of switchboards shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Install all switchboards in accordance with the manufacturer’s recommendations and requirements.
- 3.3 Coordinate switchboard location and size with architectural and interior drawings. Coordinate with other trades to identify conflicts with switchboard locations and notify the Engineer of any conflicts.
- 3.4 Coordinate switchboard size with concrete housekeeping pads.

## **Palm Ave Transitional Housing**

- 3.5 Check all connections, phase rotation, ground resistance and insulation resistance levels.
- 3.6 Ground fault protective devices shall be tested by an approved third party testing agency and a written report submitted with the operation manual for review.
- 3.7 Test all switchboards and overcurrent protection devices for voltage level, continuity, ground fault, and short circuits.
- 3.8 Install all switchboards plumb and square to structure and adjacent surfaces.
- 3.9 Connect and inspect all ground bonds prior to energizing switchboard.
- 3.10 Demonstrate the proper operation of all ground fault protective devices.
- 3.11 Clean all switchboard interiors and exteriors to be free of dirt, dust and debris prior to handing over to Owner. Touch up scratched paint and finishes as necessary.
- 3.12 Adjust and set all devices for proper operation. Set all protective devices as per the written report recommendations.
- 3.13 Install ARC Flash labeling on switchboards and panelboards per NFPA 70E.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractors Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriter's Laboratories, Inc.(UL)
  - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Architect, Resident Engineer, and Owner's Representative by the Contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

### 1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Panelboards
  - 2. Overcurrent protection, bus capacity, main ratings, AIC rating
  - 3. Mounting, enclosure, dimensions
  - 4. Voltage, ratings, and phases
  - 5. Device settings, trip ratings, and layout

## PART 2 - PRODUCTS

- 2.1 Panelboards shall be factory assembled, dead-front, metal enclosed, wall mounted type as noted in the construction documents.
- 2.2 Panelboards shall be rated 600VAC and shall not exceed 400A current capacity, unless specifically noted on the construction documents.
- 2.3 Panelboard finish shall be baked enamel factory paint of manufacturer's standard color.
- 2.4 Provide front accessibility for wireways on each side of overcurrent protective devices for entire height of panelboard.
- 2.5 All bussing shall be silver-plated copper with ratings as indicated in the construction documents.
- 2.6 Panelboard bussing and devices shall be fully-rated for the available short circuit current as determined by the Contractor's short circuit study (see requirements in Section 26 24 13).
- 2.7 Enclosures shall be galvanized sheet steel cabinet type with hinged and lockable doors, dead front, and permanently adhered identification labels on the front.
- 2.8 Panelboards shall be suitable for the environment in which they are located and shall be NEMA 3R, outdoor, unless noted otherwise on the construction documents.
- 2.9 Circuit breakers shall be molded case type; all circuit breakers shall be bolt-on type.
- 2.10 Arc fault circuit interrupting (AFCI) circuit breakers shall be provided for all dwelling unit bedroom receptacle circuits. AFCI circuit breakers shall be manufactured and listed to UL Standard 1699.
- 2.11 Main lugs shall be anti-turn solderless pressure type for use with copper conductors.
- 2.12 Instrumentation shall be provided where noted.
- 2.13 Enclosures, panel interiors, and devices shall be of one manufacture.

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- 2.14 Provide a typewritten panel schedule located in a sleeve on the interior of the panelboard door indicating loads and areas connected to each circuit.
- 2.15 Provide a ground bus in each panelboard.
- 2.16 Acceptable manufacturers shall be Siemens, Eaton, or approved equal.
- 2.17 The Contractor shall contract a California Registered Professional Electrical Engineer to furnish and submit a coordination/short circuit study and ARC Flash Study (using SKM "Power Tools" software or equal) for the entire system provided including long time, short time, instantaneous, and ground fault settings.
- 2.18 Furnish and install a minimum size of 1" high and 3" wide by 3/32" thick matte white (for normal power) and red (for emergency power) laminated phenolic nameplates with 1/4" white characters engraved in the plastic for all items of electrical equipment including, but not limited to switchboards, panel boards, automatic transfer switches, motor control centers, feeder circuit breakers, relays, time switches, disconnect switches, exposed pull or junction boxes, and all control equipment. Name plates will be attached with 2 cadmium-plated screws. Adhesive attachment will not be acceptable. Punch strip tape type name plates with card holders in any form are prohibited.
- 2.19 Provide wire marker on each conductor in electrical panel pull box, outlet, and junction box. This includes all disconnects and connections. \*If more than one neutral conductor is present, mark each related circuit and panel number.
- 2.20 Label outside of all cover plates of wiring devices and junction boxes with circuit and panel number. Each branch circuit device cover plate will be labeled (engraved or silk screen) to indicate the branch circuit and panel number. Devices will include, but not be limited to, the following: toggle switches, dimmer switches and receptacle.

### PART 3 - EXECUTION

- 3.1 Installation method of panelboards shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Install all panelboards in accordance with the manufacturer's recommendations and requirements.
- 3.3 Coordinate panelboard location and size with architectural and interior drawings. Coordinate with other trades to identify conflicts with panelboard locations and notify the Engineer of any conflicts.
- 3.4 Fasten panelboards securely to structural wall or surface to Seismic Design Category D requirements. Panelboards shall be mounted no higher than 6'0" to the highest device from finished floor and no lower than 24" above finished floor. Provide panel skirts where noted.
- 3.5 Provide 25% spare breaker space for all panelboards.
- 3.6 Provide a minimum of five (5) empty 3/4" conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as "SPARE".
- 3.7 Check all connections, phase rotation, ground resistance and insulation resistance levels.

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- 3.8 Complete the panel schedule card and place in the sleeve on the interior of the panelboard door.
- 3.9 Test all panelboards and overcurrent protection devices for voltage level, continuity, ground fault, and short circuits.
- 3.10 Install all panelboards plumb and square to structure and adjacent surfaces.
- 3.11 Connect and inspect all ground bonds prior to energizing panelboard.
- 3.12 Demonstrate the proper operation of all ground fault protective devices.
- 3.13 Clean all panelboard interiors and exteriors prior to handing over to Owner. Touch up scratched paint and finishes as necessary.
- 3.14 Adjust and set all devices for proper operation.
- 3.15 Install ARC Flash labeling on switchboards and panelboards per NFPA 70E.

END OF SECTION 26 24 16

**SECTION 26 27 26 - WIRING DEVICES AND CONNECTORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

**1.2 QUALITY ASSURANCE AND STANDARDS**

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriter's Laboratories, Inc. (UL)
  - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.



- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

### 1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Receptacles
  - 2. Switches
  - 3. Wiring devices
  - 4. Accessories

## PART 2 - PRODUCTS

### 2.1 RECEPTACLES

- A. Wiring devices shall be UL listed and suitable for the application.
- B. Devices shall be color coded per the system to which they are connected: normal power shall be white; emergency power shall be red; dedicated outlets shall be grey; unless otherwise noted on the construction documents.
- C. Receptacles shall be heavy duty, screw type, side wired, 120V, 20A, duplex type, unless noted otherwise on the construction documents. Verify NEMA configuration with construction documents.
- D. Weathertight receptacles shall be gasketed in cast metal boxes with cast metal coverplates. Coverplates shall have spring-loaded in-use hinged covers.
- E. Ground fault interrupting receptacles shall be duplex type and capable of detecting a leaking current of 5mA.
- F. Duplex Receptacle 20AMP 120v/277v Industrial Type.
  - 1. Hubbell: (20 AMP) #HBL 5326 or approved equal.
  - 2. Decorator Type DR 20DR, or approved equal.
- G. All receptacles in public areas shall be tamper-proof.
  - 1. Hubbell – HBL 8300SGA, or approved equal.
  - 2. Decorator Type DR20TR, or approved equal.

### 2.2 TOGGLE SWITCHES

- A. Toggle wall switches shall be quiet AC type, rated 120/277V, 20A and UL listed for the application.

- B. Switches shall be single pole, double throw with white finish unless noted otherwise.
- C. Wall Switches – 20 AMP 120v/277v Industrial Type.
  - 1. Hubbell: HBL 1221, or approved equal.
  - 2. Decorator Type: Hubbell DS 120-20 amp, or approved equal.

**2.3 WALL BOX DIMMERS**

- A. Wall box dimmers shall be UL listed and suitable for the application.
- B. Devices shall be white unless otherwise noted.
- C. Device shall be noted for minimum 1000W, unless otherwise noted.
- D. Device shall be available in single-pole and 3-way configurations.
- E. Device shall be Leviton ‘Touch Point’ series by Lutron, or approved equal.

**2.4 COVERPLATES**

- A. Single, combination coverplates shall be used at all ganged device locations.
- B. Provide white plastic coverplates with white screws in all office areas. Provide stainless steel coverplates with matching screws in janitorial, mechanical, laboratory, process, manufacturing, and clean room areas or as noted on the construction documents. Provide weatherproof in-use covers for all exterior locations.
- C. Provide labeled plates as noted on the construction documents.
- D. Provide labeled plates at all receptacles with circuit and panel designation. Labeling method shall utilize clear adhesive printed labels with black bold letters.

**2.5 ACCEPTABLE MANUFACTURERS**

- A. Acceptable manufacturers shall be Arrow Hart, Hubbell, Leviton, or Pass and Seymour.

**PART 3 - EXECUTION**

- 3.1 Installation method of wiring devices shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Installation of receptacles in dwelling unit bedrooms shall comply with NEC section 210-12(b) and shall be protected by an arc fault circuit interrupter.
- 3.3 Install all devices in accordance with the manufacturer’s recommendations and requirements.
- 3.4 Contractor shall verify installation orientation of duplex outlets (ground pin up or down) with

Owner's representative prior to installation.

- 3.5 Coordinate device mounting height, location and type with architectural and interior drawings. Coordinate with other trades to identify conflicts with device locations and notify the Engineer of any conflicts.
- 3.6 Install devices only in clean boxes.
- 3.7 Install all trim rings and coverplates in coordination with other trades and their installation schedules.
- 3.8 Tighten and inspect all connections prior to covering devices and reconnect or repair wiring as necessary.
- 3.9 Test all devices for voltage level, continuity, ground fault, and short circuits.
- 3.10 Install all devices plumb and square to structure and adjacent surfaces.
- 3.11 Connect and inspect all ground bonds prior to covering device.
- 3.12 Demonstrate the proper operation of all ground fault interrupting devices.
- 3.13 All devices are to have clamp style side/back connections for stranded wire only. All receptacles shall be pigtailed out so only one Color wire, a neutral wire, and a ground wire is connected to the back of the receptacles.
- 3.14 All receptacles and switches on emergency power will be RED.

END OF SECTION 26 27 26

**SECTION 26 28 16 - CIRCUIT AND MOTOR DISCONNECTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

**1.2 QUALITY ASSURANCE AND STANDARDS**

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriter's Laboratories, Inc. (UL)
  - 13. International Building Code(IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.

- E. The Contractor shall verify all points of connection with the manufacturer's requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

1.3 SUBMITTALS

- A. Submit shop drawings per Section 26 05 00 for review including the following:
  - 1. Voltage and current ratings
  - 2. NEMA enclosure type
  - 3. Horsepower and fault current rating
  - 4. Dimensions
  - 5. Fuse type and class

PART 2 - PRODUCTS

- 2.1 Disconnects shall NEMA 1, indoor type, or rated for the locations in which they are installed as noted on the construction documents.
- 2.2 Disconnects shall be UL listed and suitable for the application.
- 2.3 Disconnects in exterior, wet, cold, warm, or hot environments shall be raintight, have raintight hubs, and be rated NEMA 3R.
- 2.4 Disconnects shall be heavy-duty type, rated 600V with current capacity as noted on the construction documents. Verify NEMA configuration with construction documents.
- 2.5 Disconnects shall have hinged, lockable, dead-front doors with permanently marked ON/OFF indicators. Enclosures shall be baked enamel factory painted steel with conduit knockouts.
- 2.6 Disconnects shall be operated by a handle accessible from the exterior of the enclosure. Handles shall have provision to be padlocked in the OFF position.
- 2.7 All current carrying parts shall be high conductivity copper designed to carry rated load without damage from heat and plated to resist corrosion.
- 2.8 Switch mechanism shall be a quick-make, quick-break type such that the operation of the contact is restrained by the handle during the closing or opening operation.
- 2.9 Switches shall have a minimum fault current rating of 200,000A RMS.
- 2.10 All switches shall be fused unless specifically noted otherwise.
- 2.11 The disconnect door cover shall have an interlocking mechanism to prevent opening the cover when the switch is in the ON position.
- 2.12 Fuses will be low peak RK1 class ARC rejection type.
- 2.13 Fuses serving motor loads will be dual element with a minimum time delay of 10 seconds at 125 percent rating. Fuses will be current limiting time delay type with interrupting capacity of

200,000 ampere RMS symmetrical minimum.

- 2.14 Provide built-in fuse pullers.
- 2.15 Acceptable manufacturers shall be General Electric, Siemens, Eaton, or Square D, or approved equal. Fuses shall be Gould-Shawmut or Bussman, or approved equal.
- 2.16 Provide spare fuses in the amount of ten percent of each size and type installed, but not less than three; delivered to the Owner upon final acceptance of the project. Provide and install fuse cabinet in the electrical room for storing these extra fuses.
- 2.17 Each fusible disconnect switch will be equipped with a blown fuse indicator module.

**PART 3 - EXECUTION**

- 3.1 Installation method of disconnects shall comply with the latest enforced edition of the National Electrical Code and the authority having jurisdiction.
- 3.2 Install all disconnects in accordance with the manufacturer's recommendations and requirements.
- 3.3 Coordinate disconnect mounting height, location and type with architectural, mechanical, and interior drawings. Coordinate with other trades to identify conflicts with device locations and notify the Engineer of any conflicts. Mount switches 42" above finished floor unless noted otherwise.
- 3.4 Provide suitable galvanized metal strut framework where no wall or structure is available for the mounting of disconnects.
- 3.5 Provide flexible conduit connections for disconnects mounted to strut framework, motors, or vibrating equipment.
- 3.6 Tighten and inspect all connections and reconnect or repair wiring as necessary.
- 3.7 Test all disconnects for voltage level, continuity, ground fault, and short circuits. Check switch mechanism operation under no load conditions prior to operating under load.
- 3.8 Install all disconnects plumb and square to structure and adjacent surfaces.
- 3.9 Provide and install all fuses sized per the equipment manufacturer's recommendation.

END OF SECTION 26 28 16

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SECTION 26 31 00 - PHOTOVOLTAIC ELECTRIC GENERATING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 260500) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 16 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 QUALITY ASSURANCE AND STANDARDS

- A. All work, material or equipment shall comply with the codes, ordinances and regulations of the local government having jurisdiction, including the regulations of serving utilities and any participating government agencies having jurisdiction.
- B. All electrical work shall comply with the latest edition under enforcement including all amendments, modifications, and supplements of the following codes and standards or other regulations which may apply:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractor's Association (NECA)
  - 9. National Electrical Manufacturer's Association (NEMA)
  - 10. National Electrical Testing Association (NETA)
  - 11. National Fire Protection Association (NFPA)
  - 12. Underwriter's Laboratories, Inc. (UL)
  - 13. International Building Code (IBC)

No requirement of these drawings and specifications shall be construed to void any of the provisions of the above standards. Any conflicts or changes required to the contract documents in order to obtain compliance with applicable codes shall be brought to the immediate attention of the Engineer, Architect, Resident Engineer, and Owner's Representative by the contractor.

- C. All items shall be listed by Underwriter's Laboratories and shall bear the UL label.
- D. Equipment shown to scale is approximate only and based upon a general class of equipment specified. The Contractor shall verify all dimensions and clearances prior to commencement of work.



- E. The Contractor shall verify all points of connection with the manufacturer’s requirements, instructions, or recommendations prior to installation. The actual dimensions, weights, clearance requirements and installation requirements shall be verified and coordinated by the contractor.

**1.3 DEFINITIONS**

- A. Array: A mechanically-integrated assembly of modules, together with support structure and foundation, tracking, thermal control, and other components, if used, to form a DC power-producing unit.
- B. Azimuth angle: For a surface such as a sloped roof, project a line that extends perpendicular from the roof onto a horizontal plane. The angular deviation (in degrees) of this projection from the local meridian (north-south line) constitutes the surface azimuth angle. Due south is zero azimuth, west of south is assigned as positive azimuth, and east of south is assigned as negative azimuth.
- C. Insolation: Sunlight, direct and/or diffuse. The integrated intensity of sunlight reaching a given area, usually expressed in watts per square meter per day. This measurement may be used to express the average amount of solar energy falling on different regions of the country.
- D. Magnetic declination: The difference between true north (the axis around which the earth rotates) and magnetic north (the direction the needle of a compass will point).
- E. Module: A number of solar cells connected together electrically and sealed inside a weatherproof package with a clear face.
- F. Photovoltaic: Pertaining to the direct conversion of light into electricity.
- G. PTC (PVUSA Test Conditions): Test conditions applied to PV modules intended to represent wattage during operation. Irradiance of 1000 W/m<sup>2</sup>, 68 degrees F ambient temperature, 1 meter/second wind speed, and an air mass of 1.5.
- H. String: A number of modules interconnected electrically in series to produce the operating voltage required by the load.
- I. STC (Standard Test Conditions): Test conditions applied to PV modules. Irradiance of 1000 W/m<sup>2</sup>, cell temperature of 25 degrees C and an air mass of 1.5.
- J. Tilt Angle: The angle of inclination of a module measured from the horizontal plane.
- K. Utility-Interactive Inverter: An inverter that shall function only when electrically connected to the utility grid, and uses the prevailing line-voltage frequency on the utility line as a control parameter to ensure that the photovoltaic array’s DC output is converted to AC power and fully synchronized with the utility power. The inverter shall disconnect from the utility upon loss of the line-voltage frequency. The inverter shall not back-feed the utility.

**1.4 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Contractor is responsible for providing the PV system, including attachment to structural

system and necessary modifications to meet specified requirements and maintain visual design concepts.

2. Contract Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
3. Provide details for attachment, fastening, penetrations, and electrical connections.
4. Provide concealed fastening wherever possible.
5. Provide weather-tight penetrations of building envelope for all structural and electrical connections.
6. Attachment considerations shall take into account site peculiarities and expansion/contraction movements so there is no possibility of loosening, weakening, or fracturing the connection between PV system and building envelope components.
7. Comply with roof system manufacturer's warranty design criteria when penetrating roof system.

**B. Performance Requirements:**

1. PV system shall be designed to produce 180,000 kWh AC of energy per year.
2. DC System Size: 110kW, Premium Efficiency Panels
3. Net AC kWh energy production shall take into consideration system losses, including but not limited to wire losses, fault protection losses, inverter efficiency, string mismatch, and system component degradation over the life expectancy of the system.
4. AC kWh energy production estimation shall utilize one of following software programs:
  - a. PV Watts
  - b. PV Design Pro
  - c. PVSYST
  - d. Approved equal
5. Method and results of PV system performance estimate shall be shared with Owner and submitted as part of bid in Report format.
6. AC kWh energy production estimate Report shall include quantities of physical area required for PV modules, number of modules, string size, system kW AC Power Rating, and system kW DC STC Power Rating.
7. Photovoltaic modules shall produce no less than 80 percent of minimum rated power during the first 20 years of service.

**C. Interface with building systems**

1. PV system AC connection point: 208V 3-phase, 3-wire.
2. Data transmission means: RS232.

**D. Financial Incentives, Rebates, and Tax Credit Eligibility Requirements for PV systems:**

1. Provide PV system design and installation that complies with eligibility requirements for the PV system owner to receive incentives, rebates, and tax credits from sources such as federal, state, and electric utility services providers.

**1.5 SUBMITTALS**

**A. General:** Submit in accordance with Section 260500.

**B. Product Data:**

1. Submit product data for photovoltaic system components.
  - a. Include information for voltage, current, watts, temperature ratings, factory finishes, hardware, glass treatment, sealants, grounding, accessories, and other required components.
  
- C. Shop Drawings:
  1. Submit shop drawings covering design, fabrication, installation, and finish of specified systems.
    - a. Fully dimensioned plans and elevations.
    - b. Electrical and structural penetration details of weather-tight building envelope.
    - c. Locations and types of exposed fasteners and joints.
    - d. Wiring diagrams, including DC wiring system and AC 3-line diagram.
    - e. Voltage drop calculations and short circuit current calculations.
    - f. Rough-in requirements
  
- D. Samples:
  1. Provide (1) sample of photovoltaic module for approval. Approved samples may be used in final installation.
  2. Provide on-site mock-up of photovoltaic module installation for approval. Locate on-site mock-up within project construction site. On-site mock-up shall use mounting method and hardware intended for actual photovoltaic module installation.
  
- E. Submit the following Informational Submittals:
  1. Estimated Design Data:
    - a. Provide assumptions used to obtain AC kWh energy production including but not limited to: environmental loss factors, local weather data, and electrical losses.
    - b. Estimated monthly and yearly AC kWh energy production.
  2. Test Reports: Written results obtained from manufacturer or independent third party certification of testing specified as part of System Requirements and Source and Field Quality Control articles.
  3. Certifications specified in Quality Assurance article.
  4. Qualification Data:
    - a. Contractor's and manufacturer's qualifications.
    - b. Include list of (3) completed projects having similar scope of work identified by name, location, date, reference names, and phone numbers.
  5. Manufacturer's Instructions:
    - a. Manufacturer's printed installation instructions.
  6. Contractor's Field Reports: Written results and findings of Contractor's field services specified as part of Field Quality Control.
  
- F. Closeout Submittals
  1. Project Record Documents:

- a. Record actual locations of grounding systems and penetration of building envelope.
- b. Operation and Maintenance Data: Submit manufacturer's printed recommended operation and maintenance data.
- c. Warranty: Submit specified product warranty in accordance with Section 16050.

1.6 QUALITY ASSURANCE

- A. Single Source Responsibility: To ensure quality of appearance and performance, obtain equipment for systems from single photovoltaic system installer or from manufacturers approved by photovoltaic system installer.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
- C. Installer Qualifications: Certified in writing by equipment manufacturers as qualified for installation of specified systems. Must have NABCEP certification (North American Board of Certified Energy Practitioners) and proper licensing. Provide California state contractor's license number.
- D. Regulatory Requirements:
  - 1. Provide system meeting all requirements of the latest adopted edition of the NEC.
  - 2. Provide system meeting requirements of federal, state, and local building codes.
  - 3. Provide system that meets or exceeds San Diego Gas & Electric (SDG&E) interconnection requirements for self-generating equipment.
  - 4. Provide photovoltaic modules compliant with requirements of UL-1703.
- E. Certifications: Submit system component manufacturer's certification that products furnished for project meet or exceed specified requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect finished surfaces as necessary to prevent damage.
- B. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- C. Do not leave coating residue on any surfaces.
- D. Replace damaged units.

1.8 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. Do not install system during rain or windy conditions.
  - 2. Work on a dry roof only.
- B. Existing Conditions: Ensure existing conditions are stable, solid, and ready to accept new construction.

1.9 WARRANTY

- A. Furnish PV modules and panel components providing manufacturer's limited warranty of (25) years minimum.
- B. Furnish DC to AC inverters covered by manufacturer's warranty for minimum of (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design PV Module Manufacturers:

- 1. Siliken Modules
- 2. Kyocera Solar
- 3. Sharp Solar
- 4. Approved equal

B. Basis of Design Inverter Manufacturers:

- 1. SatCon
- 2. SMA America
- 3. Xantrex
- 4. Approved equal

2.2 REQUIRED EQUIPMENT

A. PV modules

- 1. Shall be new, undamaged, fully warranted without defect.
- 2. Listed to UL 1703.
- 3. Polycrystalline silicon cells.
- 4. Minimum 20 percent efficiency.

B. DC to AC Inverter:

- 1. Sized to provide maximum power point tracking for voltage and current range expected from photovoltaic array for temperatures and solar insolation conditions expected for project conditions.
- 2. Capable of adjusting to "sun splash" from all possible combinations of cloud fringe effects without interruption of electrical production.
- 3. Listed to UL 1741.
- 4. Rated for indoor or outdoor installation, as indicated on the drawings.
- 5. Minimum 95 percent efficiency.

C. Mounting System:

- 1. Non-penetrating Roof Mounting System:
  - a. Non-penetrating using weight (ballast) or adhesives or combination thereof to withstand wind and seismic loading.

- b. System does not typically require structural attachment to building structure.
- c. Ballasted system is intended for flat roof applications where roof slope is 2 in 12 maximum.
- d. Ballasted roof mount systems shall utilize framed PV modules or frameless PV module laminates.
- e. Ground metal framed PV modules in conformance with electrical codes.

2. PV Module Racking System:

- a. Anchor system to building structure to withstand wind and seismic loading.
- b. Module racking systems shall utilize framed PV modules.
- c. Metal framed PV modules shall be grounded in conformance with electrical codes.

D. AC Disconnect Switch:

- 1. Coordinate with SDG&E requirements.
- 2. Provide switch to disconnect ungrounded AC conductors.
- 3. Lockable, gang operated type, clearly indicating open and closed positions.
- 4. Easily visually inspected to determine that switch is in open or closed position and clearly labeled in compliance with NEC and SDG&E requirements.

- E. Dedicated kWh Meter: Install in readily accessible, outdoor, location between DC to AC inverter and interconnection with SDG&E to meter power produced by photovoltaic system. Refer to SDG&E requirements.

2.3 ACCESSORIES

- A. Provide Accessories for complete operating system, including:
- 1. Data Display (including software and hardware).
  - 2. Weather Station.
  - 3. DC Disconnect.

2.4 FINISHES

- A. Furnish PV module frames finished with manufacturer's standard finish.
- B. Finish PV array mounting structure to match PV module frames.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Examine supporting members to ensure surfaces are at proper elevation and are free from dirt or other deleterious matter.

3.2 INSTALLATION

- A. Locate PV array as shown on drawings and approved shop drawings.
- B. Install photovoltaic system in accordance with NEC, manufacturer's printed instructions, SDG&E requirements, and approved shop drawings.
- C. Install PV modules and DC to AC inverters with sufficient clearance to allow for proper ventilation and cooling.
  - 1. Comply with manufacturer's clearance recommendations.
- D. Installation shall place operational PV modules in a location and manner to ensure maximum unobstructed, direct sun exposure.
- E. Provide suitable means to secure attachments to mounting surfaces and structures.
- F. Anchors, fasteners, and braces shall be structurally stressed to not more than 50% of allowable stress when maximum loads are applied.
- G. Allow for expansion and contraction due to thermal changes and structural movement without detriment to appearance or performance.
- H. Installer shall verify that site, mounting surface substrate, supports, and other site and work conditions are adequate and proper for installation.
- I. Optimum Orientation for Roof Installation:
  - 1. Optimum azimuth orientation: Install PV modules to face within (5) degrees east or west of true south, not magnetic south.
  - 2. Optimum tilt angle orientation: Install PV modules at a tilt angle within (3) degrees of local latitude.

### 3.3 FIELD QUALITY CONTROL

- A. Site Tests: Comply with requirements of Section 260500 and 260575.
- B. Manufacturer's Field Services: Comply with requirements of Section 260500 and 260575.

### 3.4 ADJUSTING

- A. Test and adjust operating functions in accordance with manufacturer's instructions to ensure smooth operation.

### 3.5 CLEANING

- A. Clean all surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials, and other marks.
- B. Clean metal surfaces exercising care to avoid damage.
- C. Clean energy generating surfaces of the PV module to ensure no obstructions block sunlight.

3.6 COMMISSIONING

A. Commissioning:

1. To be provided by independent third party commissioning service.
2. Prior to commissioning, ensure PV system has passed and received final inspection certificate from the AHJ and SDG&E.
3. Provide training to the Owner's Representative.
4. Ensure the installation has been performed in accordance with NEC and other local codes. The following NEC articles refer to PV systems:
  - a. Article 690: Solar Photovoltaic Systems
  - b. Article 230: Service Equipment - Disconnecting Means
  - c. Article 240: Overcurrent Protection
  - d. Article 250: Grounding
  - e. Article 300: Wiring Methods
  - f. Article 310: Conductors for General Wiring
  - g. Article 705: Interconnected Electric Power Production Sources
5. Refer to commissioning requirements contained within IEEE 1547.1 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.
6. Provide suitable tools and equipment for commissioning.
7. Provide signed commissioning certificate to Owner.

END OF SECTION 263100



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SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. Provide labor, materials, tools, and equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the equipment of this section, as shown on the drawings and specified herein.
- B. Furnish and install complete lighting systems, wired, assembled and operable, except where specifically noted otherwise, which includes but not limited to the following:
  - 1. Luminaires
  - 2. Lamps and ballasts
  - 3. Mounting hardware
  - 4. Accessories as noted
- C. The materials and equipment herein specified shall be of new and furnished in accordance with the applicable standards.
- D. Specifications and drawings are intended to convey the general features, function and character of the fixtures only, and do not illustrate or set forth every item or detail necessary of the work.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of the standards listed below form an integral part of this specification:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)
  - 6. Local Code Enforcement Agency Requirements
  - 7. National Electrical Code (NEC)
  - 8. National Electrical Contractors Association (NECA)

9. National Electrical Manufacturer's Association (NEMA)
10. National Electrical Testing Association (NETA)
11. National Fire Protection Association (NFPA)
12. Underwriters' Laboratories, Inc. (UL)
13. International Building Code (IBC)
14. Illuminating Engineering Society of North America (IESNA)
15. Certified Ballast Manufacturers (CBM)
16. National Appliance Energy Conservation Amendments of 1988 (Public Law 100-357).

Materials and equipment as well as workmanship provided under this section shall conform to the highest commercial standards, and as specified and as indicated on the drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion, thermal and mechanical stresses encountered in the normal application and function of the fixtures.

#### 1.4 SUBMITTALS

- A. Shop drawings for all fixtures shall be submitted and reviewed prior to fabrication. Any material produced prior to the review of shop drawings or samples, and not in conformance with the Contract Documents, shall be rejected with the Contractor bearing full responsibility and cost. Submit shop drawings per Section 26 05 00 for review, include the following:
  1. Luminaires
  2. Lamps
  3. Ballasts
  4. Photometric reports
  5. Point-by-point calculations specific to the project.
  6. Accessories
- B. Submit shop drawings indexed, and in accordance with luminaire identification per drawings. Each item shall be tabbed, clearly identifying the catalog ordering numbers including all optional equipment specified.
- C. Luminaire shop drawings shall include the following:
  1. Manufacturers' product information sheets. Photocopy of partial data sheet or drawings is not acceptable. Product information shall include the following:
    - a. Ballast type, manufacturer and performance characteristics
    - b. Lamp type, manufacturer and performance characteristics
    - c. Finish, frame, trim and housing type
    - d. Reflector system and characteristics
    - e. Diffuser type and characteristics
    - f. Weight and dimensions
    - g. Standard manufacturer options
    - h. Luminaire series and model number
    - i. Luminaire efficiency
    - j. Coefficient of utilization
    - k. Candlepower data table
    - l. Zonal lumens table

- m. IES luminaire classification
    - n. Maintenance and operating instructions including tools required, types of cleaners to be used and suggested replacement parts list.
    - o. Average foot candle table.
  - 2. Photometric data assembled in a standard IES photometric test report.
- D. Lamp shop drawings shall include type, dimensions, manufacturer and operating characteristics, including but not limited to:
  - 1. Operating voltage range
  - 2. Color Rendering Index (CRI) value per IES standards
  - 3. Color temperature (in Kelvin)
  - 4. Mounting position
  - 5. Starting temperature, indoor and outdoor
  - 6. Starting/restrike time
  - 7. Lamp life
  - 8. Lamp efficiency
  - 9. Warranty
  - 10. Lamp base
  - 11. Lumen rating
- E. Ballast shop drawings shall include type, dimensions, manufacturer and operating characteristic including but not limited to:
  - 1. Ballast operating temperature and voltage
  - 2. Total harmonic distortion
  - 3. Ballast starting/restrike time
  - 4. Ballast efficiency factor (BEF)
  - 5. Ballast transformation type (ie: autotransformer, preheat, instant-start, rapid start, constant wattage, reactor, trigger-start)
  - 6. UL classification (ie: Class "P")
  - 7. Power factor
  - 8. Sound rating (fluorescent only)
  - 9. NEMA rating
- F. If requested by the Engineer, samples shall be submitted for final selection. Samples shall comply with the following:
  - 1. Paint chips:
    - a. Samples shall be provided and approved prior to any release to manufacture.
    - b. Samples shall be minimum of 3"x3" and be of exact finishes.
    - c. Samples shall be exact representatives of the luminaires:
      - 1) Priming process
      - 2) Painting process
      - 3) Baking process
      - 4) Finish process
      - 5) Luminaire material (i.e. sheet metal, aluminum, wood, etc)
    - d. Samples shall be labeled with manufacturers color call-out, as well as the paint

manufacturers' call-out.

2. Fixtures:
  - a. Submit for approval samples called for to the Engineer when and where directed, the components marked with the name of the project, and fixture type, and part number. Fixture shall be provided with a 6' cord and plug, and specified lamp. Allow two weeks from the date of receipt for thorough examination and review by the Engineer.
  - b. Fixtures under the contract shall be identical with the approved sample fixture. No fixture used as a sample shall be allowed to be installed on the project.
  - c. In the event the submissions are disapproved, the fixtures shall be returned to the contractor to immediately make a new submission of fixture or fixtures meeting the contract requirements.
  - d. All charges for these shipments are to be prepaid by the Contractor.
  - e. Samples shall be provided and approved prior to any release to manufacture.

## 1.5 FACTORY TESTING

- A. Luminaire testing shall be conducted by an approved independent testing laboratory.
- B. Luminaire tests shall be reported in accordance with Illuminating Engineering Society (IES) Standard Photometric Test Report.

## 1.6 WARRANTY

- A. Contractor shall warranty equipment and installation free from defects in material and workmanship for a period of no less than (1) year from the date of project completion. This includes the fixture, its finishes and components (see ballasts below).
- B. Fluorescent ballasts shall be warrenteed against defects in material and workmanship for a period of no less than (5) years for electronic ballasts, from the date of project completion regardless of the date of manufacture.
- C. HID ballasts shall be warrenteed against defects in material and workmanship for a period of no less than (2) years from the date of project completion regardless of the date of manufacture.
- D. LED modules and drivers shall each be warrantied against defects in material and workmanship for a period of no less than five (5) years, form the date of project completion regardless of the date of manufacture.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Luminaries shall bear the appropriate UL label for location, mounting position and operating conditions in which it is installed.

- B. Luminaries, ballasts and lamps shall each be of the same manufacturer and of identical finish, appearance, and performance. Luminaries which are pre-lamped before shipment shall have identical lamp manufacturer. Mix and match of different lamp manufacturer shall not be acceptable.
- C. Recessed ceiling mounted luminaires shall be provided with appropriate frame and trim type compatible with ceiling construction. Reference architectural plans for ceiling construction type and specifications.
- D. Luminaires and devices shall be free of burrs, scratches, marks, and dents which may occur during transportation, storage or installation. Construction shall be finished to eliminate sharp edges exposed to installer and end-user.
- E. Sheet metal construction of luminaires shall be of sufficient rigidity to prevent deformation during installation and typical use.
- F. Cast parts and sections of a luminaire shall be smooth, free of blemishes, rust and scale and be irradiated, sandblasted and anodized.
- G. All burned out lamps and ballasts shall be replaced by the end of contract prior to Architect, Resident Engineer, Owner Representative and Engineer final punchlist.
- H. Trim color for indoor luminaire installation shall be as indicated on plans.
- I. Enamel paint shall be baked on at a minimum 300 degrees F and have 86% reflectivity for a surface, which is to be reflective.

## 2.2 LAMPS

- A. LED (Lighting Emitting Diode) Modules
  1. Unless specified on plans or in Lighting Fixture Schedule, the module color temperature shall be 3500 Kelvin (K).
  2. Unless otherwise noted, modules shall have a CRI (color rendering index) of 82 or greater.
  3. Rated lumen output shall be based on fixture absolute lumens as defined in LM-79 (IESNA).
  4. Modules shall comply with LM-80 (IESNA).
  5. LED modules shall be interchangeable without removal or replacement of heat sink or luminaire.
  6. Luminaire Manufacturer to offer replacement modules that maintain rated lumen package per initial design luminaire.
  7. Minimum rated life of modules shall be 50,000 hours per IESNA L70.
- B. Acceptable Manufacturers
  1. LED Chips: Cree, Nichia, Philips or approved equal.
- C. All lamps shall be burned once installed in the fixtures for 100 hours, prior to switching or dimming.
- D. LED Drivers

1. Shall be UL listed when installed in luminaire.
2. Drivers shall be grounded appropriately as governed by NEC Article 410-E.
3. Drivers shall be located within the luminaire for which it is operating unless specifically indicated on plans as remote ballast type.
4. Remote drivers shall be located in accessible location, within manufacturers maximum distance requirements.
5. Drivers shall be rated weatherproof type where there is moisture present.
6. A permanent waterproof seal shall be factory provided where the wiring enters the ballast compartment of an outdoor luminaire installation.
7. Drivers shall have a standard dimming protocol of 0-10V unless otherwise noted on the Luminaire Schedule.
8. Shall operate with no detectable flicker and be high power factor (95% or higher).
9. Drivers shall be marked with the manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each LED module being powered and bear all applicable UL listing on housing.
10. All drivers shall be compatible with dimming protocol of connected room controllers, panels, local controls, devices and other luminaires.

E. Acceptable Manufacturers

1. Osram/Sylvania, GE, Philips, EldoLED, or approved equal.

2.3 LUMINAIRES

A. General

1. Escutcheon plates, coverplates, and finish trim hardware shall meet flush with ceiling, floor, wall or other surfaces to which they may be mounted.
2. Luminaire construction shall allow initial installation of recessed luminaires without the presence of finish trim, diffusers or lens.
3. Lamp sockets and reflector assemblies shall be securely fastened to luminaire housing to prevent rotation, adjustment or rocking of hardware during lamping or future relamping.
4. Luminaire lenses shall be securely retained in a fashion so that relamping or accessing to luminaire will not dislodge lens.
5. Luminaire lenses and diffusers shall be free from chromatic or spherical imperfections and have thermal characteristics capable of withstanding installed lamp temperatures.
6. Pendant type luminaires shall be mounted to provide balanced construction with the use of swivel hanger. Swivel hanger shall be provided standard or ordered as accessory unless specified otherwise.
7. Bracket type luminaires shall be specifically designed for type installation which is indicated.
8. Luminaires shall be factory tested, prewired and preassembled unless otherwise specified or intended.
9. Luminaires located in direct exposure to the weather to include rain, sleet and snow shall be marked "Suitable For Wet Locations" with UL label. Luminaires located outdoors but not in direct exposure to rain shall be marked "Suitable for Damp Locations" minimum rated.
10. Where ceiling space is not accessible, luminaire housing shall provide access to luminaire junction box to comply with NEC section 370-29.
11. Luminaires shall contain an integral ballast disconnect compliant with NEC section

410.73.

**B. LED Luminaires**

1. Luminaires shall come with manufacturer provided LED module installed.
2. All luminaires shall meet building energy code Title 24-2016 efficacy requirements.
3. Luminaire housing, driver and module shall be products of the same manufacturer.

**C. Emergency Lighting Units**

1. 90 minute internal battery packs
2. IBC/Life safety approved

**D. Acceptable manufacturers shall be as specified on plans per Lighting Fixtures Schedule unless otherwise specified herein or on plans.**

**PART 3 - EXECUTION**

**3.1 FIELD QUALITY CONTROL**

- A. Any discrepancies with specified luminaire and its proposed use or environment shall be brought to the Engineer's attention as soon as possible.**
1. At project close-out, a list of damaged fixtures received by the contractor shall be provided to the Electrical Engineer for evaluation of fixture manufacturers shipping and packaging methods.

**3.2 INSTALLATION**

- A. Luminaires shall be installed complete with all accessories, glassware, canopies, sockets, reflectors, optics, wiring devices and supplied with new lamps of the type and wattage indicated on plans or in this specification unless specifically noted otherwise.**
- B. All luminaires shall be supported in accordance with ASTM E-580 recommended guidelines for seismic restraint, as well as the latest version of the International Building Code related to lateral and vertical bracing, including but not limited to:**
1. Recessed luminaires shall have a minimum of four (4) #10 gauge wires attached to structure above; (1) wire at each corner of the luminaire. The wires shall be independent of ceiling support system.
  2. All lighting fixtures shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100 percent of the lighting fixture weight acting in any direction.
  3. Pendant-hung lighting fixtures shall be supported directly from the structure above with #9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.
- C. Mount luminaries in mechanical yards, areas and rooms to clear any mechanical equipment, conduit and clearances. Coordinate mounting with mechanical plans.**



- D. Junction box and ballast compartment shall be accessible from below when housing is installed in final position. Wiring shall be secured from damage when accessed for relamping.
- E. Fire rated gypsum board enclosures shall be constructed around all recessed luminaires that penetrate fire rated areas.
- F. All surface mounted luminaires installed on a suspended ceiling grid shall have four (4) supporting clips positively attaching corners of housing to the ceiling. Installation shall include 1/8" spacers between the housing and ceiling tile where applicable.
- G. Actual locations of luminaires and dimensions shall be referenced to architectural drawings. Electrical plans shall not be used to scale for construction purposes. Any discrepancies shall be brought to the engineer's attention prior to installation.
- H. Utilize modular wiring systems in the installation of luminaires where accessible and applicable. The system shall be complete with all required fittings, plugs, and cord drops for a complete operating system per specifications.
- I. Provide additional junction boxes as required where conductor exceeds factory provided junction box limitations.
- J. Installation shall be appropriately coordinated with all disciplines to insure proper ventilation and heat dissipation as required per manufacturer.
- K. Where luminaires are served from two sources, a barrier shall be provided to separate emergency source from normal source with notation indicating separate sources.
- L. Luminaires not utilizing modular wiring systems, shall be connected with minimum six (6) foot length of flexible metal conduit from a structurally mounted junction box.
- M. Wall mounted luminaries and junction boxes shall be rigidly supported to structure to provide adequate support during normal operation.
- N. Pendant luminaries shall be mounted in a uniform mounting height and in straight, parallel, continuous rows. Final coordination with the architectural reflected ceiling plan, mechanical equipment and plumbing fixtures shall be made in the field to ensure consistent spacing and locations.
- O. All wall mounted fixtures shall be mounted to a supporting wall bracing material in addition to the junction box. The bracing material is secured to structural elements in the wall. The bracing shall be capable of supporting the weight of the fixture and comply with the manufacturer's requirements and recommendations.

### 3.3 LABORATORY INSTALLATION

- A. Luminaires mounted in a controlled environment such as a clean room shall be gasketed and sealed where the housing meets the ceiling with a continuous silicone-based resilient sealant bead.
- B. Luminaires installed in a wet environment such as a wipe-down or hose-down laboratory shall bear the "Wet Location" UL listing and sealed waterproof with appropriate silicone based

resilient sealant.

- C. Ceiling openings installed in a sealed environment to insure accessibility to outlet boxes shall be gasketed to prevent any flow of air. The cover shall be constructed to ensure structural integrity for continuous removal from ceiling and be mounted with large head screws as required.

### 3.4 FIELD TESTING

- A. Upon completion of installation, an operation test shall be conducted to show that all equipment operates in accordance with the requirement of this specification.
- B. All applicable tests shall be conducted in the presence of an Owner Representative and copies of any reports shall be provided.
- C. Reports shall indicate when and where the test was conducted and who was present.
- D. Upon completion of installations, luminaires requiring positioning shall be adjusted and aimed at final position.
- E. Exit signs shall be individually reviewed after installation completion to ensure directional arrows are properly provided and positioned.

### 3.5 CLEANING AND REPAIR

- A. After complete lighting installation and before project completion, all damaged or faulty lenses or louvers in luminaires shall be replaced by the Electrical Contractor, at no additional cost to the Owner.
- B. All anodized or highly visual or optically sensitive reflectors shall be cleaned of all fingerprints and smudges for a clean installation per manufacturers' recommendations.
- C. All luminaries with paint scratches, dents or deformations due to installation or shipping shall be repaired, touched up or replaced as required or deemed necessary by the Electrical Engineer at no additional cost to the Owner.
- D. Upon final installation of individual luminaires, dirt and debris shall be removed from luminaire enclosures.

END OF SECTION 26 51 00

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SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. Provide labor, materials, tools, and equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the equipment of this section, as shown on the drawings and specified herein.
- B. Furnish and install complete lighting systems, wired, assembled and operable, except where specifically noted otherwise, which includes but not limited to the following:
  - 1. Luminaires
  - 2. Lamps and ballasts
  - 3. Mounting hardware
  - 4. Accessories as noted
  - 5. Poles
  - 6. Pole bases
  - 7. Anchor bolts and templates
  - 8. Spare lamps
- C. The materials and equipment herein specified shall be of new and domestic manufacturer and furnished in accordance with the applicable standards.
- D. Specifications and scale drawings are intended to convey the salient features, function and character of the fixtures only, and do not undertake to illustrate or set forth every item or detail necessary of the work.

1.3 QUALITY ASSURANCE AND STANDARDS

- A. The latest revision of the standards listed below form an integral part of this specification:
  - 1. American Disabilities Act (ADA)
  - 2. American National Standards Institute (ANSI)
  - 3. American Society for Testing and Materials (ASTM)
  - 4. Institute of Cable Engineers Association (ICEA)
  - 5. Institute of Electrical and Electronic Engineers (IEEE)

6. Local Code Enforcement Agency Requirements
7. National Electrical Code (NEC)
8. National Electrical Contractors Association (NECA)
9. National Electrical Manufacturer's Association (NEMA)
10. National Electrical Testing Association (NETA)
11. National Fire Protection Association (NFPA)
12. Underwriters' Laboratories, Inc. (UL)
13. International Building Code (IBC)
14. Illuminating Engineering Society (IESNA)
15. Certified Ballast Manufacturers (CBM)
16. National Appliance Energy Conservation Amendments of 1988 (Public Law 100-357).

Materials and equipment as well as workmanship provided under this section shall conform to the highest commercial standards, and as specified and as indicated on the drawings. Fixture parts and components not specifically identified or indicated shall be made of materials most appropriate to their use or function and as such resistant to corrosion, thermal and mechanical stresses encountered in the normal application and function of the fixtures.

#### 1.4 SUBMITTALS

- A. Shop drawings for all fixtures shall be submitted and approved before fabrication. Any material produced prior to the approval of shop drawings or samples, and not in conformance with the Contract Documents, shall be disapproved with the contractor bearing full responsibility and cost. Submit shop drawings per Section 26 05 00 for review, include the following:
  1. Luminaires
  2. Lamps
  3. Ballasts
  4. Drivers and Transformers
  5. Photometric reports
  6. Point-by-point calculations specific to the project.
- B. Submit shop drawings indexed, and in accordance with luminaire identification per drawings. Each item shall be tabbed, clearly identifying the catalog ordering numbers including all optional equipment specified.
- C. Luminaire shop drawings shall include the following:
  1. Manufacturers report of current and original source. Photocopy of partial data sheet or drawings is not acceptable. Report shall include the following:
    - a. Ballast type, manufacturer and performance characteristics
    - b. Lamp type, manufacturer and performance characteristics
    - c. Finish
    - d. Reflector system and characteristics
    - e. Diffuser type and characteristics
    - f. Weight and dimensions
    - g. EPA rating
    - h. Standard manufacturer options
    - i. Luminaire series and model number
    - j. Luminaire efficiency

- k. Candlepower data table
  - l. Zonal lumens table
  - m. IES luminaire classification
  - n. Maintenance and operating instructions including tools required, types of cleaners to be used and suggested replacement parts list.
2. Photometric data assembled in a standard IES photometric test report.
- D. Lamp shop drawings shall include type, dimensions, manufacturer and operating characteristics, including but not limited to:
- 1. Operating voltage range
  - 2. Color Rendering Index (CRI) value per IES standards
  - 3. Color temperature (in Kelvin)
  - 4. Mounting position
  - 5. Starting temperature, indoor and outdoor
  - 6. Starting/restrike time
  - 7. Lamp life
  - 8. Lamp efficiency
  - 9. Warranty
  - 10. Lamp base
  - 11. Lumen rating
- E. Ballast shop drawings shall include type, dimensions, manufacturer and operating characteristic including but not limited to:
- 1. Ballast operating temperature voltage
  - 2. Total harmonic distortion
  - 3. Ballast starting/restrike time
  - 4. Ballast efficiency factor (BEF)
  - 5. Ballast transformation type (i.e.: autotransformer, preheat, instant-start, rapid start, constant wattage, reactor, trigger-start)
  - 6. UL classification (i.e.: Class "P")
  - 7. Power factor
  - 8. Sound rating (fluorescent only)
  - 9. NEMA rating
- F. If requested by the Engineer, samples shall be submitted for final selection. Samples shall comply with the following:
- 1. Paint chips:
    - a. Samples shall be provided and approved prior to any release to manufacture.
    - b. Samples shall be minimum of 3"x3" and be of exact finishes.
    - c. Samples shall be exact representatives of the luminaires:
      - 1) Priming process
      - 2) Painting process
      - 3) Baking process
      - 4) Finish process
      - 5) Luminaire material (i.e. sheet metal, aluminum, wood, etc.)
    - d. Samples shall be labeled with manufacturers color call-out, as well as the paint

manufacturers' call-out.

2. Fixtures:

- a. Submit for approval samples called for to the Engineer when and where directed, the components marked with the name of the project, and fixture type, and part number. Fixture shall be provided with a 6' cord and plug, and specified lamp. Allow two weeks from the date of receipt for thorough examination and review by the Engineer.
- b. Fixtures under the contract shall be identical with the approved sample fixture. No fixture used as a sample shall be allowed to be installed on the project.
- c. In the event the submissions are disapproved, the fixtures shall be returned to the contractor to immediately make a new submission of fixture or fixtures meeting the contract requirements.
- d. All charges for these shipments are to be prepaid by the contractor.
- e. Samples shall be provided and approved prior to any release to manufacture.

1.5 FACTORY TESTING

- A. Luminaire testing shall be conducted by an approved independent testing laboratory.
- B. Luminaire tests shall be reported in accordance with Illuminating Engineering Society (IES) Standard Photometric Test Report.

1.6 WARRANTY

- A. Contractor shall warranty equipment and installation free from defects in material and workmanship for a period of no less than (1) year from the date of project completion. This includes the fixture, its finishes and components (see ballasts below).
- B. Fluorescent ballasts shall be warranted against defects in material and workmanship for a period of no less than (5) years for electronic ballasts, from the date of project completion regardless of the date of manufacture.
- C. HID ballasts shall be warranted against defects in material and workmanship for a period of no less than (2) years from the date of project completion regardless of the date of manufacture.
- D. LED modules and drivers shall each be warranted against defects in material and workmanship for a period of no less than five (5) years, from the date of project completion regardless of the date of manufacture.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Luminaires shall bear the appropriate UL label for location, mounting position and operating conditions in which it is installed.
- B. Luminaires, ballasts and lamps shall each be of the same manufacturer and of identical finish,

appearance, and performance. Luminaires which are pre-lamped before shipment shall have identical lamp manufacturer. Mix and match of different lamp manufacturer shall not be acceptable.

- C. Recessed ceiling mounted luminaires shall be provided with appropriate frame and trim type compatible with ceiling construction. Reference architectural plans for ceiling construction type and specifications.
- D. Luminaires and devices shall be free of burrs, scratches, marks, and dents which may occur during transportation, storage or installation. Construction shall be finished to eliminate sharp edges exposed to installer and end-user.
- E. Sheet metal construction of luminaires shall be of sufficient rigidity to prevent deformation during installation and typical use.
- F. Cast parts and sections of a luminaire shall be smooth, free of blemishes, rust and scale and be irradiated, sandblasted and anodized.
- G. All burned out lamps and ballasts shall be replaced by the end of contract prior to Architect, Resident Engineer, Owner Representative and Engineer final punchlist.
- H. Color shall be as indicated on plans.
- I. Enamel paint shall be baked on at a minimum 300 degrees F and have 86% reflectivity for a surface, which is to be reflective.
- J. Housings: Rigidly formed, weather and light tight enclosures that will not warp, sag, or deform in use.
- K. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
- L. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
- M. Lenses and Refractors: Materials as indicated. Use heat and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.

## 2.2 LAMPS

- A. LED (Lighting Emitting Diode) Modules
  - 1. Unless specified on plans or in Lighting Fixture Schedule, the module color temperature shall be 4000 Kelvin (K).
  - 2. Unless otherwise noted, modules shall have a CRI (color rendering index) of 80 or greater.
  - 3. Return lumen output shall be based on fixture absolute lumens as defined in LM-79 (IESNA).
  - 4. Modules shall comply with LM-80 (IESNA).



5. LED modules shall be interchangeable without removal or replacement of heat sink or luminaire.
6. Luminaire Manufacturer to offer replacement modules that maintain rated lumen package per initial design luminaire.
7. Minimum rated life of modules shall be 50,000 hours per IESNA L70.

B. Acceptable Manufacturers

1. LED Chips: Cree, Nichia, Philips or approved equal.

C. All lamps shall be burned once installed in the fixtures for 100 hours, prior to switching.

## 2.3 BALLASTS

A. LED Drivers

1. Shall be UL listed when installed in luminaire.
2. Drivers shall be grounded appropriately as governed by NEC Article 410-E.
3. Drivers shall be located within the luminaire for which it is operating unless specifically indicated on plans as remove ballast type.
4. Remote drivers shall be located in accessible location, within manufacturers maximum distance requirements.
5. Drivers shall be rated weatherproof type where there is moisture present.
6. A permanent weatherproof seal shall be factory provided where the wiring enters the ballast compartment of an outdoor luminaire installation.
7. Drivers shall have a standard dimming protocol of 0-10V unless otherwise noted on the Luminaire Schedule.
8. Shall operate with no detectable flicker and be high power factor (95% or higher).
9. Drivers shall be marked with the manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each LED module being powered and bear all applicable UL listing on housing.
10. All drivers shall be compatible with dimming protocol of connected room controllers, panels, local controls, devices and other luminaires.

B. Acceptable Manufacturers

1. Osram/Sylvania, GE, Philips or EldoLED.

## 2.4 LUMINAIRES

A. General

1. Escutcheon plates, coverplates, and finish trim hardware shall meet flush with ceiling, floor, wall or other surfaces to which they may be mounted.
2. Luminaire construction shall allow initial installation of recessed luminaires without the presence of finish trim, diffusers or lens.
3. Lamp sockets and reflector assemblies shall be securely fastened to luminaire housing to prevent rotation, adjustment or rocking of hardware during lamping or future relamping.
4. Luminaire lenses shall be securely retained in a fashion so that relamping or accessing to luminaire will not dislodge lens.
5. Luminaires lenses and diffusers shall be free from chromatic or spherical imperfections

- and have thermal characteristics capable of withstanding installed lamp temperatures.
6. Pendant type luminaires shall be mounted to provide balanced construction with the use of swivel hanger. Swivel hanger shall be provided standard or ordered as accessory unless specified otherwise.
  7. Bracket type luminaires shall be specifically designed for type installation which is indicated.
  8. Luminaires shall be factory tested, prewired and preassembled unless otherwise specified or intended.
  9. Luminaires located in direct exposure to the weather to include rain, sleet and snow shall be marked "Suitable For Wet Locations" with UL label. Luminaires located outdoors but not in direct exposure to rain shall be marked "Suitable for Damp Locations" minimum rated.
  10. Where ceiling space is not accessible, luminaire housing shall provide access to luminaire junction box to comply with NEC section 370-29.
  11. Luminaires shall contain an integral ballast disconnect compliant with NEC section 410.73.

**B. LED Luminaires**

1. Luminaires shall come with manufacturer provided LED module installed.
2. All luminaires shall meet building energy code Title 24-2016 efficacy requirements.
3. Luminaire housing, driver and module shall be products of the same manufacturer.
4. IES files shall include BIG ratings of fixture for each distribution and configuration.

**2.5 LUMINAIRE SUPPORT COMPONENTS**

- A. Description: Comply with AASHTO LTS-3 for pole or other support structures, brackets, arms, accessories, base, and anchorage and foundation.
- B. Wind-Load Strength of Total Support Assembly: Adequate to carry support assembly plus luminaires at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of 110 mph with a gust factor of 1.3. Support assembly includes pole or other support structures, brackets, arms, appurtenances, base, and anchorage and foundation.
- C. Finish: Match finish of pole/support structure for arm, bracket, and tenon mount materials.
- D. Mountings, Fasteners, and Accessories: Corrosion-resistant items compatible with support components.
  1. Materials: Will not cause galvanic action at contact points.
  2. Mountings: Correctly position luminaire to provide indicated light distribution.
  3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized after fabrication unless stainless-steel items are indicated.
  4. Anchor-Bolt Template: Plywood or steel.

**2.6 LUMINAIRE TYPES**

- A. See Fixture Schedule on electrical drawing.

**PART 3 - EXECUTION**

3.1 FIELD QUALITY CONTROL

- A. Any discrepancies with specified luminaire and its proposed use or environment shall be brought to the Engineer's attention as soon as possible.
  - 1. At project close-out, a list of damaged fixtures received by the contractor shall be provided to the Electrical Engineer for evaluation of fixture manufacturers shipping and packaging methods.

3.2 INSTALLATION

- A. Luminaires shall be installed complete with all accessories, glassware, canopies, sockets, reflectors, optics, wiring devices and supplied with new lamps of the type and wattage indicated on plans or in this specification unless specifically noted otherwise.
- B. Concrete Foundations: Construct according to details and drawings.
  - 1. Comply with details for reinforcement and for anchor bolts, nuts, and washers. Verify anchor-bolt templates by comparing with actual pole bases furnished.
- C. Install poles as follows:
  - 1. Use web fabric slings (not chain or cable) to raise and set poles.
  - 2. Mount pole to foundation with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 3. Secure poles level, plum, and square.
  - 4. Grout void between pole base and foundation. Use nonshrinking or expanding concrete grout firmly packed in entire void space.
- D. All luminaires (where applicable) shall be supported in accordance with ASTM E-580 recommended guidelines for seismic restraint, as well as the latest version of the Uniform Building Code related to lateral and vertical bracing, including but not limited to:
  - 1. Recessed luminaires shall have a minimum of two (2) #12 gauge wires attached to structure above, independent of ceiling support system.
  - 2. All lighting fixtures shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100 percent of the lighting fixture weight acting in any direction.
  - 3. Pendant-hung lighting fixtures shall be supported directly from the structure above with #9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.
- E. Mount luminaires in mechanical yards, areas and rooms to clear any mechanical equipment, conduit and clearances. Coordinate mounting with mechanical plans.
- F. Junction box and ballast compartment shall be accessible from below when housing is installed in final position. Wiring shall be secured from damage when accessed for relamping.
- G. Fire rated gypsum board enclosures shall be constructed around all recessed luminaires that penetrate fire rated areas.
- H. Actual locations of luminaires and dimensions shall be referenced to architectural drawings.

Electrical plans shall not be used to scale for construction purposes. Any discrepancies shall be brought to the engineer's attention prior to installation.

- I. Provide additional junction boxes as required where conductor exceeds factory provided junction box limitations.
- J. Installation shall be appropriately coordinated with all disciplines to insure proper ventilation and heat dissipation as required per manufacturer.
- K. Where luminaires are served from two sources, a barrier shall be provided to separate emergency source from normal source with notation indicating separate sources.
- L. All wall mounted fixtures shall be mounted to a supporting wall bracing material in addition to the junction box. The bracing shall be installed behind the finished wall surface and be secured to structural elements in the wall. The bracing shall be capable of supporting the weight of the fixture and comply with manufacturer's requirements and recommendations.
- M. Pendant luminaires shall be mounted in a uniform mounting height and in straight continuous rows. Final coordination with mechanical equipment and plumbing fixtures shall be made in the field to ensure consistent spacing and locations.
- N. Luminaire Attachment: Fasten to indicated structural supports.
- O. Luminaire Attachment with Adjustable Features or Aiming: Attach luminaires and supports to allow aiming for indicated light distribution.
- P. Lamp luminaires with indicated lamps according to manufacturer's written instructions. Replace malfunctioning lamps.
- Q. All exterior wall mounted fixtures shall be sealed watertight between the fixture housing or the canopy and the wall (or structure). Clear silicone caulking (or matching color), shall be used.

### 3.3 CONNECTIONS

- A. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
  - 2. Ground metal poles/support structures according to Division 26 Section "Grounding and Bonding."

### 3.4 DELIVERY, STORAGE, AND HANDLING OF POLES

- A. Package aluminum poles for shipping according to ASTM B 660.
- B. Store poles on decay-resistant treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on fiberglass poles until just before pole installation. Handle poles with web fabric straps.

- D. Retain factory-applied pole wrappings on metal poles until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

3.5 FIELD TESTING

- A. Upon completion of installation, an operation test shall be conducted to show that all equipment operates in accordance with the requirement of this specification.
- B. All applicable tests shall be conducted in the presence of an Owner Representative and copies of any reports shall be provided.
- C. Reports shall indicate when and where the test was conducted and who was present.
- D. Upon completion of installations, luminaires requiring positioning shall be adjusted and aimed at final position.

3.6 CLEANING AND REPAIR

- A. After complete lighting installation and before project completion, all damaged or faulty lenses or louvers in luminaires shall be replaced by the Electrical Contractor, at no additional cost to the Owner.
- B. All anodized or highly visual or optically sensitive reflectors shall be cleaned of all fingerprints and smudges for a clean installation per manufacturers' recommendations.
- C. All luminaires with paint scratches, dents or deformations due to installation or shipping shall be repaired, touched up or replaced as required or deemed necessary by the Electrical Engineer at no additional cost to the Owner.
- D. Upon final installation of individual luminaires, dirt and debris shall be removed from luminaire enclosures.

END OF SECTION 26 56 00

SECTION 27 13 00 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. Section Includes:
  - 1. Pathways.
  - 2. UTP cable.
  - 3. 8/125-micrometer, singlemode optical fiber cabling.
  - 4. 50/125-micrometer, multimode optical fiber cabling.
  - 5. 62.5/125-micrometer, multimode optical fiber cabling.
  - 6. Cable connecting hardware, patch panels, and cross-connects.
  - 7. Cabling identification products.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. LAN: Local area network.
- F. OFL: Over filled launch
- G. RCDD: Registered Communications Distribution Designer.
- H. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

- A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For coaxial cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.
- B. Shop Drawings:
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  - 3. Cabling administration drawings and printouts.
  - 4. Wiring diagrams to show typical wiring schematics including the following:
    - a. Cross-connects.
    - b. Patch panels.
    - c. Patch cords.
  - 5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
  - 6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
    - a. Vertical and horizontal offsets and transitions.
    - b. Clearances for access above and to side of cable trays.
    - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.
- G. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

#### 1.7 QUALITY ASSURANCE AND STANDARDS

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- 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.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight.



2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

#### 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

#### 1.11 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

#### 1.12 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. UTP Patch-panel units: Four (4) of each type.
  2. Optical fiber connector panels: Two (2) of each type

### PART 2 - PRODUCTS

#### 2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  1. Support brackets with cable tie slots for fastening cable ties to brackets.

2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cablofil Inc.
  - b. Cooper B-Line, Inc.
  - c. Cope - Tyco/Allied Tube & Conduit.
  - d. PW Industries.
  - e. Approved Equal
2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches thick.
  - a. Ladder Cable Trays: Nominally 12 inches wide, and a rung spacing of 9 inches.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceways" and "Boxes."

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high and 2-1/2 inches deep.

## 2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 6 Section "Rough Carpentry" for plywood backing panels.

## 2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturer:

1. Superior Essex

- B. Description: 100-ohm, 4-pair UTP, with a gray thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - a. Communications, General Purpose: Type CM or CMG.
  - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

## 2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturer:
  - 1. Leviton Incorporated, or approved equal.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 10 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, 4-pair cables in 72-inch and 120-inch lengths; terminated with 8-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

## 2.5 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturer:
  - 1. Corning Incorporated, or approved equal.
- B. Description: Multimode 50/125-micrometer (12-fiber), multimode 62.5/125-micrometer (12-fiber), singlemode 8/125-micrometer (12-fiber) nonconductive, tight buffer, optical fiber cable.
  - 1. Comply with ICEA S-83-596 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
  - 3. Comply with TIA/EIA-492AAAA-B for detailed specifications.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
    - a. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
  - 5. Multimode 50/125-micrometer performance:

- a. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
  - b. Minimum OFL Bandwidth: 700 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
6. Multimode 62.5/125-micrometer performance:
- a. Maximum Attenuation: 3.4 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
  - b. Minimum OFL Bandwidth: 200 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
7. Singlemode 8/125-micrometer performance:
- a. Maximum Attenuation: 0.4 dB/km at 1310 nm; 0.3 dB/km at 1550 nm.
- C. Jacket:
1. Jacket Color: yellow for 8/125-micrometer, aqua for 50/125-micrometer cable, and orange for 62.5/125-micrometer cable.
  2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
  3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

## 2.6 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products the following manufacturer:
1. Corning Incorporated.
  2. Leviton Incorporated.
  3. Approved Equal.
- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 72-inch lengths.
- D. Cable Connecting Hardware:
1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
  2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
  3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

## 2.7 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.

- B. Comply with ANSI-J-STD-607-A.

## 2.8 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

## 2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.
- E. Cable will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 WIRING METHODS

- A. Wiring Method: Install cables under raised floors, in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for raceways and boxes specified in Division 26 Sections "Raceways" and "Boxes."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### 3.2 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

- C. Comply with requirements in Division 26 Sections "Raceways" and "Boxes" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Install 110-style IDC termination hardware unless otherwise indicated.
  - 4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
  - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
  - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  - 10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
  - 1. Comply with TIA/EIA-568-B.2.
  - 2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable as required below each feed point.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

**3.4 FIRESTOPPING**

- A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

**3.5 GROUNDING**

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 2 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

**3.6 IDENTIFICATION**

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.
  - 1. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Comply with requirements in Division 26 Section "Communications Horizontal Cabling" for cable and asset management software.
- D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
- F. Cable and Wire Identification:
  - 1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.



2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:
1. Cables use flexible vinyl or polyester that flexes as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  3. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  4. Optical Fiber Cable Tests:

## Palm Ave Transitional Housing

- a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- b. Link End-to-End Attenuation Tests:
  - 1) Backbone link measurements: Test at 850, 1300, 1310, and 1550 nm in one direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
  - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
- D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.
- F. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION 27 13 00

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SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

1.2 SCOPE

- A. Section Includes:
  - 1. Pathways.
  - 2. UTP cabling.
  - 3. Cable connecting hardware, patch panels, and cross-connects.
  - 4. Telecommunications outlet/connectors.
  - 5. Cabling system identification products.
  - 6. Cable management system.

1.3 DEFINITIONS

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel.
- D. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- E. EMI: Electromagnetic interference.
- F. IDC: Insulation displacement connector.
- G. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- H. LAN: Local area network.
- I. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

- J. RCDD: Registered Communications Distribution Designer.
- K. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom without ventilation openings.
- L. Trough or Ventilated Cable Tray: A fabricated structure consisting of longitudinal side rails and a bottom having openings for the passage of air.
- M. UTP: Unshielded twisted pair.

#### 1.4 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
  - 3. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
  - 1. For UPT cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.
- B. Shop Drawings:
  - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
  - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
  - 3. Cabling administration drawings and printouts.

4. Wiring diagrams to show typical wiring schematics, including the following:
    - a. Cross-connects.
    - b. Patch panels.
    - c. Patch cords.
  5. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
  6. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
    - a. Vertical and horizontal offsets and transitions.
    - b. Clearances for access above and to side of cable trays.
    - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
    - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance Data: For splices and connectors to include in maintenance manuals.
- G. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.

## 1.7 QUALITY ASSURANCE AND STANDARDS

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
  2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
  3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- 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.
- E. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- F. Grounding: Comply with ANSI-J-STD-607-A.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

#### 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.10 COORDINATION

- A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

#### 1.11 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Patch-panel units: Four (4) of each type.
  - 2. Device plates: Ten (10) of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- C. Cable Trays:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cablofil Inc.
    - b. Cooper B-Line, Inc.
    - c. Cope - Tyco/Allied Tube & Conduit.
    - d. PW Industries.
    - e. Approved Equal.
  - 2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick.
    - a. Ladder Cable Trays: Nominally 12 inches wide, and a rung spacing of 9 inches.
- D. Conduit and Boxes: Comply with requirements in Division 26 Sections "Raceways" and "Boxes."
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Division 6 Section "Rough Carpentry" for plywood backing panels.



2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products the following manufacturer:
  - 1. Superior Essex, or approved equal.
- B. Description: 100-ohm, 4-pair UTP, with a grey thermoplastic jacket.
  - 1. Comply with ICEA S-90-661 for mechanical properties.
  - 2. Comply with TIA/EIA-568-B.1 for performance specifications.
  - 3. Comply with TIA/EIA-568-B.2, Category 6.
  - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
    - a. Communications, Plenum Rated: Type CMP, complying with NFPA 262.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturer:
  - 1. Leviton Incorporated, or approved equal.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 10 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in 72-inch and 120-inch lengths; terminated with eight-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch cords shall have color-coded boots for circuit identification.

**2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS**

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Four-port-connector assemblies mounted in single faceplate.
  - 1. Plastic Faceplate: High-impact plastic. Modular furniture workstation faceplates shall be black with white-text-on-black labels. Standard workstation faceplates shall be white with black-text-on-white labels.
  - 2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.
    - a. Flush mounting jacks, positioning the cord at a 90 degree angle.
  - 3. Legend: Machine printed, in the field, using adhesive-tape label.

**2.6 GROUNDING**

- A. Comply with requirements in Division 26 Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

**2.7 IDENTIFICATION PRODUCTS**

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

**2.8 CABLE MANAGEMENT SYSTEM**

- A. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturer:
  - 1. Chatsworth Products.

**2.9 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Cable will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

**PART 3 - EXECUTION**

**3.1 WIRING METHODS**

- A. Wiring Method: Install cables under raised floors, in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

**3.2 INSTALLATION OF PATHWAYS**

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Sections "Raceways" and "Boxes" for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

**3.3 INSTALLATION OF CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed Under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable as required below each feed point.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
  - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

- b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
- a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
- a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
  - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
  - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 FIRESTOPPING

- A. Comply with requirements in Division 7 Section "Through-Penetration Firestop Systems."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 2 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

1. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 9 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- E. Cable and Wire Identification:
  1. Label each cable within 4 inches of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
  4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
  1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
  3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  5. UTP Performance Tests:
    - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
      - 1) Wire map.
      - 2) Length (physical vs. electrical, and length requirements).
      - 3) Insertion loss.
      - 4) Near-end crosstalk (NEXT) loss.
      - 5) Power sum near-end crosstalk (PSNEXT) loss.
      - 6) Equal-level far-end crosstalk (ELFEXT).
      - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
      - 8) Return loss.
      - 9) Propagation delay.
      - 10) Delay skew.
  6. Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
    - a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
    - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

END OF SECTION 27 15 00



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**SECTION 28 31 11 - DESIGN/BUILD FIRE ALARM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The general conditions, Division 1, and Basic Electrical Requirements (Section 26 05 00) are part of this section and the contract for this work and apply to this section as fully as if repeated herein.
- B. Reference to other sections: The applicable requirements from other Division 26 sections required for a complete and operational system shall form a part of the electrical work and each section shall be thoroughly reviewed by the Contractor for application to all other sections.

**1.2 DESCRIPTION**

- A. The Contractor shall design, furnish and install a complete and operating life safety, design/build fire alarm system in compliance with all applicable state and local codes and ordinances. The Contractor shall review the construction documents including architectural, mechanical, plumbing, electrical, etc. as required to properly coordinate with all design disciplines and include all coordination work in the design and cost. The Contractor shall coordinate with other design/build disciplines, including fire sprinkler systems, elevator systems, and include all coordination items in the fire alarm system design and cost. The Contractor shall submit completed drawings to the governing fire code authority and obtain design approval and construction permits as required. All costs necessary for a code-compliant system shall be included in the fire alarm system design/build cost.
- B. The design/build system shall include the design, furnishing, installation, connection and testing of an addressable microprocessor controlled fire alarm system. It shall include, but not be limited to, alarm initiating devices, trouble indicating devices, main fire alarm control panel, auxiliary control devices, annunciation devices, annunciator panels, transducer panels, and wiring.
- C. The alarm system shall comply with requirements of the latest version of NFPA Standard 72 for protected Premises Signaling Systems except as modified and supplemented by this specification.

**1.3 SCOPE**

- A. A new intelligent reporting, microprocessor-controlled automatic and manual fire detection and alarm system shall be installed in accordance with all state and local requirements. As a minimum, the system shall monitor the following: Manual alarm, waterflow alarm switches, valve supervisory tamper switches, post indicator valves, back-flow preventer supervisory switches, smoke/heat detectors for elevator re-call, and door release, duct smoke detectors and/or area smoke detectors for fan stop and control of fire/smoke dampers, and heat detectors for elevator shut-down. The system shall include dry relay contacts for connection to a digital alarm communicator transmitter for Central Station Monitoring.

- B. Provide Carbon Monoxide detection and alarm tie-in. Furnish and Install per the Requirements of NFPA 720, 2016 California Building Code and any Authorities Having Jurisdiction.
- C. Basic Performance
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
  - 2. Initiation Device Circuits (IDC) shall be wired Class B (NFPA Style B) as part of an addressable device connected by the SLC Circuit.

#### 1.4 BASIC SYSTEM FUNCTIONAL OPERATION

- A. When an alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:
  - 1. The system alarm LED on the control panel shall flash.
  - 2. A local piezo electric signal in the control panel shall sound.
  - 3. A backlit 80 character LCD display on the control panel shall indicate all information associated with the alarm condition, including the type of alarm point and its location within the protected premises.
  - 4. History storage equipment shall log the information associated each new alarm control panel condition, along with time and date of occurrence.
  - 5. All system output programs assigned via control-by-event programming corresponding to the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

#### 1.5 SUBMITTALS

- A. General:
  - 1. Six copies of all submittals shall be submitted to the Architect, Resident Engineer and Engineer for review.
  - 2. For equipment other than that specified, the contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment.
- B. Shop Drawings:
  - 1. Scaled drawings (1/8" equals 1' 0") shall be provided.
  - 2. Include manufacturer's name, model numbers, ratings, power requirements, voltage drop calculations, battery back-up calculations, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
  - 3. Show annunciator layout, configurations, and termination on the architect's floor plans.
  - 4. Provide additional documents as may be required by the governing code authority.
- C. Manuals:
  - 1. Submit simultaneously with the shop drawings, complete operating manuals listing the manufacturer's name(s), including technical data sheets.
  - 2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.

3. Provide a clear and concise description of operation that gives, in detail, the alarm, supervisory, and trouble conditions.

D. Software Modifications

1. Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the technician to the site shall not exceed 24 hours.
2. Provide all hardware, software, programming tools and documentation necessary to modify the alarm system on site

E. Certifications:

1. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the installing contractor is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.6 GUARANTEE

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included.

1.7 QUALITY ASSURANCE AND STANDARDS

- A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.
- B. National Fire Protection Association (NFPA) - USA:
- C. Underwriters Laboratories Inc. (UL) - USA:
- D. California State Building Codes.
- E. All requirements of the Local fire authority.

1.8 APPROVALS:

- A. The system shall have proper listing and/or approval from the following recognized agencies:
  1. UL - Underwriters Laboratories Inc.
  2. FM - Factory Mutual
  3. CSFM - California State Fire Marshal
  4. Local fire authority

**PART 2 - PRODUCTS**

2.1 EQUIPMENT AND MATERIAL, GENERAL

- A. All equipment and components shall be new, and the manufacturer's current model.
- B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations.

2.2 CONDUIT AND WIRE

- A. Conduit:
  - 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.
  - 2. Conduit shall not enter the alarm control panel, or any other remotely mounted control panel equipment or backboxes, except where conduit entry is specified by the fire alarm system manufacturer.
  - 3. Conduit shall be 3/4 inch minimum.
- B. Wire:
  - 1. All alarm system wiring shall be new.
  - 2. Wiring shall be in accordance with local, state and national codes and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG.
  - 3. All wire and cable shall be listed and/or approved by a recognized testing agency.
  - 4. All field wiring shall be electrically supervised for open circuit and ground fault.
- C. Terminal Boxes, Junction Boxes and Cabinets:
  - 1. All boxes and cabinets shall be UL listed for their use and purpose.

2.3 MAIN ALARM CONTROL PANEL

- A. The main control panel shall be equal to a NOTIFIER Model AFP-200 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.
- B. System Capacity and General Operation:
  - 1. The control panel shall provide, or be capable of expansion to 198 intelligent/addressable devices.
  - 2. The control panel shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 3.0 amps at 30 VDC. It shall also include four Class B (NFPA Style Y) or Class A (NFPA Style Z) programmable Notification Appliance Circuits.
  - 3. The alarm control panel shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad for the field programming and control of the alarm system.
  - 4. All programming or editing of the existing program in the system shall be achieved

without special equipment and without interrupting the alarm monitoring functions of the alarm control panel. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.

5. The system shall allow the programming of any input to activate any output or group of outputs.

C. The main control panel shall provide the following features:

1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
2. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 7.
3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. The ability to display or print system reports.
5. Periodic detector test, conducted automatically by the software.

D. Signaling Line Circuits (SLC)

1. The system shall include one SLC. The SLC interface shall provide power to and communicate with up to 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control) for a system capacity of 198 devices. The SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The Loop Interface Board (LIB) shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, Chapter 7 requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

E. Serial Interfaces

1. The system shall include two serial RS - 232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.
2. The system shall include an RS – 485S port for the serial connection of optional annunciators and remote LCD displays.
3. The RS - 485 interface may be used for network connection to a proprietary receiving unit.

F. Notification Appliance Circuit (NAC) Module

1. The Notification Appliance Circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits.
2. The notification circuit capacity shall be 3.0 amperes maximum.

G. Control Relay Module

1. The control relay module shall provide eight Form-C auxiliary relay circuits rated at 5

- amperes, 28 VDC.
  - 2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
- H. Enclosures:
- 1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
  - 2. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be selected for either right or left hand hinging.
- I. Power Supplies:
- 1. The main power supply for the alarm control panel shall provide 3.0 amps of available power for the control panel and peripheral devices.
  - 2. The main power supply shall continuously monitor all field wires for earth ground conditions.
  - 3. The main power supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge.
  - 4. A separate auxiliary power supply for door holders shall be provided. Loss of 120 VAC power to the auxiliary power supply shall release the door holders.
  - 5. All circuits shall be power-limited, per UL864 requirements.

## 2.4 SYSTEM COMPONENTS

- A. Waterflow Indicator:
- 1. Waterflow Switches shall be furnished by the Sprinkler Contractor.
  - 2. Waterflow Switches shall be connected under this section but installed and adjusted by the sprinkler contractor.
- B. Sprinkler and Valve Supervisory Switches
- 1. Each sprinkler system water supply control valve riser, zone control valve, and standpipe system riser control valve shall be equipped with a supervisory switch.
  - 2. PIV (post indicator valve) or main gate valves shall be equipped with a supervisory switch.
  - 3. Valve supervisory switches shall be connected under this section and furnished, installed, and adjusted for proper operation by the sprinkler contractor.
- C. Serially Connected Annunciator, equal to NOTIFIER LCD-80
- 1. The annunciator shall communicate with the alarm control panel via a two wire RS – 485S (multi-drop) communications circuit.
  - 2. The annunciator shall require no more than four wires for operation. Annunciation shall include: intelligent addressable points, system software zones, control relays, and notification appliance circuits. The following operations shall also be provided:
- D. Door Holders

1. Door holders shall be furnished by the Hardware Contractor.
2. Door holders shall be connected and powered under this section but installed and adjusted by the hardware contractor.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Final device coordination shall be coordinated with the project architect and resident engineer.
- D. Manual pull station shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed 48 inches above the finished floor.
- E. Smoke detector(s) at the top of the elevator hoistway(s) shall be mounted on a U.L. 10-B self closing and self locking access door(s). Access door(s) shall be provided and installed by other divisions of the specifications.

#### 3.2 TEST

- A. The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72, Chapter 7.
- B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- C. Close each sprinkler system flow valve and verify proper supervisory alarm at the main control panel.
- D. Verify activation of all waterflow switches.
- E. Open initiating device circuits and verify that the trouble signal actuates.
- F. Open and short signaling line circuits and verify that the trouble signal actuates.
- G. Ground all circuits and verify response of trouble signals.
- H. Check installation, supervision, and operation of all intelligent smoke and heat detectors.



- I. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the main control panel and the correct activation of the control points.

3.3 FINAL INSPECTION

- A. At the final inspection, a factory trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4 INSTRUCTION

- A. Instruction shall be provided to the building operator as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The Contractor shall provide a written "Sequence of Operation" which shall be included in the Operations Manual and reviewed during the training period.

END OF SECTION 28 31 11

Section 32 13 16

**DECORATIVE CONCRETE PAVEMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Furnishing of services, labor, materials, transportation, tools and equipment necessary to perform the work indicated on the Drawings and specified herein as required to properly complete the work in this contract.
- B. This Section includes the following:
  - 1. Cement concrete pavement

Related Sections include the following: List below only products and construction that the reader might expect to find in this Section but are specified elsewhere.

- 2. 03 33 10 Landscape Site Concrete Walls
- 3. 12 93 00 Site Furnishings
- 4. 32 31 13 Chainlink Fences and Gates
- 5. 32 84 00 Landscape Irrigation
- 6. 32 93 16 Exterior Plants

**1.2 REFERENCES**

- A. Conform to the following codes and standards:
  - 1. American Institute (ACI)
  - 2. American Society" for Testing and Materials (ASTM): The specifications and standards hereinafter referred.
  - 3. Standard Specifications for Public Works Construction 2015

**1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

**1.4 SUBMITTALS**

- A. Product Data: Furnish manufacturer's product specifications and installation instructions for the following and for each type of product indicated.
  - 1. Integral color/ color admixture
  - 2. Form release agent
  - 3. Plastic dowel sleeves
  - 4. Curing agents
  - 5. Clear sealer
  - 6. Expansion joint filler material

7. Fiber reinforcement
  8. Joint sealant
  9. Finish retardant
- B. Products; Submit one-pound samples, clearly identified, for each component used to prepare each paving type, including but not limited to:
1. Aggregate
- C. Design Mixtures: Furnish certified reports of proposed mix design for each type of concrete installation. For each decorative cement concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Paving Mix Designs: Provide documentation for each paving type specified on Drawings that will enable Owner's Authorized Representative's to better match replaced concrete:
- E. Laboratory and Cement Test Reports: Submit six (6) copies of laboratory test reports for concrete materials and a certificate with each concrete mixer truck, stating mix design, PSI, rating, slump, water and cement quantity, cement/water ration, fine and coarse aggregate and color additives.
1. Cement:
    - a. Manufacturer and plant location.
    - b. Cement type, i.e. Type I, II, III, or V.
  2. Admixtures:
    - a. Manufacturer and plant location.
  3. Sand:
    - a. Source and Type.
  4. Aggregates:
    - a. Source and Type.
  5. Sign certification from a licensed structural engineer.
- F. Coordinate paragraph below with qualification requirements in Division 1 Section "Quality Control" and as supplemented in "Quality Assurance" Article.
- G. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
  2. Material Certificates: For the following materials, signed by manufacturers:

- a. Cementitious materials.
  - b. Steel reinforcement and reinforcement accessories.
  - c. Fiber reinforcement.
  - d. Admixtures.
  - e. Curing compounds.
  - f. Applied finish materials.
  - g. Bonding agent or epoxy adhesive.
  - h. Joint fillers.
3. Field quality-control test reports.
  4. Minutes of preinstallation conference.
  5. Delivery slips.
- H. Certification that Owner's Authorized Representative's sample panels have been reviewed and that materials and processes provided will achieve intended effects indicated on Owner's Authorized Representative's sample panel.
- I. Submittals for above items shall be made in one package. If submittals are judged incomplete or non-responsive to the directions of the Owner's Representative after three (3) submissions the Contractor shall be back charged for the Owner's Representatives costs to process additional Submittals.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative cement concrete pavement systems.
- B. Pre-Bid Conference: Prior to submitting bid, attend pre-bid conference with Owner's Authorized Representative to review Owner's Authorized Representative's production run quality samples of all specified concrete colors and finishes and to review requirements and artistic effect desired.
- C. Slip Resistance: Provide a finish surface slip resistance coefficient of friction equal or greater than 0.6 for flat surfaces and 0.8 for ramps, when tested in accordance with ASTM F 489.
- D. Ready-Mix-Concrete Producer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Producer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- E. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

## Palm Ave Transitional Housing

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- F. Source Limitations: Obtain decorative cement concrete pavement products and each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate through one source.
- G. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- H. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- I. Referee Panels: The Owner's Representative will provide production run quality samples of all specified concrete paving colors and finishes to be used as Referee Panels to judge the Field Mock-ups. The Owner's Representative will provide information and assist the Contractor on the mix design components used to achieve the Referee Panels.
- J. Mockups: Cast mockups of sections approximately 48-inches by 48-inches of decorative cement concrete pavement to demonstrate typical pattern, texture, surface finish, color, joints, and standard of workmanship.
  1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Owner's Representative. Include joints and joint materials, caulking, and scoring treatments specified on the plans.
  2. If multiple colors and finishes are specified, all samples shall be prepared for review at the same time.
  3. In presence of Owner's Representative, damage part of the exposed surface of decorative cement concrete pavement for each finish, color, and texture required, and demonstrate materials and techniques proposed for repair to match adjacent undamaged surfaces.
  4. The Mock-ups shall be reviewed and approved by the Owner's Representative before proceeding with the work. Mock-ups will be judged against the appearance of the Referee Panels. Mock-ups that do not match the Referee Panels and do not demonstrate all specified joints and joint materials, caulking, and scoring treatments will be rejected. Remove and reconstruct the mock-ups until approved. The Contractor shall be back-charged for the costs of the Owner's Representative to review more than two (2) mock-up attempts. Approved mock-ups shall serve as standard of acceptance for paving work and remain available for the duration of the project.
  5. Demolish and remove mock-ups at the completion of the project.
- K. Preinstallation Conference: Conduct conference at Project site.
  1. Before submitting design mixtures, review decorative cement concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and decorative cement concrete pavement construction practices. Require representatives of each entity directly concerned with decorative cement concrete pavement to attend, including the following:
    - a. Contractor's superintendent.

- b. Independent testing agency responsible for concrete design mixes.
  - c. Ready-mix concrete producer.
  - d. Decorative cement concrete pavement Installer.
2. Manufacturer's representative of decorative cement concrete pavement system.
- L. Formwork: Comply with Recommended Practice for Concrete Formwork, ACI 347.
- 1. Qualifications: Refer to Section 01400 Quality Requirements.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

1.7 DELIVERY AND HANDLING

- A. Conform to Section 01600 Product Requirements.
- B. Deliver, store, and handle reinforcement to prevent damage.

1.8 REGULATORY REQUIREMENTS

- A. Testing: Slump tests shall be taken to certify compliance with mix design. Slump shall be in accordance
- B. Mix design shall be in accordance with ACI 211-6.with ASTM C 143.
- C. Conform to applicable laws, codes, and regulations required by authorities having jurisdiction over the work.

1.9 SITE CONDITIONS

- A. Do not place concrete when subbase surface temperature is less than 40 degrees F, nor when surface is wet.

1.10 COORDINATION

- A. In accordance with Division 01.
- B. Ensure that irrigation sleeves, electrical conduit, food cart outlets, and other utility elements are accommodated and as-built located prior to pouring concrete.

1.11 INSPECTION OF SITE

- A. Verify conditions at site affect Work of this Section, and take field measurements as requires. Report major discrepancies between Drawings and field dimensions to Owner's Authorized Representative prior to commencing work.

**PART 2.0 - PRODUCTS**

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to

**DECORATIVE CONCRETE PAVING**

product selection:

- B. Products: Subject to compliance with requirements, provide one of the products specified.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 FORMS

- A. Form Materials: Either steel or wood, of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are free of distortion and defects.
- B. Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
  - 1. Use flexible or curved forms for curves of a radius 100 feet or less.
  - 2. Flexible spring steel forms, laminated boards, or bender boards to form radius bends as required.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.
  - 1. Form work to be new, #2 grade Douglas Fir, free of knots, checks, bows, and cracks.
  - 2. Form-Release Agent: A non-staining form release compound that will not discolor or de-face the surface of the concrete. Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

## 2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets. 6 x 6 x W4.0 x W4.0 conforming to ASTM A 185. Furnished in flat sheets, not rolls, unless otherwise accepted by the Owner's Representative.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
  - 1. Grade 40 or 60 billet steel conforming to ASTM A 626/615M. Bending process shall conform to the Manual of Standard Practice of the Concrete Reinforcing Steel Institute. Kinked bars shall not be used.
  - 2. Reinforcing Steel: Conforming to ASTM A 615, clean and free of rust, dirt, grease or oils.
- C. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- F. Plastic dowel alignment sleeves Products:

1. Speed Dowel or equal (no known equal).
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or pre-cast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
- H. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
- I. Polypropylene Fiber Reinforcement: 100% virgin multifilament polypropylene fibers, engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116 - Type III.
  1. Acceptable Manufacturers:
    - a. Fibermix®; Stealth® Fibers – 1/4” inch long (423)892-8080 or [www.fibermesh.com](http://www.fibermesh.com).
    - b. Forta Fiber; Microfiber (800)245-0306.
    - c. Grace Construction Products; Microfiber™ (800)433-0020 or [www.grace.com](http://www.grace.com).
    - d. Or Approved Equal.
  2. Application Rate: 1/2 lb./cy of mix.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source, throughout Project:
  1. Gray Portland Cement: ASTM C 150, Type II
- B. Refer to Drawings for specific paving finishes requiring different cement types, to include Type II cements (unless otherwise identified in the Drawings) conforming to ASTM C 150.
- C. Use same brand of cement from single source throughout entire Project for each paving type.
- D. Refer to Statement of Mix Design for cement type used.
- E. Fly Ash: ASTM C 618, Class F.
- F. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- G. Normal-Weight Aggregates: ASTM C 33, uniformly graded. Provide aggregates from a single source with satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.
- H. Maximum Aggregate Size: Refer to Drawings for maximum aggregate size. Coarse Aggregate: Aggregate composed of gravel, crushed rock, or a blended mixture conforming to Standard Specifications Section 200-1.4. Aggregates shall be washed clean, uniformly screen graded, and contain not more than 2% percent by weight of deleterious materials such as shale, schist, alkali, clay lumps, earth loam, mica, or similar materials.



## Palm Ave Transitional Housing

- I. Clean, hard, and durable coarse aggregate, conforming to ASTM C 33.
- J. Use same coarse aggregate from single source throughout entire Project.
- K. Refer to Statement of Mix Design for coarse aggregate type used.
- L. Aggregates shall be washed clean, uniformly screen graded, and contain not more than 2% percent by weight of deleterious materials such as shale, schist, alkali, clay lumps, earth loam, mica, or similar materials.
- M. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
  - 1. Sand shall consist of a natural or manufactured granular material, or combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Sand shall be washed and conform to Standard Specifications Section 200-1.5.3.
- N. Clean, hard, and durable washed concrete sand, conforming to ASTM C 33.
- O. Use same fine aggregate from single source throughout the entire Project.
- P. Refer to Statement of Mix Design for fine aggregate type used.
- Q. Sand shall be free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended.
- R. Base Material: Washed concrete sand, uniformly graded and meeting the requirements of Standard Specifications Section 200-2.2. At the time of spreading, the material shall have a moisture content sufficient to obtain the required compaction.
- S. Water: Potable and complying with ASTM C 94/C 94M. Free from deleterious materials such as oils, acids, and organic matter.
- T. Air-Entraining Admixture: ASTM C 260.
- U. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 3. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

### 2.5 ADMIXTURES

- A. Provide concrete admixtures that contain not more than 1 percent chloride ions and no calcium chloride.
- B. Water-Reducing Admixture: ASTM C 494, Type A.
- C. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
- D. Water-Reducing and Retarding Admixture: ASTM C 494, Type D or E.

E. Acceptable Manufacturers:

1. Water-Reducing Admixtures:
  - a. ChemMasters Corp; Chemtard.
  - b. Cormix Construction Chemicals: Type A Series.
  - c. Euclid Chemical Company; Eucon WR-75.
  - d. Or Approved Equal.
2. High-Range Water-reducing Admixtures:
  - a. Anti-Hydro Co. Inc.: super P.
  - b. Cormix Construction Chemicals: Cormix 2000, PSI Super.
  - c. Euclid Chemical Company; Eucon 37.
  - d. Or Approved Equal.
3. Water-Reducing and Acceleration Admixtures:
  - a. Conspec Marketing & Manufacturing Company; Q-Set.
  - b. Cormix Construction Chemicals; Gilco Accelerator or Lub NCR.
  - c. Euclid Chemical Company; Lithochrome Surface Retarder.
  - d. Or Approved Equal.

2.6 COLOR MATERIALS

- A. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, [free of carbon black, nonfading, and resistant to lime and other alkalis.
- B. Integral Color: Integrally color concrete in colors, blending mixtures and application rates necessary to create colors, gradations, and variations to match Owner's Authorized Representative's mock-up.
- C. Manufacturers:
  1. Davis Colors.
  2. Solomon Colors.
  3. Or Approved Equal.

2.7 CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M 182, Class 2.
- B. Moisture-Retaining Cover: One of the following complying with ASTM C 171:

1. Waterproofing paper.
  2. Polyethylene film.
  3. White burlap-polyethylene sheeting.
- C. Clear, Waterborne Membrane-Forming Curing Compounds:
1. Provide curing materials that have a maximum volatile organic compound (VOC) rating of 350 g/l.
- D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.
1. Clear, Waterborne Membrane-Forming Curing Compounds Acceptable Manufacturers:
    - a. Anti-Hydro Company; Clear Cure Water Base.
    - b. The Burke Company; Spartan Cote WB.
    - c. Cormix Construction Chemicals; Sealco VOC.
    - d. Or Approved Equal.
  2. Acceptable Evaporation Control Manufacturers:
    - a. Conspec Marketing and MFG. Company; Aquafilm.
    - b. Euclid Chemical Company; Eucobar.
    - c. L&M Construction Chemicals; E-Con.
    - d. Or Approved Equal.
- E. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, complying with ASTM C 171.
- F. Surface Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products:
    - a. Top Cast/Top Face by Grace Products
    - b. Rugasol
    - c. Or Approved e\Equal.
- G. Waterbased Clear siloxane or silane penetrating sealer. Acceptable products include, but not limited to:
- a. “Pentane”
  - b. “Weather Worker J-26 WB” or equal. (No known equal).
  - c. Or Approved Equal.

H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A, specifically manufactured for use with colored concrete.

1. Products:

- a. Anti-Hydro Company; Clear Cure Water Base
- b. The Burke Company; Spartan Cote WB
- c. Cormix Construction Chemicals; Sealco VOC
- d. Or Approved Equal.

## 2.8 JOINT MATERIALS

A. Expansion- and Isolation-Joint Materials: -Filler Strips: Pre-moulded material, 3/8" thick, depth as required by slab, of resilient, non-bituminous material, depth as required by slab.

## 2.9 RELATED MATERIALS

A. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

## 2.10 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 and ACI 318, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Mix design shall be the responsibility of the Contractor.
2. Contractor shall employ a Testing Laboratory approved by the Landscape Architect and Resident Engineer under the active direction of the Civil Engineer, who shall determine mix designs to fulfill the specified requirements for strength, aggregate size and workability of concrete, and such designs shall be used in proportioning all structural concrete.
3. Mix designs shall be submitted to the Landscape Architect and Resident Engineer for review at least 10 days prior to scheduled concrete pour.
4. Review by the Landscape Architect and Resident Engineer shall not be considered unqualified approval, and shall not relieve the Contractor of his responsibility to furnish concrete of proper consistency and specified strengths.
5. Provide concrete of the strengths indicated in the structural general notes
6. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): As indicated in the Drawings or 2500 psi.

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.61 Select slump limit from options in subparagraph below or revise to suit Project.
3. Slump Limit: 5 inches.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
  1. Air Content: 2 percent
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water reducing admixture and retarding admixture [and accelerating admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

## 2.11 PAVING TYPES

- A. Concrete Paving Type 1: See Materials Legend for finish and color
  1. Color Pigment: Add color pigment or colored water-reducing admixture to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- B. Concrete Paving Type 2: See Materials Legend for finish and color
  1. Color Pigment: Add color pigment or colored water-reducing admixture to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- C. Concrete Bands at Bike Racks and Bike Lockers- See Hardscape Legend for color and finish.

## 2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
  1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3.0 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the site and verify that no defects or errors are present that would cause defective installation or latent defects in the workmanship and function. Report unsatisfactory conditions to the Owner's Representative. Do not begin paving work until unsatisfactory conditions have been corrected and the area is ready to receive the work. Continuing with the installation constitutes acceptance of the unsatisfactory conditions and responsibility for satisfactory performance.
- B. Verify that paving subgrade consists of a minimum of 4-inches of compacted washed con-

- crete sand, passes less than 7% through a #200 sieve, and is compacted to at least 95% of the materials ASTM D 1557 maximum dry density for its full depth.
- C. Verify that paving subgrade extends 1-foot beyond the outside edge of paving or curbing and has positive outfall for trapped water.
  - D. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
  - E. Remove loose material from compacted subbase immediately before placing concrete.
  - F. Provide necessary chairs or supports, and maintain position of reinforcing bars.
  - G. Wet surface of sand subgrade prior to placing concrete.
  - H. Examine exposed subgrades and subbase surfaces for compliance with tolerances for dimensional, grading, and elevation tolerances.
  - I. Proof-roll prepared subbase surface with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
  - J. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
  - K. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - L. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/4 inch require correction according to requirements in Division 2 31
  - M. Proceed with decorative cement concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
  - N. Synthetic Fiber reinforcement; ½ lb. per cubic yard of mix added at batch plant.
  - O. Adjustment to Concrete Mixes: Mix design adjustments may be required by Contractor when characteristics of material, Project conditions, weather, test results, or other circumstances warrant.
  - P. Coordinate with other trades, placement of accessories, chases, and other embedded items. Provide sufficient time to complete installation of their work.

### 3.2 SURFACE PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.
- B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.
- C. Subgrade Preparation: Unless noted otherwise, subgrades shall be compacted to a relative density as specified in the soils report, and to elevations necessary to achieve the finished surface indicated. Semi-porous subgrades shall be sprinkled sufficiently with water to eliminate suction and extremely porous subgrades shall be sealed in an approved manner.

- D. **Base Preparation:** Where indicated, washed concrete sand or structural “CU soil base material shall be deposited at a uniform quantity that will provide the required compacted thickness within ¼” above or below the grade determined from the Drawings. The relative compaction of the base material shall not be less than specified in the soils report. Compacted areas that do not conform to the requirements specified, shall be reworked, watered, and thoroughly re-compacted to conform to the specified requirements.

### 3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Shall conform to the shape, lines, and dimensions as called for on the Drawings.
- B. Completed formwork shall be free of hardened concrete, washed clean and shall have excess water removed, reinforcement secured in place, expansion joint material and other embedded items positioned, forms shall be thoroughly cleaned, washed out with water, and made tight. Before reinforcing steel is placed on top of or adjacent to forms that have been sealed, the surface sealer shall be wiped off so that none may be tracked over, or in any way come in contact with the reinforcing steel. Bottoms of forms shall be cleaned and wet down before placing concrete.
- C. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- D. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage
- E. Check completed formwork and screeds for grade and alignment to following tolerances:
  - 1. Top of Forms: Not more than 1/8-inch in 10-feet.
  - 2. Vertical Face on Longitudinal Axis: Not more than ¼-inch in 10-feet.
  - 3. Joints and Corners: Construct forms such that joints occur at approved locations. Form intersecting planes to provide true, crisp corner with no edge grain of forms exposed to the face of the concrete. Construct exposed corners to produce smooth, solid, unbroken lines.

### 3.4 STEEL REINFORCEMENT

- A. **General:** Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Sized and placed where indicated on the Drawings.
- C. The complete work shall be in place and approved a minimum of one (1) working day prior to placing of concrete.
- D. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- E. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- F. **Wire Mesh:** Panels shall be spliced not less than two (2) mesh openings, and shall be in placed on (1) working day prior to placing concrete. While the concrete is still plastic, the

- mesh shall be carefully lifted into position as specified on the Drawings.
- G. Install welded wire reinforcement in lengths as long as practicable. Flat sheets, not rolls unless otherwise accepted by Owner's Representative. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
  - H. Reinforcing Bars: Bars shall be placed in accordance with the size and spacing shown on the Drawings. The bars shall be firmly and securely wired together and held in place with concrete or metal chairs. The complete work shall be in place and approved a minimum of one (1) working day prior to placing of concrete.
  - I. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a 2-inch overlap to adjacent mats.
  - J. Dowel: Speed Dowels, or equal (no known equal). Before reinforcing steel is placed on top of or adjacent to forms that have been sealed, the surface sealer shall be wiped off so that none may be tracked over, or in any way come in contact with the reinforcing steel. Bottoms of forms shall be cleaned and wet down before placing concrete.

### 3.5 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
  - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
  - 2. Locate as indicated on the Drawings.
- B. Construction Joints or Expansion Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
  - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  - 2. Provide tie bars at sides of pavement strips where indicated.
  - 3. Dowels: Provide steel dowels across construction joints to reduce differential movement across the joint. Utilize steel dowels based upon the following:
    - a. 6-inch Thick Pavement:
      - Diameter: ½-inch.
      - Length: 24-inch.
      - On-center Spacing: Per reinforcing schedule.
    - b. 4-inch Thick Pavement:



Diameter: ½-inch.

Length: 24-inch.

On-center Spacing: Per reinforcing schedule.

4. To assist in correct alignment of steel dowels along construction joints use Speed Dowel™ plastic dowel alignment sleeves:
  - a. Insure that wood edge forms are true to line and grade prior to installing plastic dowel alignment sleeves.
  - b. Install plastic dowel sleeves on wood forms at the specified on-center dowel spacing, centered between top and bottom of wood form.
- C. Expansion/ Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
  1. Expansion material shall be placed at the appropriate elevation to achieve the depth of the sealant indicated on the Drawings. The top of the finished sealant shall be between 1/8” and 1/4” below the finished surface.
  2. Locate expansion joints at intervals as indicated on drawings, unless otherwise indicated.
  3. Extend joint fillers full width and depth of joint.
  4. Terminate joint filler, as indicated on drawings, below finished surface if joint sealant is indicated.
  5. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  6. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints or Scorelines: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows as indicated in the Drawings.
  1. Saw-cut Scorelines: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
  2. Provide machine-sawn Contraction joints as soon as concrete has sufficient strength to support sawing equipment.
  3. Joints shall meet the size and depth indicated on the drawings. Joints shall be true to lines and shapes shown on the Drawings and not vary from true. Grooves shall be

smooth and uniform.

4. The completed groove at the finished surface shall not vary more than 1/32" inch of the width indicated.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

### 3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- D. Do not add water to concrete during delivery or at Project site.
- E. Do not add water to fresh concrete after testing.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
  1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Screed pavement surfaces with a straightedge and strike off.
- I. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- J. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- K. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by low temperatures.
  1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

- L. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
  - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  - 3. Fog spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.
- M. At the end of a work day, or when more than two hours may elapse between concrete pours, installation shall terminate at an expansion joint or other transition as shown on the Drawings.
- N. Removal of Forms: The supporting forms shall not be disturbed until the concrete has hardened sufficiently to permit their removal with safety.

### 3.7 CONCRETE FINISHING

- A. General: Paving finishes to match approved mock-up finishes.
- B. After placing concrete, tamp with heavy grille tamper until at least 3/8" of mortar has been brought to the surface, as soon as the surface becomes workable, push down all coarse aggregate, filling all holes and leveling surface to a true and even surface.
- C. Sand Finish or Buff Wash Finish:
- D. Finish paving to match approved mock-up and have a uniform color and texture over the entire area.
  - 1. Surfaces shall be free of ruts, grooves, dimples.
  - 2. Edges shall be crisp and true to lines, and have finishes consistent with the field area. Float surfaces to required surfaces and planes. Finish to etch surface so that fines are exposed (no aggregate exposed.)
  - 3. Ensure that paving surfaces receiving the finish are hand-troweled before final concrete set.
  - 4. Match approved paving sample. It is recommended that a 2-foot x 2-foot test sample be poured from the same field mix and finished as same for each finish specified.
  - 5. Sand Wash Finishes:
    - a. Light:
      - i. Approximately 1/32 to 3/32-inches deep.
      - ii. Light finish paving to match approved mock-up.
      - iii. Thoroughly clean field pour and allow to dry.

- iv. Check for “hard spots”.
- v. Follow steps as outlined above for a light finish.

**E. Exposed Aggregate:**

1. Exposed aggregate finish paving to match approved mock-up and have a uniform color and texture over the entire area.
2. Surfaces shall be free of ruts, grooves, dimples.
3. Edges shall be crisp and true to lines, and have finishes consistent with the field area. Float surfaces to required surfaces and planes. Finish to etch surface so that fines are exposed (no aggregate exposed.)
4. Immediately after concrete has been screeded and darbied, apply specified surface aggregate (if specified in the Drawings), evenly over entire surface, allowing no voids in coverage.
5. After seeding aggregate (if specified in the Drawings), embed the aggregate by hand-floating, so that top of aggregate is just below the surface.
6. As soon as the concrete has achieved a firm set, begin simultaneously brushing and hosing the surface with water so as to achieve a clean, uniform surface with no aggregate exposed more than 1/8-inch.
7. Do not dislodge or unevenly expose the surface so as to take on a “bald” spot appearance. Doing so may lead to paving rejection.

**3.8 FLOAT FINISHING**

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Edge forms and intermediate screed strips shall be set accurately to produce the elevations and contours in the finished surface.
- C. After placing concrete, tamp with heavy grille tamper until at least 3/8" inch of mortar has been brought to the surface, as soon as the surface becomes workable, push down all coarse aggregate, filling all holes and leveling surface to a true and even surface.
- D. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
- E. Washed Aggregate Finish: Finished surface shall match the approved mock-up panel in color and texture. Surfaces shall be free of ruts, grooves, dimples and have a uniform distribution of exposed coarse and fine aggregate over the entire surface area. Edges shall be crisp and true to lines, and have a finish consistent with the field area.

**3.9 CONCRETE PROTECTION AND CURING**

- A. Protect freshly placed concrete from premature drying and excessive cold or hot tempera-

- tures. Comply with the recommendations of ACI 305R for hot weather and ACI 306R for cold weather protection during curing.
- B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
  - C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
  - D. Curing Methods: Cure concrete by moisture curing, moisture retaining cover, curing compound, or combination of following:
    - 1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with following materials:
      - a. Water.
      - b. Continuous water fog spray.
      - c. Absorptive cover, water saturated, kept continuously wet.
    - 2. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.
    - 3. Curing Compound:
      - a. Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions.
      - b. Recoat areas subjected to heavy rainfall within three hours of initial application.
      - c. Maintain continuity of coating and repair damage during curing period.
  - E. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  - F. Comply with ACI 306.1 for cold-weather protection.
  - G. Protection and Curing: Provide and apply a sheet curing material that conforms to ASTM C 171, Standard Specifications for Sheet Material Curing Concrete. Protect concrete from defacement. All defaced concrete shall be replaced between expansion joints at no additional expense to the Owner.
  - H. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching **0.2 lb/sq. ft. x h** before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
  - I. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
  - J. Curing Compound: Apply curing compound immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after

- application. Maintain continuity of coating and repair damage during curing period.
1. Cure integrally colored concrete with a pigmented curing compound.
  2. Cure concrete finished with pigmented mineral dry-shake hardener with a pigmented curing compound.
- K. Sealers: Prepare the finished surface and apply the penetrating sealer as recommended by the manufacturer.
- L. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
- M. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over pavement edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

### 3.10 SEALER

- A. Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90-degrees to the direction of the first coat using same application methods and rates.
1. Begin sealing dry surface no sooner than 14 days after concrete placement or per the manufacturer's recommendations.
  2. Allow stained concrete surfaces to dry before applying sealer.

### 3.11 MIX SLIP-RESISTANT ADDITIVE THOROUGHLY IN SEALER BEFORE APPLICATION ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS. STIR SEALER OCCASIONALLY DURING APPLICATION TO JOINT SEALANT

- A. Prior to applying the sealant, the joints shall be cleaned of all mortar, laitance, scale, dirt, dust, oil, curing compound, and other foreign materials. The joints and adjacent surfaces shall be dry and where called for by the manufacturer, prepared with a primer. The joints shall be filled from bottom to top without voids. All adjoining surfaces shall be protected during the sealing operations and any stains, marks, or damage resulting from the sealant operations shall be corrected.

### 3.12 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
  2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
  4. Lateral Alignment and Spacing of Dowels: 1 inch.

5. Vertical Alignment of Dowels: 1/4 inch.
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
7. Joint Spacing: 3 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

### 3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
- C. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
  1. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- D. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
- E. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
- F. Concrete Temperature: ASTM C 1064/C 1064M; 1 test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and 1 test for each composite sample.
- G. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
- H. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days for information and 2 specimens at 28 days.
  1. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- I. Strength of each concrete mix will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- J. Test results shall be reported in writing to Owner's Representative, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of

- break for both 7- and 28-day tests.
- K. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner's Representative but will not be used as sole basis for approval or rejection of concrete.
  - L. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Owner's Representative.
  - M. Remove and replace decorative cement concrete pavement where test results indicate that it does not comply with specified requirements.
  - N. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.14 REPAIRS AND PROTECTION

- A. Remove and replace decorative cement concrete pavement that is broken, damaged, or does not comply with requirements in this Section in complete sections from joint to joint, unless otherwise approved by Owner's Representative.
- B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain decorative cement concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep decorative cement concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION



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SECTION 32 31 13

CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Section Includes:

1. Chain-link fences.
2. Gates: swing.

B. Related Sections:

1. 03 33 10 Landscape Site Concrete Walls
2. 12 93 00 Site Furnishings
3. 32 13 16 Decorative Concrete Paving
4. 32 31 13 Chainlink Fences and Gates
5. 32 84 00 Landscape Irrigation
6. 32 93 16 Exterior Plants

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7:

1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet .
2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
  - a. Fence Height: See Hardscape Legend.
  - b. Material Group: See Hardscape Legend.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Fence and gate posts, rails, and fittings.
2. Chain-link fabric, reinforcements, and attachments.
3. Gates and hardware.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Samples for Initial Selection: For components with factory-applied color finishes.
- D. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer or factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
  - 1. Gate hardware.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding. Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- C. Mockups: Build mockups to set quality standards for fabrication and installation.
  - 1. Include 10-foot length of fence and gate; may be included as part of final product.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: Twelve years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
  - 1. Fabric Height: As indicated on Drawings.
  - 2. Steel Wire Fabric: 11 gauge.
    - a. Mesh Size: 1" inches.
    - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before weaving.
    - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
  - 3. Selvage: Knuckled at both selvages.

### 2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
  - 1. Fence Height: As indicated on Drawings.
  - 2. Full Weight Pipe: Material round steel pipe.
    - a. Line Post: 2-3/8" O.D. Full Weight Pipe.
    - b. End, Corner and Pull Post: 4.0 inches .
  - 3. Horizontal Framework Members: Top and bottom rails complying with ASTM F 1043.
    - a. Top Rail: 1-5/8" O.D. Full Weight Pipe.
  - 4. Brace Rails: Comply with ASTM F 1043.

- a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating per ASTM A 653/A 653M.
- b. Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
- c. External, Type B, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
- d. Type C, Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
- e. Coatings: Any coating above.

### 2.3 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824, with the following metallic coating:
  1. Type II, zinc coated (galvanized) by hot-dip process, with the following minimum coating weight:
    - a. Matching chain-link fabric coating weight.

### 2.4 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and [single][double] swing gate types.
  1. Gate Leaf Width: As indicated on the drawings.
  1. Gate Fabric Height: As indicated on the drawings.
- B. Pipe and Tubing:
  1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
  2. Gate Posts: Round tubular steel
  3. Gate Frames and Bracing: Round tubular steel
- C. Frame Corner Construction: assembled with corner fittings.
- D. Hardware:
  1. Hinges: 360-degree inward and outward swing.
  2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
  3. Lock: Per owner's required lock.
  4. Closer: Manufacturer's standard.

### 2.5 FITTINGS

- A. General: Comply with ASTM F 626.

- B. Post Caps: Provide for each post.
  - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
  - 1. Top Rail Sleeves: Pressed-steel not less than 6 inches long.
  - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
  - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
    - a. Hot-Dip Galvanized Steel: galvanized coating thickness matching coating thickness of chain-link fence fabric.
- I. Finish:
  - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

## 2.6 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended in writing by manufacturer, for exterior applications.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a verified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  - 1. Do not begin installation before final grading is completed unless otherwise permitted by Owner's Representative.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 PREPARATION**

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

**3.3 INSTALLATION, GENERAL**

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
  - 1. Install fencing on established boundary lines inside property line.

**3.4 CHAIN-LINK FENCE INSTALLATION**

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    - b. Concealed Concrete: Top 2 inches below grade [as indicated on Drawings] to allow covering with surface material.
    - c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
    - d. Posts Set into Voids in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with

anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at per landscape plan o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
  - 1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
  - 1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
  - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.



- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

### 3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

### 3.6 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION

**SECTION 32 31 19.53 - DECORATIVE METAL SECURITY FENCES AND GATES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Decorative metallic-coated-steel security fences.
2. Swing gates.
3. Horizontal-slide gates.
4. Gate operators, including controls.

B. Related Requirements:

1. Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls and post concrete fill.

**1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

- B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details.
2. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
3. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For gate operators to include in maintenance manuals.

DECORATIVE METAL SECURITY FENCES  
AND GATES

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## PART 2 - PRODUCTS

### 2.1 DECORATIVE METALLIC-COATED-STEEL SECURITY FENCES

- A. Decorative Metallic-Coated-Steel Security Fences:
1. Manufacturers: Subject to compliance with requirements, provide Ameristar Fence Products Montage Plus Steel Ornamental Fence System, Majestic style, three rail and Ameristar Fence Products PassPort II Gate Steel Roll Gate System Industrial Ornamental; design series Majestic Style, three rail or equal products by the following: :
    - a. BetaFence USA LLC.
    - b. Builders Fence Company, Inc.
    - c. Master Halco.
    - d. Xcel Fence.
    - e. Or approved equal.
- B. Fence system rails shall be 1 1/2" x 1 1/2", 14 ga steel with 3/4" square 18 ga pickets centered 4.675" o.c. Fence posts shall be designed for 6' high fence and minimum 2 1/2" x 2 1/2" x 16 ga. Gate posts shall be 6' tall and a minimum of 3"x3" x12 ga. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft<sup>2</sup> (184 g/m<sup>2</sup>), Coating Designation G-60.
- C. Roll Gate System rails shall include ornamental picket material 1" square x 14 Ga. Tubing. Picket spacing shall be 4-3/4". Material for top rails, uprights and diagonals rails shall be 2" square x 12 Ga. Material for the bottom rail shall be 2" x 4" x 11 Ga. Posts shall be a minimum of 4" square x 11 Ga. Steel material for roll gate components (i.e. pickets, rails, diagonals and uprights), shall be commercial steel with a minimum yield strength of 45,000 psi (344 MPa).
- D. Finish: Powder coating, color black.

### 2.2 SWING GATES

- A. Gate Configuration: Single leaf.
- B. Gate Frame Height: 72 inches.
- C. Gate Opening Width: 36 inches.
- D. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
  2. Material: Malleable iron; galvanized.
- E. Mortise Locks: BHMA A156.13, Grade 1, suitable for exterior use.
1. Function: F09 - Apartment, exit, or public toilet lock.

DECORATIVE METAL SECURITY FENCES  
AND GATES

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2. Material: Brass or bronze.
  3. Levers: Cast, forged, or extruded brass or bronze.
  4. Mounting Box: Configuration necessary to enclose locks. Fabricate from 1/8-inch- thick, steel plate; galvanized.
- F. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail-safe, and suitable for exterior use. Provide card reader and remote door release.
1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- thick, steel plate; galvanized.
  2. Mounting: Mortise into post.

### **2.3 HORIZONTAL-SLIDE GATES**

- A. Gate Configuration: Single leaf.
1. Type: Cantilever slide, with external roller assemblies.
- B. Gate Frame Height: 72 inches.
- C. Gate Opening Width: As indicated.
- D. Infill: Comply with requirements for adjacent fence.
- E. Hardware: Latches permitting operation from both sides of gate, roller assemblies
- 1.

### **2.4 GATE OPERATORS**

- A. Gate Operators:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Door King 9150 Commercial Slide Gate Operator with 1 hp continuous duty motor or comparable product by one of the following:
    - a. Amazing Gates of America LLC.
    - b. AutoGate, Inc.
    - c. Byan Systems, Inc.
    - d. CAME Americas Automation LLC.
    - e. Chamberlain Group, Inc. (The).
    - f. Eagle Access Control Systems, Inc.
    - g. HySecurity.
    - h. Tymetal Corp.
    - i. US Automatic Inc.
    - j. Or approved equal.

- B. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
  - 1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
  - 2. Provide operator with UL-approved components.
  - 3. Provide electronic components with built-in troubleshooting diagnostic feature.
  - 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.
- C. Comply with NFPA 70.
- D. UL Standard: Manufacturer and label gate operators to comply with UL 325.
- E. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with enclosure for mounting, and with space for additional optional equipment. Provide the following remote-control device(s):
  - 1. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
    - a. Transmitters: Single-button operated, with open function.
    - b. Channel Settings: Two independent channel settings controlling separate receivers for operating more than one gate from each transmitter.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.
- B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

### 3.3 DECORATIVE SECURITY FENCE INSTALLATION

- A. Install fences according to manufacturer's written instructions.
- B. Install fences by setting posts as indicated and fastening rails and infill panels to posts. Peen threads of bolts after assembly to prevent removal.
- C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.
- D. Post Setting: Set posts in concrete and with mechanical anchors at indicated spacing into firm, undisturbed soil or to the existing concrete retaining wall.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.
  - 3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
  - 4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
    - a. Extend posts at least 5 inches into sleeve.
    - b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
  - 5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch larger than outside diagonal dimension of post.
    - a. Extend posts at least 5 inches into concrete.
    - b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.

**3.4 GATE INSTALLATION**

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

**3.5 GATE OPERATOR INSTALLATION**

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Pedestals: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.
- C. Concrete Bases: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

**3.6 ADJUSTING**

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.
  - 1. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lubricate hardware, gate operators, and other moving parts.

**END OF SECTION 32 31 19.53**

DECORATIVE METAL SECURITY FENCES  
AND GATES

**32 31 19.53 - 6**

SECTION 32 84 00 –  
LANDSCAPE IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.
- B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.
- C. RELATED WORK SPECIFIED ELSEWHERE
  - 1. 03 33 10 Landscape Site Concrete Walls
  - 2. 12 93 00 Site Furnishings
  - 3. 32 13 16 Decorative Concrete Paving
  - 4. 32 31 13 Chainlink Fences and Gates
  - 5. 32 93 16 Exterior Plants

1.2 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Owner's Representative shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Owner's Representative as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.3 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.



- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnish directions covering points not shown in the drawings and specifications.
- C. All local, municipal, and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to Owner.
- E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

#### 1.4 SUBMITTALS

- A. Submittals Materials List:
  - 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.
  - 2. The submittals materials list shall include the following information:
    - a. A title sheet with the job name, the contractor's name, contractor's address and telephone number, submittal date and submittal number.
    - b. An index sheet showing the item number (i.e. 1,2,3, etc.); an item description (i.e. sprinkler head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
    - c. The catalog cuts shall be one or two pages copied from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
    - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
    - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
  - 3. Submittal materials list format requirements:
    - a. Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
    - b. Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing. Submittals shall not have tabs, tab sheets, spiral binding, or any other type of binding that will interfere with automated copying of submittals.
    - c. Submittal package shall have all pages numbered in the lower right-hand corner. Page numbers shall correspond with submittal index.

- d. Re-submitted packages must be revised to include only the equipment being re-submitted. Equipment previously reviewed and accepted shall not be re-submitted in the materials list/index sheet or in the catalog cut sheet package.
- B. Substitutions: If the Irrigation Contractor wishes to substitute any equipment or materials for those equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect or Owner's authorized representative for approval.
  1. Provide a written statement indicating the reason for making the substitution.
  2. Provide catalog cut sheets, technical data, and performance information for each substitute item.
  3. Provide in writing the difference in installed price if the item is accepted.
- C. The Landscape Architect or Owner's authorized representative will allow no substitutions without prior written acceptance.
- D. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- E. The Landscape Architect or Owner's authorized representative will not review the submittal package unless provided in the format described above.

#### 1.5 EXISTING CONDITIONS

- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and telephone line connection to the irrigation system.
- B. Irrigation design is based on the available static water pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.
- C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground, and shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect and Owner who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.
- E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans prior to paving operations.
- F. The Contractor shall verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.

- G. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.
- H. Contractor shall notify Owner's Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- I. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Owner's Representative.
- J. The contractor shall provide bore holes under any existing pavement or paving encountered for the required lateral, mainline and low voltage control wire sleeving. Bore holes under 2 inches in diameter and smaller shall be made with a BulletMole® underground boring tool as manufactured by Dimension Tools, LLC (Contact telephone number (888)-650-5554 or at [www.bulletmole.com](http://www.bulletmole.com)) or Approved Equal. Bore holes larger than 2 inches in diameter shall be made with an approved mechanical boring tool. No air jacking or hydraulic boring of any kind shall be allowed.

## 1.6 INSPECTIONS

- A. The Contractor shall permit the Landscape Architect and Owner's authorized representative to visit and inspect at all times any part of the work and shall provide safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Contractor's expense.
- C. Inspections will be required for the following at a minimum:
  - 1. Pre-construction meeting.
  - 2. System layout.
  - 3. Pressure test of irrigation mainline (Four hours at 125 PSI or 120% of static water pressure, whichever is greater.) Mainline pressure loss during test shall not exceed 2 PSI.
  - 4. Coverage test of irrigation system. Test shall be performed prior to any planting.
  - 5. Final inspection prior to start of maintenance period.
  - 6. Final acceptance prior to turnover.
- D. Site observations and testing will not commence without the field record drawings as prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.
- E. Work that fails testing and is not accepted will be retested. Hourly rates and expenses of the Landscape Architect, Owner's authorized representative, and governing agencies for re-inspection or retesting will be paid by the Irrigation Contractor at no additional expense to Owner.

## 1.7 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner and at no additional cost to the Owner.
- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

## 1.8 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Owner's authorized representative.
- B. At the time of completion, the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

## 1.9 TURNOVER ITEMS

- A. Record Drawings:
  - 1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below.
  - 2. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.
  - 3. All record drawings shall be prepared using AutoCAD 2014 drafting software and the original irrigation drawings as a base. No manual drafted record drawings shall be acceptable. The Contractor may obtain digital base files from the Landscape Architect or Owner's authorized representative.
  - 4. If the Contractor is unable to provide the AutoCAD drafting necessary for the record drawings the irrigation designer does provide record drawing drafting as a separate service.
  - 5. Prior to final inspection of work, submit record drawings plotted onto vellum sheets for review by the Landscape Architect or Owner's authorized representative. After acceptance by the Landscape Architect, City Inspector or Owner's authorized representative re-plot the record drawings onto reproducible Mylar sheets. The Contractor shall also provide record drawing information on a digital AutoCAD Release 2014 drawing file. All digital files shall be provided on a compact disc (CD) clearly marked with the project name, file descriptions and date.
    - a. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
    - b. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with

no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.

6. Show locations and depths of the following items:
    - a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.)
    - b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing)
    - c. Isolation valves
    - d. Automatic remote-control valves (indicate station number and size)
    - e. Quick coupling valves
    - f. Drip air relief and flush valves
    - g. Routing of control wires where separate from irrigation mainline
    - h. Irrigation controllers (indicate controller number and station count)
    - i. Related equipment (as may be directed)
- B. Controller Charts:
1. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of six individual colors shall be used for the controller chart unless less than six control valves are indicated.
  2. Landscape Architect or Owner's authorized representative must approve record drawings before controller charts are prepared.
  3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
  4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.
- C. Operation and Maintenance Manuals:
1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
  2. Each complete, bound manual shall include the following information:
  3. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
    - a. Operating and maintenance instructions for all equipment.
    - b. Spare parts lists and related manufacturer information for all equipment.
- D. Equipment:
1. Supply as a part of this contract the following items:
    - a. Two (2) wrenches for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
    - b. Three 30-inch sprinkler keys for manual operation of control valves.
    - c. Two keys for each automatic controller.
    - d. Two quick coupler keys with a 3/4" bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
    - e. One valve box cover key or wrench.

- f. Six extra sprinkler heads of each size and type.
  - g. For specified ball valves if required: One (1) 5-foot long valve handle, to fit the specified ball valves.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

#### 1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. Punch list to be checked off by contractor and submitted to Landscape Architect or Owner's Authorized representative prior to any follow-up meeting. This checked off list to indicate that all punch list items have been completed. At the time of the post-maintenance period or final inspection the work will be re-inspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.
- B. The Owner's authorized representative shall have final authority on all portions of the work.
- C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.
- D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired to the Owner's satisfaction by the Contractor without any additional expense to the Owner. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

#### 1.11 GUARANTEE

- A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.
- B. Should any problem with the irrigation system be discovered within the guarantee period, said problem shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs as determined by the Owner constitute an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvement resulting either from faulty materials or workmanship, or from the necessary repairs to correct same, shall be repaired to the satisfaction of the Owner by the Contractor, all at no additional cost to the Owner.
- C. Guarantee shall be submitted on Contractors own letterhead as follows:

#### GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of

Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of our failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE

SIGNED:

DATE:

### 1.13 COMMISSIONING

- A. Commissioning requires the participation of Division 32 landscape irrigation contractor to work to ensure that all systems are operating in a manner consistent with the construction documents and the design intent. The general commissioning requirements and coordination are detailed in Division 32. This Division shall be familiar with all parts of Division 32 and the commissioning plan issued by the Commissioning Authority and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
- B. The irrigation contractor is responsible for assisting the commissioning agent throughout the entire commissioning process on the work under their section. The work is not complete until the commissioning agent and the Owner has signed off on the commissioned systems.

## PART 2 - MATERIALS

### 2.1 SUMMARY

- A. Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

### 2.2 PIPE

- A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.
- B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device, unless otherwise directed.

- C. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.
- D. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote-control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

### 2.3 METAL PIPE AND FITTINGS

- A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.
- B. Fittings shall be medium brass, screwed 125-pound class.
- C. Copper pipe and fittings shall be Type "K" sweat soldered, or brazed as indicated on the drawings.

### 2.4 PLASTIC PIPE AND FITTINGS

- A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.
- B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.
- C. All solvent weld PVC fittings shall be standard weight Schedule 40 (and Schedule 80 where specified on the irrigation detail sheet, all mainline fittings shall be Schedule 80 PVC) and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.
- D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.
- E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.
- G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.



## 2.5 BACKFLOW PREVENTION UNITS

- A. The backflow prevention unit shall be of the manufacturer, size, and type indicated on the drawings.
- B. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.
- C. The backflow enclosure shall be of the manufacturer, size, and type indicated on the drawings.

## 2.6 VALVES

- A. Ball Valves:
  - 1. Ball valves shall be constructed of a bronze body, stainless steel ball, stem and stainless-steel handle. Ball valves shall have threaded connections. Ball valves with stainless steel handles shall be Wilkins 850XL-SB or equal.
  - 2. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.
  - 3. Use ball valves at point of connection, mainline change of direction and at manifolds.
- B. Quick Coupler Valves:
  - 1. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
  - 2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have 1" female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve.
- C. Automatic Control Valves:
  - 1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
  - 2. Automatic control valves shall be electrically operated.
  - 3. Provide Christy's valve ID tags for each remote-control valve with valve number.
- D. Drip Valve with Pressure Regulator and Filter Assembly
  - 1. Drip Valve with Pressure Regulator and Filter Assembly shall be of the manufacturer, size, and type indicated on the drawings.

## 2.7 VALVE BOXES

- A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils as manufactured by CARSON (Specification Grade).
- B. The valve box cover shall be green (in lawn area) and tan (in mulched planting area) in color and secured with a hidden latch mechanism or bolts.
- C. The cover and box shall be capable of sustaining a load of 1,500 pounds.

- D. Valve box extensions shall be by the same manufacturer as the valve box.
- E. The plastic irrigation valve box cover shall be an overlapping type.
- F. Automatic control valve, master valve, flow sensor, and gate/ball valve boxes shall be CARSON 1419 specification grade rectangular box. Valve box covers shall be marked "RCV" with the valve identification number, or "MV", "FS", "GV", "BV" "heat branded" onto the cover in 1-1/4 inch high letters / numbers.
- G. Drip valve boxes shall CARSON 1220 specification grade jumbo rectangular box. Valve box covers shall be marked "RCV" with the valve identification number, onto the cover in 1-1/4 inch high letters / numbers.
- H. Drip flush valve and Air relief valve boxes shall be CARSON 809 specification grade 7" circular box. Valve box covers shall be marked with "FV" or "ARV" "heat branded" onto the cover in 1-1/4 inch high letters.
- I. Quick coupler valve boxes shall be CARSON 910 specification grade 10" circular box. Valve box covers shall be marked with "QCV" "heat branded" onto the cover in 1-1/4 inch high letters.

## 2.8 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.
- B. Controller enclosure shall be of the manufacturer, size, and type indicated on the drawings.
- C. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

## 2.9 ELECTRICAL

- A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.
- B. All electrical work shall conform to local codes and ordinances.

## 2.10 LOW VOLTAGE CONTROL WIRING

- A. Remote control wire shall be direct-burial AWG-UF type, size as indicated on the drawings, and in no case smaller than 14 gauge.
- B. Remote control wire shall be 14 AWG solid core twisted pair, type as indicated on the irrigation drawings.
- C. Connections shall of the manufacturer, size, and type indicated on the drawings.
- D. Common wires shall be white in color. Control wires shall be red (where two or more controllers are used, the control wires shall be a different color for each controller. These colors shall be noted on the "Record Drawings" plans located on controller door).
- E. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

## 2.11 IRRIGATION HEADS AND DRIP EMITTERS AND INLINE DRIP TUBING

- A. Irrigation heads, drip emitters and inline drip tubing shall be of the manufacturer, size, type, with radius of throw, operating pressure, and discharge rate indicated on the drawings.
- B. Irrigation heads, drip emitters and inline drip tubing shall be used as indicated on the drawings.

## 2.12 DRIP IRRIGATION EQUIPMENT

- A. Drip tubing equipment such as flush valves, air relief valves, wye strainers and pressure regulators shall be of the manufacturer, size, and type indicated on the drawings.

## 2.13 MISCELLANEOUS EQUIPMENT

- A. Landscape Fabric:
  - 1. Landscape fabric for valve box assemblies shall be 5.0- oz. weight woven polypropylene weed barrier. Landscape fabric shall have a burst strength of 225 PSI, a puncture strength of 60 lbs. and capable of water flow of 12 gallons per minute per square foot.
  - 2. Type: DeWitt Pro 5 Weed Barrier or approved equal.
- B. Equipment such as flow sensors, rain sensors, freeze sensors, flush valves, air relief valves, wye strainers, and master valves shall be of the manufacturer, size and type indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 SITE CONDITIONS

- A. Inspections:
  - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
  - 2. Verify that irrigation system may be installed in strict accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.
- B. Discrepancies:
  - 1. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
  - 2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.
- C. Grades:
  - 1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
  - 2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.
- D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
  2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
  3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities, which are caused by his operations or neglect.
- E. Diagrammatic Intent:
1. The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in equipment locations as necessary to conform with structures and to avoid obstructions or conflicts with other work at no additional expense to Owner.
- F. Layout:
1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventer, and automatic controller.
  2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.
- G. Water Supply:
1. Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
- H. Electrical Service:
1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made at no additional expense to Owner.
  2. Contractor shall make electrical connections to the irrigation controller. Electrical power source to controller locations shall be provided by others.
  3. Contractor shall make electrical connections to the irrigation controller. 230-volt single-phase electrical power source to pump assembly location shall be provided by others per NEC codes.

### 3.2 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Provide minimum cover of 18 inches on pressure supply lines 2 ½ inches and smaller.
- C. Provide minimum cover of 24 inches on pressure supply lines 3 inches and larger.
- D. Provide minimum cover of 18 inches for control wires within planters.
- E. Provide minimum cover of 24 inches for control wires within sleeves below paving.
- F. Provide minimum cover of 36 inches on pressure supply lines under vehicular travel ways.

- G. Provide minimum cover of 12 inches for non-pressure lines.
- H. Pipes installed in a common trench shall have a 4-inch minimum space between pipes.

### 3.3 THRUST BLOCKS

- A. Thrust blocks must be constructed of Class “B” concrete.
- B. Thrust blocks shall be poured against undisturbed site soil.
- C. PVC fitting joints shall be kept free of concrete. Do not encase fitting in concrete.
- D. Thrust blocking shall be sized to provide the minimum bearing areas as shown below. Bearing areas indicated have been calculated for Class 200 PVC pipe at a test pressure of 150 PSI in soil with 2,000 PSI bearing capacity. Increase thrust block sizing as necessary for varying soil conditions.
  - 1. Provide a minimum thrust block bearing area of 2.0 square feet on all bends (all degrees) and tees installed on pressure supply lines 4 inches and smaller.

### 3.4 BACKFILLING

- A. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 inches in diameter.
- B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.
- C. Flooding in lieu of tamping is not allowed.
- D. Under no circumstances shall truck wheels be used to compact backfill.
- E. Provide sand backfill a minimum of 4 inches over and under all piping under paved areas.

### 3.5 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs, and reaming. Install pipe with all markings up for visual inspection and verification.
- D. Remove all dented and damaged pipe sections.
- E. All lines shall have a minimum clearance of 4 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.

- G. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner, which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Center load all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape or Teflon paste.
- K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal connections, except where noted otherwise. All plastic-to-metal connections shall be made with plastic female adapters.

### 3.6 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.
- B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area.

### 3.7 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.
- B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote-control valve.
- E. A continuous run of wire shall be used between a controller and each remote-control valve. Under no circumstances shall splices be used without prior approval.

### 3.8 VALVES

- A. Automatic control valves, quick coupler, and ball valves are to be installed in the approximate locations indicated on the drawings.

- B. Valve shall be installed in shrub areas whenever possible.
- C. Install all valves as indicated in the detail drawings.
- D. Valves to be installed in valve boxes shall be installed one valve per box.
- E. Provide valve ID tags for each remote-control valve with valve number.

### 3.9 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible.
- B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

### 3.10 IRRIGATION HEADS DRIP EMITTERS AND INLINE DRIP TUBING

- A. Irrigation heads, drip emitters and inline drip tubing shall be installed as indicated on the drawings.
- B. Spacing of heads and inline drip tubing shall not exceed maximum indicated on the drawings.
- C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.

### 3.11 BACKFLOW PREVENTION UNITS

- A. Backflow Prevention Units shall be installed as indicated on the drawings. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes.
- B. The exact location of the backflow device shall be approved by the Landscape Architect or Owner's authorized representative before installation.
- C. The contractor shall be responsible for the testing and certification of the backflow device for proper operation. Testing and certification shall be performed by a state qualified backflow tester.

### 3.12 MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Quick coupler valves shall be set approximately 18 inches from walks, curbs, header boards, or paved areas where applicable.
- C. Install devices such as rain sensors, freeze sensors, flush valves, and air relief valves, master valves and flow sensors as indicated on the drawings and as recommended by the manufacturer.

### 3.13 FLUSHING THE SYSTEM

- A. Prior to installation of irrigation heads, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Irrigation heads shall be installed after flushing the system has been completed.

### 3.14 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves, align heads, and check the coverage of each system prior to coverage test.
- B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.
- C. The entire system shall be operating properly before any planting operations commence.
- D. Automatic control valves are to be adjusted so that the irrigation heads, drip emitters and inline drip tubing operate at the pressure recommended by the manufacturer.

### 3.15 TESTING AND OBSERVATION

- A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and governing agencies.
- B. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.
- C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.
- D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the Landscape Architect. This test shall be accepted by the Landscape Architect and accomplished before starting any planting.
- E. Areas to be maintained for the formal maintenance period shall start maintenance at the same time, as directed by the Landscape Architect, Owner, and governing agencies. Partial areas will not be released into maintenance prior to completion of items listed in the pre-maintenance review. The maintenance period may not be phased.
- F. If, after the maintenance review, the irrigation systems are not accepted by the Landscape Architect, the contractor shall reimburse the Architect for additional site visits, or additional time required to review work. All additional time will be billed at the Architect's hourly rate and will be paid for by the contractor at no additional cost to the Owner.



- G. Final inspection will not commence without record drawings as prepared by the Irrigation Contractor.

### 3.16 MAINTENANCE

- A. During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

### 3.17 COMPLETION CLEANING

- A. Clean up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be swept, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION 32 84 00

SECTION 32 93 16

EXTERIOR PLANTS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Section Includes complete installation of landscape items as shown on the Drawings and as specified in this Section
- B. Related Sections
  - 1. 03 33 10 Landscape Site Concrete Walls
  - 2. 12 93 00 Site Furnishings
  - 3. 32 13 16 Decorative Concrete Paving
  - 4. 32 31 13 Chainlink Fences and Gates
  - 5. 32 84 00 Landscape Irrigation
  - 6. 32 93 16 Exterior Plants

1.2 GENERAL REQUIREMENTS/DEFINITIONS

- A. The term "Planting Area" shall mean areas to be planted with trees, shrubs, groundcovers, lawn, or seed, or areas to be covered with various gravel or stone mulches not intended for pedestrian or vehicular circulation.
- B. The term "Contract Close-out" shall mean the date at the close of the Maintenance Period when the work has been completed, checked, accepted, and written approval of the work has been given by the Owner's Representative.
- C. The term "Date of Acceptance" shall mean the date at the end of the warranty periods as specified herein, and written acceptance has been given by the Owner's Representative.
- D. Protect and maintain at all times the existing plant material identified on the Drawings as "to remain".
- E. Finish Grade: Elevation of finished surface of planting soil.
- F. Import Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- G. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- H. Planter Pot Soil/Interior Plant Medium: Soil produced by blending a mixture of organics, sand and nutrients to be used as a growing medium for plants in pots located interior or exterior.
- I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- J. Raised Planter: Planted areas that are bounded by any (1) wall 12in" higher than adjacent grade or surface. To be filled with import topsoil to the full and complete depth of the planter.

1.3 SUBMITTALS

- A. Submittals for above items shall be made in one package. If submittals are judged incomplete or non-responsive to the directions of the Owner's Representative after three

(3) submissions the Contractor shall be back charged for the Owner's Representatives costs to process additional Submittals.

B. Product Data and Samples:

1. Soil amendments and fertilizers: Submit manufacturer's product data on amendments and fertilizers as noted. Include brand names, estimated quantities, and supplier.
2. Plant materials: Submit a list of all plant materials with quantities, sizes, and source.
3. Trees: For each species, submit three (3) colored photographs with botanical name, container size, height, spread, and nursery source on the back of each photo. Include an adult human figure in each photograph for scale.
  - a. Palm Trees: Submit photos as noted above. Submit documentation from the nursery certifying the trees have been inspected by a county or state agricultural agency, the trees are disease and pest free, and are available for sale.
4. Bark Mulches: Submit three (3) 1/4 lb. bagged samples of each specified material. Label bag with name, source, size, and color range.
5. Decomposed Granite and Rock Mulch 3/8in"-3/4in" to 1in" -2in" diameter: Submit three (3) 1 lb. bagged samples of each specified material. Label bag with: name, source, size, and color range.
6. Landscape products: Submit manufacturer's product data for all landscape products specified below.

C. Soil Analysis: Soil analysis test reports shall be completed after rough grading to determine actual recommended soil amendments. Refer to Part 1: SOIL TESTING. Provide soil testing laboratory a copy of the 32 93 16 Exterior Plants Specification and Plant List with soil samples. Maintenance Instructions: Prepare instructions for maintenance in cooperation with the Owner for the Maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods. Instructions shall include but not be limited to the following tasks:

1. Fertilizing
2. Irrigation schedule
3. Dead heading
4. Mulch or other inert groundcover replenishment
5. Pruning of Shrubs to maintain design intent

D. As Built Drawings of Landscape Planting.

1.4 QUALITY ASSURANCE

A. Reference Standards: Reference Standards apply to this Sections and shall be the latest edition of the following:

1. "A Checklist of Woody Ornamental Plants of California", Owner of California, College of Agriculture
2. ANSI Z60.1 American Standards for Nursery Stock
3. "Seed Laws" State of California Department of Food and Agriculture
4. "Seed Laws" U.S. Department of Agriculture

5. Hortus Third
6. Sunset Western Garden Book, Sunset Publishing Corporation

B. Landscaping Contractor

1. Installer Qualifications: All of the work required to be provided as described in this Section of the Specifications shall be provided by a sub-contractor skilled in this specialty, holding a valid C-27 California contractor's license.
2. The qualified landscape installer shall exhibit work that has resulted in exterior plants establishment. Submitted qualifications shall include a client list with contact names, phone numbers and date exterior planting was installed. Submitted qualifications shall include a client list with contact names, phone numbers and date California Native Plant Landscapes were installed.
3. All work shall be performed by a trained crew in accordance with the standards and practices related to the trade.
4. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.

1.5 WARRANTY AND REPLACEMENTS

- A. Submit written warranties on the Contractor's or subcontractor's letterhead, addressed to the Owner. Submit all warranties in duplicate or modified as approved to suit the conditions pertaining to the warranty.
- B. Trees shall be warranted to remain healthy and in a vigorous growing condition for a period of one year from Contract Close-out.
- C. Shrubs, vines and groundcovers shall be warranted to remain healthy and in a vigorous growing condition for a period of six months from Contract Close-out.
- D. Palm trees shall be warranted to remain healthy and in a vigorous growing condition for a period of two years from Contract Close-out.
- E. Plants found dead or not in a vigorous growing condition during the Warranty Period shall be removed and replaced within 14 days of written notification by the Owner's Representative. Replacement plants shall be of the same size, species and variety as specified. Replacement includes restoration of surrounding area to match the existing conditions. All work shall be provided at no additional expense to the Owner.

1.6 REJECTION AND SUBSTITUTION

- A. Products or materials, whether installed or not, not conforming to the requirements herein specified shall be considered defective, and be marked as rejected. Materials shall be removed and replaced with approved materials at no additional cost to the Owner.
- B. Submit written request for each proposed substitution. Provide data substantiating request as well as a "Certificate of Suitability" certifying that the proposed substitution is equal or better in all respects to that specified and that it will, in all respects perform the function for which it is intended. Include with request all required samples. Submit 3 copies of all written requests and data for proposed substitution.

1.7 SITE OBSERVATIONS

- A. Schedule and coordinate site observation visits for the following construction activities. Reviews shall be performed by the Owner’s Representative and notification shall be given in advance as noted:

Item	Advance Notice
1. Protection of existing plant materials	48 hours
2. Rough grade and soil tests	48 hours
3. Plant material	48 hours
4. Soil preparation and finish grade	48 hours
5. Percolation tests	48 hours
6. Plant layout and installation	48 hours
7. Substantial Completion Punch List	7 days
8. Punch List Completion	7 days
(Authorize start of Maintenance Period)	
9. Maintenance Completion	7 days

- B. Site observations and acceptance will be documented in writing by the Owner’s Representative. No site observations shall commence without items noted in previous reports being completed, remedied, or waived by the Owner. If Contractor is not prepared for a scheduled site observation the Contractor shall be back charged for the costs incurred by the Owner’s Representative.

1.8 TEMPORARY UTILITIES

- A. Provide all temporary piping, wiring, meters, panels and other related appurtenances required between the source of supply and the point of use of utilities.
- B. Permission to shut off in-use utilities must be obtained 48 hours in advance, in writing from the Owner’s Representative. The Owner’s Representative shall determine the length of time for each shut-off.

1.9 SOIL TESTING

- A. Qualifications
  - 1. Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- A. Supply Soil Testing Laboratory with complete copy of 32 93 16 Specification Section and Plant List at time of soil tests. Soil amendment recommendations from soil laboratory shall be based on the submitted products in this specification when possible.
- B. Soil Testing After Rough Grading
  - 1. At the conclusion of rough grading, collect soil samples per planting plan with key map indicating soil sample number, and submit the samples to an agricultural soils laboratory for testing. Submit the test results to the Owner’s Representative for review. No amendments shall be applied prior to receipt of test results. The Owner’s Representative shall recommend changes to the amendments and/or procedure listed herein, after review of the test results. Costs for testing shall be

included in the base bid. Cost change for soil preparation work shall be in accordance with the provisions of the General Conditions.

2. A soil analysis shall be made after rough grading operations are complete to determine actual recommended soil amendments.
3. Soil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter, textural test, textural classification, silt sand clay content; sodium absorption rate (SAR), electrical conductivity (ECe), cation exchange capacity; boron content, deleterious material; pH; mineral and plant-nutrient content of topsoil and elemental data, corrective recommendations and soil amendment recommendations.
4. Report suitability of soil for plant growth. State recommended quantities of amendments and soil amendments to be added to produce satisfactory planting soil. Testing agency must use amendments listed in this specification in their recommendations.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Label each plant group with full botanical name, species, and varieties on weatherproof tags attached securely to the plant before delivery to the site. Provide a minimum of one labeled plant for each five (5) plants in a group.
- B. Plants shall have a normal growth habit, be sound, healthy, vigorous and free from insect pests, insect eggs, plant diseases, sun scalds, fresh bark abrasions, excessive disfigurements, and meet or exceed the measurements specified. Trunks shall be sturdy and well "hardened-off". Plants shall have normal well-developed, vigorous and fibrous root systems which are neither root, nor container-bound, are free of kinked or girdling roots. Plants shall have grown in their containers for at least six months, but not over two years. Plants that have cracked or broken rootballs shall be replaced with the same species, size, and character as specified.
- C. Groundcover plants shall be healthy vigorous rooted cuttings grown in flats for at least three months, but not over six months.
- D. Succulents: Shall be acquired from a licensed nursery. Provide the nursery suppliers to the Owner's Representative. Succulents shall be free of insects, mottled leaves, broken or split branches or trunks, scarring or any other uncharacteristic growth patterns.
- E. Obtain inspections, and secure permits or certificates required by City, County, or State authorities prior to delivery to the site.
- F. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement. Plants shall have normal well-developed, vigorous and fibrous root systems which are neither root, nor container-bound, are free of kinked or girdling roots.
- G. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.

2.2 TREE AND SHRUB MATERIAL

- A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement. Plants shall have normal well-developed, vigorous and fibrous root systems which are neither root, nor container-bound, are free of kinked or girdling roots. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.
- B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.
- C. Label at least five trees and five shrubs of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.
- D. In formal arrangements, if matching specimens are indicated or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.
- E. Obtain inspections, and secure permits or certificates required by authorities having jurisdiction prior to delivery.

2.3 TREES / PALM TREES

- A. Typical Distinctions are Standard, Natural Form, Multi-stem.
- B. Standard Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height, width and caliper indicated, complying with ANSI Z60.1 for type of trees required.
- C. Natural Form Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, width and branching according to ANSI Z60.1.
- D. Multi-stem Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, width and branching according to ANSI Z60.1. Multi-stem trees shall be naturally occurring as multi-stem trees. Nursery created multi-stem trees are not acceptable.
- E. Trees shall be grown under climatic conditions similar to the conditions of the project site. Take care to prevent scarring, marking or injury to the trunks during delivery and installation.
- F. Palm Trees shall be grown under climatic conditions similar to the conditions of the project site. Take care to prevent scarring, marking or injury to the trunks and terminal bud/crown during delivery and installation. Prior to delivery remove dead fronds lower than 5' from the crown and "bundle and tie" the remaining fronds over the crown with hemp rope. Field grown trees shall have the root balls "balled and burlapped" prior to delivery.

2.4 DECIDUOUS SHRUBS

- A. Form and Size: Deciduous shrubs with not less than the minimum height and spread specified in the drawings or required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

2.5 CALIFORNIA NATIVE PLANTING

- A. Form and Size: California Native Planting with not less than the minimum height and spread specified in the drawings or required by and measured according to ANSI Z60.1 for type, shape, and height of California Native Planting.

2.6 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in flats, pots or similar containers, and complying with ANSI Z60.1
- B. Groundcover plants shall be healthy vigorous rooted cuttings grown in containers for at least three months, but not over six months.

2.7 SOIL AMENDMENT AND FERTILIZER

- A. Organic Soil Amendment/Conditioner: An organic, sustainably sourced product made from plant trimmings supplying slow release primary minerals of Nitrogen, Phosphate, Potash. Shall not contain poultry, animal or human waste. Finished product screened through 3/8in" mesh and have a moisture content of 25% percent. "Humic Compost" by Agri Service (800) 262-4167.
- B. Gypsum: a commercially processed and packaged gypsum (CaSo4, H2O) Calcium Sulfate Product - 94.3%percent. Ninety percent shall pass a 50 mesh screen.
- C. Iron Sulfate: a commercially processed and packaged product (FeSO4 H2O) Ferrous Sulphate Monohydrate - 95.7%percent. Ninety percent passing a 50 mesh screen. (Per soils lab analysis).
- D. Sulfur: a commercially processed and packaged product in elemental form (S) Sulfur - 95.0%percent, capable of oxidizing over time and providing nutrient sulfur. Pelletized. (Per soils lab analysis).
- E. Pre-plant Fertilizer: Pre-plant Fertilizer for plants (5-3-1) with Soil Penetrant Added. Fertilizer and soil conditioner derived from organic materials consisting of higher plant form life, composted beyond the fibrous stage. Shall not contain any of the following: poultry, animal or human waste, pathogenic viruses, fly larvae, insecticides, herbicides, fungicides or poisonous chemicals that would inhibit plant growth. Physical properties: A uniform "Beaded" homogenous mixture - 100.00% percent passing through a #4 mesh screen - a water soluble bio-degradable binder is used to insure fast breakdown. Such as "Gro-Power Plus 5-3-1" as manufactured by Gro-Power®, Inc. (909)393-3744, or approved equal.

Nitrogen	5%	minimum
Phosphoric Acid	3%	minimum
Water Soluble Potash	1%	minimum
Humus	70%	minimum
Humic Acids	15%	minimum
Soluble Metallic Iron	1%	minimum
Soil Penetrant: (Alkyl Naphthalene Sodium Sulfonate)		
	1%	minimum



Bacterial "stimulator": (Common soil and airborne organisms - aerobic, anaerobic, yeast and mold)

60,000 per 100 gram minimum

- F. Post-plant Fertilizer: Controlled release blend of methylene ureas, phosphorus, Potash and trace minerals. Humus and humic acids are added to aid the plant to assimilate necessary nutrients. Not dependent on bacterial breakdown. As manufactured by Gro-Power®, Inc. (909)393-3744, no known equal.

Chemical analysis: 12-8-8, nitrogen 12.00% percent, phosphate 8.00% percent, soluble potash 8.00% percent, calcium

Nitrogen	12%	minimum
Phosphoric acid	8%	minimum
Soluble potash	8%	minimum

- G. Mineral Soil Conditioner plus Calcium: JTM Nutrients 'Activator Ca' Fertilizer and soil conditioner derived from magnetic rock, and rock phosphate. 10% percent humic acid as derived from humic shale ore. Shall not contain poultry, animal or human waste. As manufactured by JTM Nutrients® (949) 632-7378, no known equal.

Chemical Analysis: 0-5.5-0 (7% percent) Ca, phosphate 4.00% percent, Calcium 7.00% percent, Iron 1.00% percent.

Phosphate	4%	minimum
Calcium	7%	minimum
Iron	1%	minimum

- H. Mycorrhizal Soil Conditioner: Mycorrhizal Inoculum shall be both Endo and Ecto (granular), with consisting of propagules (spores, fragments of fungal mycelium, and pieces of mycorrhizal roots capable of colonizing host plant roots) of the vesicular arbuscular mycorrhizal species Glomus intraradices, Glomus aggregatum, Glomus mosseae, combined with other species and/or additional genera including, Sclerocystis, Gigaspora, Scutellospora, Entrophospora, and Acaulospora. Ectomycorrhiza include Pisolithus and 4 species of Rhizopogon. Soil Conditioner portion shall consist of organic materials consisting of higher plant form life, composted beyond the fibrous stage, to humus. Also shall have humic acids and beneficial soil bacteria strains. It shall NOT contain poultry, animal or human waste (i.e., sewage sludge), pathogenic viruses, fly larvae, insecticides, herbicides, fungicide or poisonous chemicals that would inhibit plant growth. Shall be "GroLife" As manufactured by GroPower (909)393-3744 – no known equal.

<u>Ingredients</u>	<u>percentage (minimum)</u>
Mycorrhizal Inoculum	6,500/55,000 propagules per lb.*
Humus	65%
Humic Acids	25%

- I. Palm Fertilizer: Nontoxic concentrated Vitamin solution such as 'Superthrive' Vitamin Solution, as manufactured by Superthrive, (800) 441.8482.

J. Planting Tablets:

Tightly compressed chip type commercial grade planting tablets, and containing the following available percentages by weight of plant food, slow release fertilizer tablets, soil conditioner, and 24-month formulation with trace elements, composted organic higher plant form life and mineral matter. Shall not contain any poultry, animal or human waste. Such as “Gro-Power Planting Tablets (20-10-5)” as manufactured by Gro-Power®, Inc. (909)393-3744, no known equal:

Nitrogen	20%	minimum
Phosphoric Acid	10%	minimum
Potash	05%	minimum

2.8 BIORETENTION PLANTER SOIL

- A. Bioretention planter soil mix of manufactured Loamy Sand per USDA Soil Classification Criteria, Well aged Humic Compost, and AXIS®. As manufactured by Gail Materials (951) 667-6106.

Upper Layer Mix Proportions:	75% Loamy Sand, 20% Humic Compost, 5% AXIS®
Lower Layer Mix Proportions:	95% Loamy Sand, 5% AXIS®.

2.9 IMPORT TOPSOIL (IF NEEDED)

- A. Provide soils test on proposed import soil for suitability review prior to delivery to the site.
- B. Import topsoil to be supplied for the full depth of all raised planters; see Part 1 for definition of raised planters.
- C. Import topsoil also to be used on-grade as required for fill operations or as specified in the drawings.
- D. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% percent passing the 2.0 millimeter sieve. The sodium absorption rate (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 milliohms per centimeter at 25 degrees centigrade. The boron content shall be no greater than 1 part per million as measured on the saturation extract. Submit results of agricultural soils analysis for review and approval by the Owner’s Representative.
- E. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

2.10 VEGGIE BIN PLANTING MEDIUM

- A. Interior planting medium shall be a commercially blended interior growing medium consisting of Canadian Sphagnum peat moss, coarse perlite, dolomite limestone, organic starter nutrient charge, gypsum, organic wetting agent and RESiLIENCE such as, Sunshine Professional Growing Mix Sunshine #1 N&O by Sun Gro Horticulture, 1(888)797.7328 or approved equal.

2.11 STAKING AND GUYING MATERIALS

- A. Wood stakes shall be lodge pole pine. Stakes shall not be treated with copper naphthenate. Stakes shall be straight shafts, shaved and cut clean and bare of branches and stubs, of uniform thickness with a minimum diameter of 2 inches, free of loose knots, splits or bends. Stakes for 24”in box trees and smaller shall be no less than ten (10) feet in length. Stakes for 36”in box trees and larger shall be no less than twelve (12) feet in length and 3” in diameter.
- B. Tree ties shall be flexible non-deteriorating self-fastening, UV coated black vinyl ties of sizes required to adequately support trees, “Century Universal Tree Tie, as supplied by Century Products, (714) 632.7083.
- C. Vine Anchors and ties: Shall be silicone epoxy type, with wire clasp for vine.

2.12 MULCH

- A. Rock: See Planting Legend for type - from Decorative Stone Solutions (800) 540-1147, or approved equal.
- B. Bark Mulch: See Planting Legend for type and source.
- C. Drainage Mulch at Veggie Boxes: See Planting Legend for type and source.

2.13 ACCESSORIES

- A. Tubes: 4” dia. SDR 35 perforated pipe cut to length as shown on the Drawings.
- B. Grates: 4” National Diversified Sales (NDS) #13S flat, round drain grates 'Sand' color in planting areas, dg, bark, rock or cobble mulch, #11 black in lawn or groundcover areas.
- C. Filter fabric “sock”: Trevira Spunbond, Tyvar 3341, Geoscape Landscape Fabric - 2.5 oz., Commercial Grade", or approved equal.
- D. Root barrier shall be “Tyvar Biobarrier” root control root fabric with Treflan, manufactured by Dow Elanco., as supplied by Century Products., (714) 632.7083.
- E. Landscape fabric shall be “Tyvar 3301 Professional Landscape Fabric” manufactured by Dow Elanco, as supplied by John Deere Landscape (800) 347-4272.
  - 1. Unit Weight – 3.0 oz./Square yards
  - 2. Tensile Strength – 135 lbs.
  - 3. Color - Black

PART 3 - EXECUTION

3.1 GENERAL

- A. Rip and Re-compact: Rip and re-compact sub-grade in all on grade planting areas to a depth of 18 inches or as indicated in the Drawings prior to placement of amendments and prior to the installation of any irrigation lines. Remove all rocks in the top 6 inches. Mitigate compaction in planting areas due to staging or construction.
- B. Finish Grading: All grades shall be finished graded prior to the commencement of planting operations. Finish grades shall be coordinated with adjacent finish paving and finish surfaces.

3.2 EXAMINATION

- A. Examine areas to be planted before start of work, locate utilities, improvements, and easements, verify dimensions and areas shown on the Drawings with actual conditions, identify and tag existing plant material to remain. Document conditions which are in direct conflict with the Drawings and notify the Owner’s Representative. Do not start work until conditions that would adversely affect performance, installation, or quality of the work has been corrected. Start of work of this Section constitutes acceptance of the conditions.

3.3 WEED CONTROL

- A. Prior to commencement of the planting operations, remove all weeds including the roots, remove existing plant material including stumps designated not to remain, dispose of cleared and grubbed material at a legal refuse site.
- B. Prior to using herbicides, review procedures with the Owner’s Representative, and obtain written approval. Herbicide applications requiring government or agency approvals shall be performed by an operator licensed by the County.
- C. Protect existing plant material on site and on adjacent properties from exposure to herbicides and equipment.

3.4 SOILS TESTS

- A. At the conclusion of rough grading, collect soil samples as indicated on Drawings, and submit the samples to an agricultural soils laboratory for testing along with a copy of the 32 93 16 Exterior Plants Specification and a plant list. Soil amendment recommendations from soil laboratory shall be based on the submitted products in this specification when possible. Submit the test results to the Owner’s Representative for review. No amendments shall be applied prior to receipt of test results. The Owner’s Representative shall recommend changes to the amendments and/or procedure listed herein, after review of the test results. Costs for testing shall be included in the base bid. Cost change for soil preparation work shall be in accordance with the provisions of Base Bid.

3.5 SOIL PREPARATION AND FINISH GRADES

- A. Spread amendments over all planting areas indicated on the Drawings, and mechanically till and blend to a depth of six (6) inches. Prepare areas within the dripline of existing trees by hand, do not use mechanical tillers. Remove foreign material, construction debris, and rocks larger than 2” in diameter. Rake smooth, lightly water, and compact to the finish grades shown on the Drawings. Use the amendments listed below for bidding purposes only. Materials and application rates may be modified after receipt of soils tests noted in item 3.04.

	<u>Amendments</u>	<u>Rate or Quantity/1,000 s.f.</u>
1.	Organic Soil Conditioner	4 cu. yds.
2.	Nutrient Soil Conditioner plus Calcium	150 lbs.
3.	Gypsum	10 lbs.
4.	Soil Sulfur	10 lbs.
5.	Pre-Plant Fertilizer	20 lbs.

- B. Float smooth and compact all soil preparation areas to 85% percent relative dry density, maintain positive drainage, flow lines, and swells to area drains, fine grade to within plus or minus 0.10 foot of the grades shown on the Drawings.

3.6 PERCOLATION TESTS

- A. Locate and prepare the percolation test pits where indicated on the Drawings (2 locations), and as described herein.
- B. Excavate the pits as describe under the plant installation section, remove all loose material, and fill the pits with six inches (6") of water. After 12 hours refill with the same amount of water. Six hours after the second filling, inspect the pits with the Owner’s Representative and document locations where water remains in the pit.
- C. If percolation problems occur, provide means and methods for correcting said problems. Planting operations at the locations identified shall be suspended as necessary or as directed by the Owner’s Representative. Payment for corrective work shall be in accordance with the provisions of the Base Bid. Proceeding with the work without written approval, does not entitle the Contractor to additional compensation for corrective work.

3.7 TREE AND SHRUB PLANTING

- A. Tree Planting:
  - 1. Typical minimum distance from trees to building is 12 feet.
  - 2. Typical minimum distance from trees to walls or walks is 8 feet.
  - 3. Do not plant trees over utilities, or typically closer than 10 feet.
  - 4. Dig holes for trees minimum 2 times greater than the diameter of the rootball.
  - 5. Minimum tree planting cutout is 100 square feet.
  - 6. Create minimum 24 inch diameter mulched zone around trees within lawn area.
- B. Shrub Planting:
  - 1. Dig holes for shrubs and vines a minimum 3 times greater than the rootball.
  - 2. Typical minimum distance from shrub to edge of walks is one-half mature width. See Plant Legend for required offsets from paving.
- C. Placement: Center each tree, shrub or vine, set plumb, and hold rigidly in position until the planting backfill work is complete. Prior to backfilling, check for girdling or kinked roots, and correct the conditions according to accepted nursery practice. Set plants at a level that after settling results in the root crown to finish grade relationship shown on the Drawings and Details. Specimen plants in 36”in box size or larger shall be placed, positioned, and set with a crane.
- D. Backfill and Compaction: Place backfill in maximum 6 inch layers. Compact to 85% relative dry density prior to placement of each succeeding layer in planting areas. At completion of the planting operation, thoroughly water-in each plant to the full depth of the plant pit. Use the amendments listed below for bidding purposes only. Materials and application rates may be modified after receipt of soils tests noted in item 3.04.
  - 1. Backfill mixture for all plants shall be thoroughly blended, consisting of the following:
 

1. Existing Soil	4 parts
2. Gypsum	25 lbs./CY of mix
3. Iron Sulfate	2 lbs./CY of mix
4. Soil Sulfur	1 lb./CY of mix
5. *Organic Soil Conditioner	15 lb./CY (Incorporate in only the top 18” layer.)

- 6. \*Pre-plant Fertilizer (8-2-4) 30 lb./CY of mix (Incorporate in only the top 18” layer.)
- 7. \*\*Mycorrhizal Soil Conditioner 10 lb./CY of mix

3.8 CALIFORNIA NATIVE PLANTING

- A. Dig holes for California Native Planting a minimum 2 times greater than the rootball.
- B. Typical minimum distance from shrub to edge of walks is one-half mature width.
- C. Placement: Center each tree, shrub or vine, set plumb, and hold rigidly in position until the planting backfill work is complete. Prior to backfilling, check for girdling or kinked roots, and correct the conditions according to accepted nursery practice. Set plants at a level that after settling results in the root crown to finish grade relationship shown on the Drawings. Specimen plants in 36” box size or larger shall be placed, positioned, and set with a crane.
- D. Backfill and Compaction: Place backfill in maximum 6 inch layers. Compact to 85% relative dry density prior to placement of each succeeding layer in planting areas. At completion of the planting operation, thoroughly water-in each plant to the full depth of the plant pit. Use the amendments listed below for bidding purposes only. Materials and application rates may be modified after receipt of soils tests noted in item 3.04.
  - 1. Backfill mixture for all California Native Plants shall be thoroughly blended, consisting of the following:
    - 1. Existing Soil 4 parts
    - 2. Organic Soil Conditioner 1 part
    - 3. Mycorrhizal Inoculum / Soil Conditioner 10 lbs./ cu. yard of mix
    - 4. Soil Conditioner plus Calcium 30 lbs./ cu. yard of mix

3.9 PALM INSTALLATION

- A. Delivery and Handling: Off-load and set all palms with a crane using a sling system designed for handling palms. Stockpile palms in an upright vertical position and protect the rootball from injury, drying, or cracking. Schedule deliveries, and crane time such that all bareroot palms are planted within 48 hours of delivery.
- B. Planting Pits: Excavate planting pits with vertical walls and level bottoms to the size and depth shown on the Drawings.
- C. Installation: Center palm in the pit, plumbed to true vertical from all directions and matched crown height. Align palms in the group in all directions. Adjust palms that may settle out of alignments during the construction, maintenance, and warranty periods.
- D. Pruning shall be done with reciprocal saws to prevent broadcast of any disease the tree may harbor. Chain saws will not be allowed. Saw blades shall be sterilized prior to beginning with 50%percent household bleach and 50%percent water for 10 minutes.
- E. All remaining fronds above horizontal shall be lifted up and tied together around the crown in an upright position. Due caution shall be taken not to bind or injure the crown.
- F. Backfill mixture for palm trees shall be thoroughly blended, consisting of the following:
  - 1. Washed Concrete Sand
  - 2. ‘Superthrive’ Vitamin Solution 2Tbsp/per 5 gal. water
  - 3. Mycorrhizal Inoculum / Soil Conditioner 5 lbs. / cu. yard of mix

3.10 GROUNDCOVERS INSTALLATION

- A. Prior to planting, check soil moisture for acceptable levels and lightly irrigate area as necessary, do not install plants in dry soil. Install plants in staggered rows and evenly spaced at the intervals indicated on the drawings. Excavate plant pits slightly larger than the rootball and place a 5 gram plant tablet in each pit, set plants to cover all roots, backfill, tamp, and rake area smooth.
- B. As each planting area is completed, thoroughly water-in the area to the full depth of planting pits.

3.11 PLANTING TABLETS

- A. Place planting tablets in all planting pits at the following rates:

<u>Plant Size</u>	<u>Quantity</u>	<u>Tablet Size</u>
Liner and flat size plant	1	5 gram
1 gallon container	1	21 gram
5 gallon container	2	21 gram
15 gallon container	3	21 gram
Box/Specimen	2	21 gram for each 12" of box size

3.12 AERATION TUBES

- A. Wrap tubes with the fabric and set plumb in opposite corners of the planting pit. Place gravel and backfill mix as shown on the Drawings. Cut tubes to 1" above finish grade and cap with a drain grate.

3.13 TREE AND VINE STAKING

- A. Tree Staking: Remove nursery stakes and ties. Single or double stake trees as noted and shown on the Drawings. Set stake on the side of the prevailing wind with the other stake (if double-staking) on the opposite side of the tree. Remove stakes at the end of the Warranty Period, or earlier if tree is self-supporting.
- B. Vine Staking: Remove nursery stakes or trellis from vines, and spread or "fan out" the branches in a symmetrical form against the adjacent walls, columns, fences, or structures. Allow main leader to remain in a horizontal fashion to encourage stems to bud. Attach the branches as necessary with vine ties. Use clear silicone to attach ties to masonry, concrete, or stucco, and 4d galvanized nails to wood fences.

3.14 POST-PLANT FERTILIZERS

- A. Controlled release fertilizers shall be applied according to the manufacturer's instructions and standard horticultural practices.

3.15 MULCH APPLICATION

- A. Gravel/D.G. Mulch: At the completion of the planting work, rake smooth the areas indicated on the Drawings, and spread a 3" in layer of gravel/D.G. over the areas, taper to adjacent paving.

- B. Bark Mulch: At the completion of the planting work, rake smooth the areas indicated on the Drawings, and spread a 3”in layer of bark over the areas, taper to adjacent paving. Arrange mulch so as to not allow any visible grade showing.
- C. Lift all leaves, low hanging stems and other green portions of small plants out of mulch if covered.

**3.16 ROOT BARRIER**

- A. Root barrier shall be installed against hardscape features, or as shown diagrammatically on the Drawings, not encircling tree rootball. Install per manufacturer recommendations.

**3.17 CLEAN-UP**

- A. As the work progresses, maintain areas in a neat, clean, orderly manner, and remove unsightly debris as necessary. At the completion of the work, sweep and clean all walks, parking, and other paved areas adjacent to plantings.
- B. Remove and dispose of all tags, flagging materials are removed from plant material and accessories.
- C. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

**3.18 PROTECTION DURING CONSTRUCTION**

- A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.
- B. **DAMAGE DONE BY THE CONTRACTOR, OR ANY OF THEIR SUB-CONTRACTORS TO EXISTING OR INSTALLED PLANTS, OR ANY OTHER PARTS OF THE WORK OR EXISTING FEATURES TO REMAIN, INCLUDING ROOTS, TRUNK OR BRANCHES OF LARGE EXISTING TREES, SOIL, PAVING, UTILITIES, LIGHTING, IRRIGATION, OTHER FINISHED WORK AND SURFACES INCLUDING THOSE ON ADJACENT PROPERTY, SHALL BE CLEANED, REPAIRED OR REPLACED BY THE CONTRACTOR AT NO EXPENSE TO THE OWNER. THE OWNER’S REPRESENTATIVE SHALL DETERMINE WHEN SUCH CLEANING, REPLACEMENT OR REPAIR IS SATISFACTORY.**

**3.19 DISPOSAL**

- A. Disposal: All grubbed material, rock, surplus soil and waste material, including excess subsoil, unsuitable soil, trash and other debris shall be removed from the Owner’s property and disposed of in a legal disposal site.

**3.20 SUBSTANTIAL COMPLETION ACCEPTANCE**

- A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.
  - 1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.
- B. The date of substantial completion of the planting shall be the date when the Owner’s Representative accept that all work in Planting, Planting Soil, and Irrigation installation sections is complete.



- C. The Plant Warranty period begins a date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.21 MAINTENANCE

- A. See City of San Diego Greenbook/Whitebook.

3.22 END OF MAINTENANCE

- 1. See City of San Diego Greenbook/Whitebook.

END OF SECTION

**SUPPLEMENTARY SPECIAL PROVISIONS**  
**APPENDICES**

**APPENDIX A**  
**NOTICE OF EXEMPTION**

## NOTICE OF EXEMPTION

(Check one or both)

TO:  Recorder/County Clerk  
P.O. Box 1750, MS A-33  
1600 Pacific Hwy, Room 260  
San Diego, CA 92101-2422

FROM: City of San Diego  
Development Services Department  
1222 First Avenue, MS 501  
San Diego, CA 92101

Office of Planning and Research  
1400 Tenth Street, Room 121  
Sacramento, CA 95814

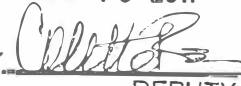
**FILED**  
Ernest J Dronenburg, Jr. Recorder County Clerk

PROJECT TITLE/ No.: **Palm Avenue Transitional Housing / 569136**

STATE CLEARINGHOUSE No.: *Not Applicable*

PROJECT LOCATION-SPECIFIC: 1788 Palm Avenue San Diego, CA

PROJECT LOCATION-CITY/COUNTY: San Diego/San Diego

**DEC 13 2017**  
BY:   
DEPUTY

DESCRIPTION OF NATURE AND PURPOSE OF THE PROJECT: A request for a CONDITIONAL USE PERMIT and SITE DEVELOPMENT PERMIT for the repurposing of an existing two-story, 64-room, 24,154-square-foot hotel into a transitional housing facility. The proposed conversion of the existing structure and site would include both interior and exterior work. Interior renovations would include the following: renovations to incorporate communal space (comprised of kitchen, dining room, living room, training room, alternative smaller living room, two small meeting rooms, storage locker area, laundry facility). Exterior renovations include parking are to be reconfigured and asphalt restriping, removal of some asphalt for installation of enhanced landscaping, and bring the site into compliance with ADA regulations. The existing pool would be removed and replaced with a green area/communal garden with partial shade structure. The project would also construct associated site improvements (i.e. hardscape, site utilities, drainage improvements, landscaping, and walls). The applicant voluntarily proposes 100-percent of the project (42 units) as affordable to targeted rental households with rents at 60-percent AMI for a period of 55 years, and in conformance with the criteria of the Inclusionary Housing requirements and the Affordable/In-Fill Housing and Sustainable Buildings Expedite Program. The developed 0.98-acre project site is located at 1788 Palm Avenue. The parcel is designated Community-Commercial and zoned CC-4-2 within the Otay-Nestor Community Plan. Furthermore, the project site is located within the Coastal Height Limitation Overlay Zone, the Coastal Overlay Zone (Appealable Area), the First Public Roadway, the Parking Impact Overlay Zone (Coastal Impact Area), Federal Aviation Administration Part 77 Noticing Area for NOLF Imperial Beach, Airport Land Use Compatibility Overlay Zone, and the Airport Influence Area (AIA Review Area 2) for Brown Field. (LEGAL DESCRIPTION: Lot 2 of Palm Avenue Subdivision, Map No. 3693).

NAME OF PERSON OR AGENCY CARRYING OUT PROJECT: Stephen Maduli-Williams, Economic Development Department, City of San Diego, 1200 3<sup>rd</sup> Avenue, MS-56D, San Diego, CA 92101, (619) 533-6510.

EXEMPT STATUS: (CHECK ONE)

- MINISTERIAL (SEC. 21080(b)(1); 15268)
- DECLARED EMERGENCY (SEC. 21080(b)(3); 15269(a))
- EMERGENCY PROJECT (SEC. 21080(b)(4); 15269 (b)(c))
- CATEGORICAL EXEMPTION: 15301 (Existing Facilities)
- STATUTORY EXEMPTIONS:

REASONS WHY PROJECT IS EXEMPT: The City of San Diego conducted an environmental review that determined that the project would not have the potential for causing a significant effect on the environment in that the project meets the criteria set forth in CEQA Section 15301 which allows for the operation, repair, maintenance, permitting, licensing, or minor alteration of existing facilities (public or private) involving negligible or no expansion of use beyond that existing at the time determination. This determination was based on project review and project-specific technical documents. Furthermore, the project involves a negligible expansion of use as the site currently contains a motel and the transitional use would continue to operate in the same manner. Furthermore, the

exceptions listed in CEQA Section 15300.2 would not apply in that no cumulative impacts were identified; no significant effect on the environment were identified; the project is not adjacent to a scenic highway; the project was not identified on a list of hazardous waste sites pursuant to Section 65962.5 of the Government Code. (R-311455)

LEAD AGENCY CONTACT PERSON: E. Shearer-Nguyen

TELEPHONE: (619) 446-5369

IF FILED BY APPLICANT:

- 1. ATTACH CERTIFIED DOCUMENT OF EXEMPTION FINDING.
- 2. HAS A NOTICE OF EXEMPTION BEEN FILED BY THE PUBLIC AGENCY APPROVING THE PROJECT?  
 YES       NO

IT IS HEREBY CERTIFIED THAT THE CITY OF SAN DIEGO HAS DETERMINED THE ABOVE ACTIVITY TO BE EXEMPT FROM CEQA.

  
 \_\_\_\_\_  
 SIGNATURE/TITLE    Legislative Recorder

December 11, 2017  
 \_\_\_\_\_  
 DATE

CHECK ONE:

- SIGNED BY LEAD AGENCY
- SIGNED BY APPLICANT

DATE RECEIVED FOR FILING WITH COUNTY CLERK OR OPR: \_\_\_\_\_

FILED IN THE OFFICE OF THE COUNTY CLERK  
 San Diego County on DEC 13 2017  
 Posted DEC 13 2017 Removed \_\_\_\_\_  
 Returned to agency on \_\_\_\_\_  
 Deputy C. Reison

**APPENDIX B**  
**FIRE HYDRANT METER PROGRAM**

<b>CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS</b>	<b>NUMBER DI 55.27</b>	<b>DEPARTMENT Water Department</b>
<b>SUBJECT  FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)</b>	<b>PAGE 1 OF 10</b>	<b>EFFECTIVE DATE  October 15, 2002</b>
	<b>SUPERSEDES DI 55.27</b>	<b>DATED April 21, 2000</b>

1. **PURPOSE**

1.1 To establish a Departmental policy and procedure for issuance, proper usage and charges for fire hydrant meters.

2. **AUTHORITY**

2.1 All authorities and references shall be current versions and revisions.

2.2 San Diego Municipal Code (NC) Chapter VI, Article 7, Sections 67.14 and 67.15

2.3 Code of Federal Regulations, Safe Drinking Water Act of 1986

2.4 California Code of Regulations, Titles 17 and 22

2.5 California State Penal Code, Section 498B.0

2.6 State of California Water Code, Section 110, 500-6, and 520-23

2.7 Water Department Director

**Reference**

2.8 State of California Guidance Manual for Cross Connection Programs

2.9 American Water Works Association Manual M-14, Recommended Practice for Backflow Prevention

2.10 American Water Works Association Standards for Water Meters

2.11 U.S.C. Foundation for Cross Connection Control and Hydraulic Research Manual

3. **DEFINITIONS**

3.1 **Fire Hydrant Meter:** A portable water meter which is connected to a fire hydrant for the purpose of temporary use. (These meters are sometimes referred to as Construction Meters.)

<b>CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS</b>	<b>NUMBER DI 55.27</b>	<b>DEPARTMENT Water Department</b>
<b>SUBJECT  FIRE HYDRANT METER PROGRAM (FORMERLY: CONSTRUCTION METER PROGRAM)</b>	<b>PAGE 2 OF 10</b>	<b>EFFECTIVE DATE  October 15, 2002</b>
	<b>SUPERSEDES DI 55.27</b>	<b>DATED April 21, 2000</b>

- 3.2 **Temporary Water Use:** Water provided to the customer for no longer than twelve (12) months.
- 3.3 **Backflow Preventor:** A Reduced Pressure Principal Assembly connected to the outlet side of a Fire Hydrant Meter.

4. **POLICY**

- 4.1 The Water Department shall collect a deposit from every customer requiring a fire hydrant meter and appurtenances prior to providing the meter and appurtenances (see Section 7.1 regarding the Fees and Deposit Schedule). The deposit is refundable upon the termination of use and return of equipment and appurtenances in good working condition.
- 4.2 Fire hydrant meters will have a 2 ½" swivel connection between the meter and fire hydrant. The meter shall not be connected to the 4" port on the hydrant. All Fire Hydrant Meters issued shall have a Reduced Pressure Principle Assembly (RP) as part of the installation. Spanner wrenches are the only tool allowed to turn on water at the fire hydrant.
- 4.3 The use of private hydrant meters on City hydrants is prohibited, with exceptions as noted below. All private fire hydrant meters are to be phased out of the City of San Diego. All customers who wish to continue to use their own fire hydrant meters must adhere to the following conditions:
  - a. Meters shall meet all City specifications and American Water Works Association (AWWA) standards.
  - b. Customers currently using private fire hydrant meters in the City of San Diego water system will be allowed to continue using the meter under the following conditions:
    - 1. The customer must submit a current certificate of accuracy and calibration results for private meters and private backflows annually to the City of San Diego, Water Department, Meter Shop.



<b>CITY OF SAN DIEGO CALIFORNIA DEPARTMENT INSTRUCTIONS</b>	<b>NUMBER DI 55.27</b>	<b>DEPARTMENT Water Department</b>
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	<b>SUPERSEDES DI 55.27</b>	<b>DATED April 21, 2000</b>

2. The meter must be properly identifiable with a clearly labeled serial number on the body of the fire hydrant meter. The serial number shall be plainly stamped on the register lid and the main casing. Serial numbers shall be visible from the top of the meter casing and the numbers shall be stamped on the top of the inlet casing flange.
3. All meters shall be locked to the fire hydrant by the Water Department, Meter Section (see Section 4.7).
4. All meters shall be read by the Water Department, Meter Section (see Section 4.7).
5. All meters shall be relocated by the Water Department, Meter Section (see Section 4.7).
6. These meters shall be tested on the anniversary of the original test date and proof of testing will be submitted to the Water Department, Meter Shop, on a yearly basis. If not tested, the meter will not be allowed for use in the City of San Diego.
7. All private fire hydrant meters shall have backflow devices attached when installed.
8. The customer must maintain and repair their own private meters and private backflows.
9. The customer must provide current test and calibration results to the Water Department, Meter Shop after any repairs.
10. When private meters are damaged beyond repair, these private meters will be replaced by City owned fire hydrant meters.

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11. When a private meter malfunctions, the customer will be notified and the meter will be removed by the City and returned to the customer for repairs. Testing and calibration results shall be given to the City prior to any re-installation.
  12. The register shall be hermetically sealed straight reading and shall be readable from the inlet side. Registration shall be in hundred cubic feet.
  13. The outlet shall have a 2 ½ “National Standards Tested (NST) fire hydrant male coupling.
  14. Private fire hydrant meters shall not be transferable from one contracting company to another (i.e. if a company goes out of business or is bought out by another company).
- 4.4 All fire hydrant meters and appurtenances shall be installed, relocated and removed by the City of San Diego, Water Department. All City owned fire hydrant meters and appurtenances shall be maintained by the City of San Diego, Water Department, Meter Services.
- 4.5 If any fire hydrant meter is used in violation of this Department Instruction, the violation will be reported to the Code Compliance Section for investigation and appropriate action. Any customer using a fire hydrant meter in violation of the requirements set forth above is subject to fines or penalties pursuant to the Municipal Code, Section 67.15 and Section 67.37.
- 4.6 Conditions and Processes for Issuance of a Fire Hydrant Meter**
- Process for Issuance
- a. Fire hydrant meters shall only be used for the following purposes:
    1. Temporary irrigation purposes not to exceed one year.

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2. Construction and maintenance related activities (see Tab 2).
  - b. No customer inside or outside the boundaries of the City of San Diego Water Department shall resell any portion of the water delivered through a fire hydrant by the City of San Diego Water Department.
  - c. The City of San Diego allows for the issuance of a temporary fire hydrant meter for a period not to exceed 12 months (365 days). An extension can only be granted in writing from the Water Department Director for up to 90 additional days. A written request for an extension by the consumer must be submitted at least 30 days prior to the 12 month period ending. No extension shall be granted to any customer with a delinquent account with the Water Department. No further extensions shall be granted.
  - d. Any customer requesting the issuance of a fire hydrant meter shall file an application with the Meter Section. The customer must complete a "Fire Hydrant Meter Application" (Tab 1) which includes the name of the company, the party responsible for payment, Social Security number and/or California ID, requested location of the meter (a detailed map signifying an exact location), local contact person, local phone number, a contractor's license (or a business license), description of specific water use, duration of use at the site and full name and address of the person responsible for payment.
  - e. At the time of the application the customer will pay their fees according to the schedule set forth in the Rate Book of Fees and Charges, located in the City Clerk's Office. All fees must be paid by check, money order or cashiers check, made payable to the City Treasurer. Cash will not be accepted.
  - f. No fire hydrant meters shall be furnished or relocated for any customer with a delinquent account with the Water Department.
  - g. After the fees have been paid and an account has been created, the

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meter shall be installed within 48 hours (by the second business day). For an additional fee, at overtime rates, meters can be installed within 24 hours (within one business day).

#### 4.7 Relocation of Existing Fire Hydrant Meters

- a. The customer shall call the Fire Hydrant Meter Hotline (herein referred to as “Hotline”), a minimum of 24 hours in advance, to request the relocation of a meter. A fee will be charged to the existing account, which must be current before a work order is generated for the meter’s relocation.
- b. The customer will supply in writing the address where the meter is to be relocated (map page, cross street, etc). The customer must update the original Fire Hydrant Meter Application with any changes as it applies to the new location.
- c. Fire hydrant meters shall be read on a monthly basis. While fire hydrant meters and backflow devices are in service, commodity, base fee and damage charges, if applicable, will be billed to the customer on a monthly basis. If the account becomes delinquent, the meter will be removed.

#### 4.8 Disconnection of Fire Hydrant Meter

- a. After ten (10) months a “Notice of Discontinuation of Service” (Tab 3) will be issued to the site and the address of record to notify the customer of the date of discontinuance of service. An extension can only be granted in writing from the Water Department Director for up to 90 additional days (as stated in Section 4.6C) and a copy of the extension shall be forwarded to the Meter Shop Supervisor. If an extension has not been approved, the meter will be removed after twelve (12) months of use.
- b. Upon completion of the project the customer will notify the Meter Services office via the Hotline to request the removal of the fire hydrant meter and appurtenances. A work order will be generated

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for removal of the meter.

- c. Meter Section staff will remove the meter and backflow prevention assembly and return it to the Meter Shop. Once returned to the Meter Shop the meter and backflow will be tested for accuracy and functionality.
- d. Meter Section Staff will contact and notify Customer Services of the final read and any charges resulting from damages to the meter and backflow or its appurtenance. These charges will be added on the customer's final bill and will be sent to the address of record. Any customer who has an outstanding balance will not receive additional meters.
- e. Outstanding balances due may be deducted from deposits and any balances refunded to the customer. Any outstanding balances will be turned over to the City Treasurer for collection. Outstanding balances may also be transferred to any other existing accounts.

5. **EXCEPTIONS**

- 5.1 Any request for exceptions to this policy shall be presented, in writing, to the Customer Support Deputy Director, or his/her designee for consideration.

6. **MOBILE METER**

- 6.1 Mobile meters will be allowed on a case by case basis. All mobile meters will be protected by an approved backflow assembly and the minimum requirement will be a Reduced Pressure Principal Assembly. The two types of Mobile Meters are vehicle mounted and floating meters. Each style of meters has separate guidelines that shall be followed for the customer to retain service and are described below:

- a) **Vehicle Mounted Meters:** Customer applies for and receives a City owned Fire Hydrant Meter from the Meter Shop. The customer mounts the meter on the vehicle and brings it to the Meter Shop for

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inspection. After installation is approved by the Meter Shop the vehicle and meter shall be brought to the Meter Shop on a monthly basis for meter reading and on a quarterly basis for testing of the backflow assembly. Meters mounted at the owner's expense shall have the one year contract expiration waived and shall have meter or backflow changed if either fails.

b) **Floating Meters:** Floating Meters are meters that are not mounted to a vehicle. **(Note: All floating meters shall have an approved backflow assembly attached.)** The customer shall submit an application and a letter explaining the need for a floating meter to the Meter Shop. The Fire Hydrant Meter Administrator, after a thorough review of the needs of the customer, (i.e. number of jobsites per day, City contract work, lack of mounting area on work vehicle, etc.), may issue a floating meter. At the time of issue, it will be necessary for the customer to complete and sign the "Floating Fire Hydrant Meter Agreement" which states the following:

- 1) The meter will be brought to the Meter Shop at 2797 Caminito Chollas, San Diego on the third week of each month for the monthly read by Meter Shop personnel.
- 2) Every other month the meter will be read and the backflow will be tested. This date will be determined by the start date of the agreement.

If any of the conditions stated above are not met the Meter Shop has the right to cancel the contract for floating meter use and close the account associated with the meter. The Meter Shop will also exercise the right to refuse the issuance of another floating meter to the company in question.

Any Fire Hydrant Meter using reclaimed water shall not be allowed use again with any potable water supply. The customer shall incur the cost of replacing the meter and backflow device in this instance.

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7. **FEE AND DEPOSIT SCHEDULES**

7.1 **Fees and Deposit Schedules:** The fees and deposits, as listed in the Rate Book of Fees and Charges, on file with the Office of the City Clerk, are based on actual reimbursement of costs of services performed, equipment and materials. These deposits and fees will be amended, as needed, based on actual costs. Deposits, will be refunded at the end of the use of the fire hydrant meter, upon return of equipment in good working condition and all outstanding balances on account are paid. Deposits can also be used to cover outstanding balances.

All fees for equipment, installation, testing, relocation and other costs related to this program are subject to change without prior notification. The Mayor and Council will be notified of any future changes.

8. **UNAUTHORIZED USE OF WATER FROM A HYDRANT**

8.1 Use of water from any fire hydrant without a properly issued and installed fire hydrant meter is theft of City property. Customers who use water for unauthorized purposes or without a City of San Diego issued meter will be prosecuted.

8.2 If any unauthorized connection, disconnection or relocation of a fire hydrant meter, or other connection device is made by anyone other than authorized Water Department personnel, the person making the connection will be prosecuted for a violation of San Diego Municipal Code, Section 67.15. In the case of a second offense, the customer's fire hydrant meter shall be confiscated and/or the deposit will be forfeited.

8.3 Unauthorized water use shall be billed to the responsible party. Water use charges shall be based on meter readings, or estimates when meter readings are not available.

8.4 In case of unauthorized water use, the customer shall be billed for all applicable charges as if proper authorization for the water use had been obtained, including but not limited to bi-monthly service charges, installation charges and removal charges.

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- 8.5 If damage occurs to Water Department property (i.e. fire hydrant meter, backflow, various appurtenances), the cost of repairs or replacements will be charged to the customer of record (applicant).

**Water Department Director**

- Tabs: 1. Fire Hydrant Meter Application  
2. Construction & Maintenance Related Activities With No Return To Sewer  
3. Notice of Discontinuation of Service

#### APPENDIX

**Administering Division:** Customer Support Division

**Subject Index:** Construction Meters  
Fire Hydrant  
Fire Hydrant Meter Program  
Meters, Floating or Vehicle Mounted  
Mobile Meter  
Program, Fire Hydrant Meter

**Distribution:** DI Manual Holders





# Application for Fire Hydrant Meter (EXHIBIT A)

(For Office Use Only)

NS REQ	FAC#
DATE	BY

METER SHOP (619) 527-7449

## Meter Information

Application Date	Requested Install Date:
------------------	-------------------------

Fire Hydrant Location: (Attach Detailed Map//Thomas Bros. Map Location or Construction drawing.) <u>Zip:</u>	T.B.	G.B. (CITY USE)
Specific Use of Water:		
Any Return to Sewer or Storm Drain, if so, explain:		
Estimated Duration of Meter Use: <input type="text"/>	<input type="checkbox"/>	Check Box if Reclaimed Water

## Company Information

Company Name:			
Mailing Address:			
City:	State:	Zip:	Phone: ( )
*Business license#		*Contractor license#	
A Copy of the Contractor's license OR Business License is required at the time of meter issuance.			
Name and Title of Billing Agent: <small>(PERSON IN ACCOUNTS PAYABLE)</small>			Phone: ( )
Site Contact Name and Title:			Phone: ( )
Responsible Party Name:			Title:
Cal ID#			Phone: ( )
Signature:		Date:	
<small>Guarantees Payment of all Charges Resulting from the use of this Meter. Insures that employees of this Organization understand the proper use of Fire Hydrant Meter</small>			

<b>Fire Hydrant Meter Removal Request</b>	Requested Removal Date:
Provide Current Meter Location if Different from Above:	
Signature:	Title:      Date:
Phone: ( )	Pager: ( )

<input type="checkbox"/> City Meter	<input type="checkbox"/> Private Meter	
Contract Acct #:	Deposit Amount: <b>\$ 936.00</b>	Fees Amount: <b>\$ 62.00</b>
Meter Serial #	Meter Size: <b>05</b>	Meter Make and Style: <b>6-7</b>
Backflow #	Backflow Size:	Backflow Make and Style:
Name:	Signature:	Date:

**WATER USES WITHOUT ANTICIPATED CHARGES FOR RETURN TO SEWER**

Auto Detailing  
Backfilling  
Combination Cleaners (Vactors)  
Compaction  
Concrete Cutters  
Construction Trailers  
Cross Connection Testing  
Dust Control  
Flushing Water Mains  
Hydro Blasting  
Hydro Seeing  
Irrigation (for establishing irrigation only; not continuing irrigation)  
Mixing Concrete  
Mobile Car Washing  
Special Events  
Street Sweeping  
Water Tanks  
Water Trucks  
Window Washing

**Note:**

1. If there is any return to sewer or storm drain, then sewer and/or storm drain fees will be charges.

Date

Name of Responsible Party  
Company Name and Address  
Account Number: \_\_\_\_\_

Subject: Discontinuation of Fire Hydrant Meter Service

Dear Water Department Customer:

The authorization for use of Fire Hydrant Meter # \_\_\_\_\_, located at *(Meter Location Address)* ends in 60 days and will be removed on or after *(Date Authorization Expires)*. Extension requests for an additional 90 days must be submitted in writing for consideration 30 days prior to the discontinuation date. If you require an extension, please contact the Water Department, or mail your request for an extension to:

City of San Diego  
Water Department  
Attention: Meter Services  
2797 Caminito Chollas  
San Diego, CA 92105-5097

Should you have any questions regarding this matter, please call the Fire Hydrant Hotline at (619) \_\_\_\_\_ - \_\_\_\_\_.

Sincerely,

Water Department

## **APPENDIX C**

### **MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE**

## **MATERIALS TYPICALLY ACCEPTED BY CERTIFICATE OF COMPLIANCE**

1. Soil amendment
2. Fiber mulch
3. PVC or PE pipe up to 16 inch diameter
4. Stabilizing emulsion
5. Lime
6. Preformed elastomeric joint seal
7. Plain and fabric reinforced elastomeric bearing pads
8. Steel reinforced elastomeric bearing pads
9. Waterstops (Special Condition)
10. Epoxy coated bar reinforcement
11. Plain and reinforcing steel
12. Structural steel
13. Structural timber and lumber
14. Treated timber and lumber
15. Lumber and timber
16. Aluminum pipe and aluminum pipe arch
17. Corrugated steel pipe and corrugated steel pipe arch
18. Structural metal plate pipe arches and pipe arches
19. Perforated steel pipe
20. Aluminum underdrain pipe
21. Aluminum or steel entrance tapers, pipe downdrains, reducers, coupling bands and slip joints
22. Metal target plates
23. Paint (traffic striping)
24. Conductors
25. Painting of electrical equipment
26. Electrical components
27. Engineering fabric
28. Portland Cement
29. PCC admixtures
30. Minor concrete, asphalt
31. Asphalt (oil)
32. Liquid asphalt emulsion
33. Epoxy

**APPENDIX D**  
**SAMPLE CITY INVOICE WITH SPEND CURVE**

City of San Diego, CM&FS Div., 9753 Chesapeake Drive, SD CA 92123

**Project Name:**

Work Order No or Job Order No.

City Purchase Order No.

Resident Engineer (RE):

RE Phone#: Fax#:

**Contractor's Name:**

Contractor's Address:

Contractor's Phone #:

Contractor's fax #:

Contact Name:

**Invoice No.**

**Invoice Date:**

Billing Period: ( To )

Item #	Item Description	Contract Authorization				Previous Totals To Date		This Estimate		Totals to Date	
		Unit	Price	Qty	Extension	%/QTY	Amount	% / QTY	Amount	% / QTY	Amount
1					\$ -		\$ -		\$ -	0.00%	\$ -
2					\$ -		\$ -		\$ -	0.00%	\$ -
3					\$ -		\$ -		\$ -	0.00%	\$ -
4					\$ -		\$ -		\$ -	0.00%	\$ -
5					\$ -		\$ -		\$ -	0.00%	\$ -
6					\$ -		\$ -		\$ -	0.00%	\$ -
7					\$ -		\$ -		\$ -	0.00%	\$ -
8					\$ -		\$ -		\$ -	0.00%	\$ -
5					\$ -		\$ -		\$ -	0.00%	\$ -
6					\$ -		\$ -		\$ -	0.00%	\$ -
7					\$ -		\$ -		\$ -	0.00%	\$ -
8					\$ -		\$ -		\$ -	0.00%	\$ -
9					\$ -		\$ -		\$ -	0.00%	\$ -
10					\$ -		\$ -		\$ -	0.00%	\$ -
11					\$ -		\$ -		\$ -	0.00%	\$ -
12					\$ -		\$ -		\$ -	0.00%	\$ -
13					\$ -		\$ -		\$ -	0.00%	\$ -
14					\$ -		\$ -		\$ -	0.00%	\$ -
15					\$ -		\$ -		\$ -	0.00%	\$ -
16					\$ -		\$ -		\$ -	0.00%	\$ -
17	Field Orders				\$ -		\$ -		\$ -	0.00%	\$ -
					\$ -		\$ -		\$ -	0.00%	\$ -
	<b>CHANGE ORDER No.</b>				\$ -		\$ -		\$ -	0.00%	\$ -
					\$ -		\$ -		\$ -	0.00%	\$ -
	Total Authorized Amount (including approved Change Order)				\$ -		\$ -		\$ -	<b>Total Billed</b>	\$ -

**SUMMARY**

A. Original Contract Amount	\$ -
B. Approved Change Order #00 Thru #00	\$ -
C. Total Authorized Amount (A+B)	\$ -
D. Total Billed to Date	\$ -
E. Less Total Retention (5% of D )	\$ -
F. Less Total Previous Payments	\$ -
<b>G. Payment Due Less Retention</b>	<b>\$0.00</b>
H. Remaining Authorized Amount	\$0.00

I certify that the materials  
have been received by me in  
the quality and quantity specified

Resident Engineer

Construction Engineer

**Retention and/or Escrow Payment Schedule**

Total Retention Required as of this billing (Item E)	\$0.00
Previous Retention Withheld in PO or in Escrow	\$0.00
<b>Add'l Amt to Withhold in PO/Transfer in Escrow:</b>	<b>\$0.00</b>
<b>Amt to Release to Contractor from PO/Escrow:</b>	

Contractor Signature and Date: \_\_\_\_\_

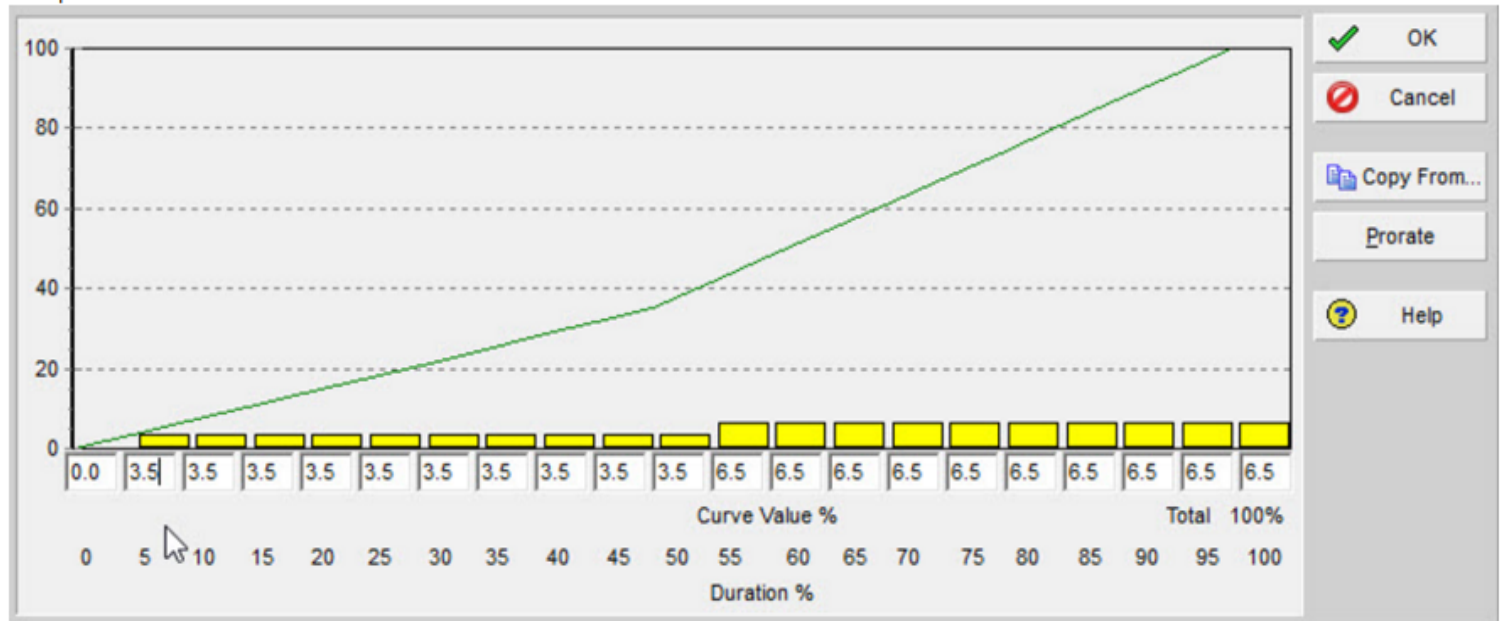
## Sample Project Spend Curve

Sample Date Entries Required

Incremental Curve Value  
Duration % Increment

0.0%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%

Sample Screenshot from Primavera P6





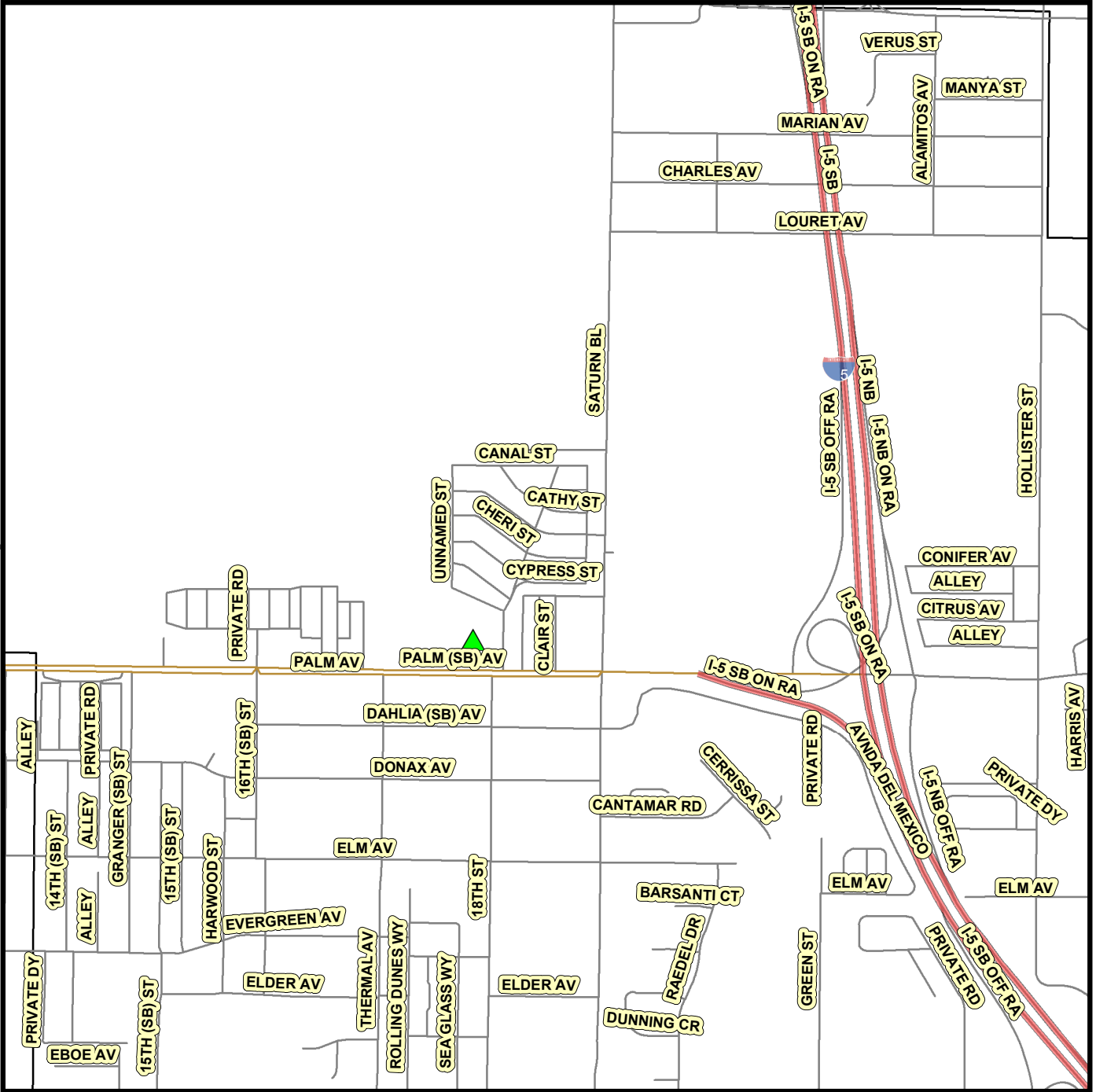
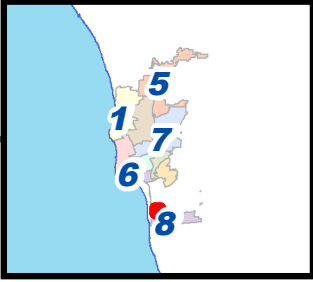
**APPENDIX E**  
**LOCATION MAP**

## Palm Avenue Transitional Housing

SENIOR ENGINEER  
Jason Grani  
619-533-7525

PROJECT MANAGER  
Jasiah Neff  
619-533-7462

FOR QUESTIONS ABOUT THIS PROJECT  
Call: 619-533-4207  
Email: [engineering@sandiego.gov](mailto:engineering@sandiego.gov)



### Legend

 Palm Avenue Transitional Housing

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**APPENDIX F**  
**SAMPLE OF PUBLIC NOTICE**



## CONSTRUCTION NOTICE

### PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

#### The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
- Streets where trenching takes place will be resurfaced and curb ramps will be upgraded to facilitate access for persons with disabilities where required.
- This work is anticipated to be complete in your community by December 2016.

#### How your neighborhood may be impacted:

- Water service to some properties during construction will be provided by a two-inch highline pipe that will run along the curb. To report a highline leak call 619-515-3525.
- Temporary water service disruptions are planned. If planned disruptions impact your property, you will receive advance notice.
- Parking restrictions will exist because of the presence of construction equipment and materials.
- "No Parking" signs will be displayed 72 hours in advance of the work.
- Cars parked in violation of signs will be TOWED.

#### Hours and Days of Operation:

Monday through Friday X:XX AM to X:XX PM.

#### City of San Diego Contractor:

Company Name, XXX-XXX-XXXX



## CONSTRUCTION NOTICE

### PROJECT TITLE

Work on your street will begin within one week to replace the existing water mains servicing your community.

#### The work will consist of:

- Saw-cutting and trench work on Ingulf Street from Morena Boulevard to Galveston Street to install new water mains, water laterals and fire hydrants.
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- Temporary water service disruptions are planned. If planned disruptions impact your property, you will receive advance notice.
- Parking restrictions will exist because of the presence of construction equipment and materials.
- "No Parking" signs will be displayed 72 hours in advance of the work.
- Cars parked in violation of signs will be TOWED.

#### Hours and Days of Operation:

Monday through Friday X:XX AM to X:XX PM.

#### City of San Diego Contractor:

Company Name, XXX-XXX-XXXX

To contact the City of San Diego:  Public Works  
619-533-4207 | [engineering@sandiego.gov](mailto:engineering@sandiego.gov) | [sandiego.gov/CIP](http://sandiego.gov/CIP)

To contact the City of San Diego:  Public Works  
619-533-4207 | [engineering@sandiego.gov](mailto:engineering@sandiego.gov) | [sandiego.gov/CIP](http://sandiego.gov/CIP)

## **APPENDIX G**

### **ADVANCED METERING INFRASTRUCTURE (AMI) DEVICE PROTECTION**

## Protecting AMI Devices in Meter Boxes and on Street Lights

The Public Utilities Department (PUD) has begun the installation of the Advanced Metering Infrastructure (AMI) technology as a new tool to enhance water meter reading accuracy and efficiency, customer service and billing, and to be used by individual accounts to better manage the efficient use of water. **All AMI devices shall be protected per Section 5-2, "Protection", of the 2015 Whitebook.**

AMI technology allows water meters to be read electronically rather than through direct visual inspection by PUD field staff. This will assist PUD staff and customers in managing unusual consumption patterns which could indicate leaks or meter tampering on a customer's property.

Three of the main components of an AMI system are the:

- A. Endpoints, see Photo 1:

**Photo 1**



B. AMI Antenna attached to Endpoint (antenna not always required), see Photo 2:

**Photo 2**



Network Devices, see Photo 3:

**Photo 3**



AMI endpoints transmit meter information to the AMI system and will soon be on the vast majority of meters in San Diego. These AMI devices provide interval consumption data to the PUD's Customer Support Division. If these devices are damaged or communication is interrupted, this Division will be alerted of the situation. The endpoints are installed in water meter boxes, coffins, and vaults adjacent to the meter. A separate flat round antenna may also be installed through the meter box lid. This antenna is connected to the endpoint via cable. The following proper installation shall be implemented when removing the lid to avoid damaging the antenna, cable, and/or endpoint. Photo 4 below demonstrates a diagram of the connection:

**Photo 4**





The AMI device ERT/Endpoint/Transmitter shall be positioned and installed as discussed in this Appendix. If the ERT/Endpoint/Transmitter is disturbed, it shall be re-installed and returned to its original installation with the end points pointed upwards as shown below in Photo 5.

**The PUD's code compliance staff will issue citations and invoices to you for any damaged AMI devices that are not re-installed as discussed in the Contract Document**

Photo 5 below shows a typical installation of an AMI endpoint on a water meter.

**Photo 5**

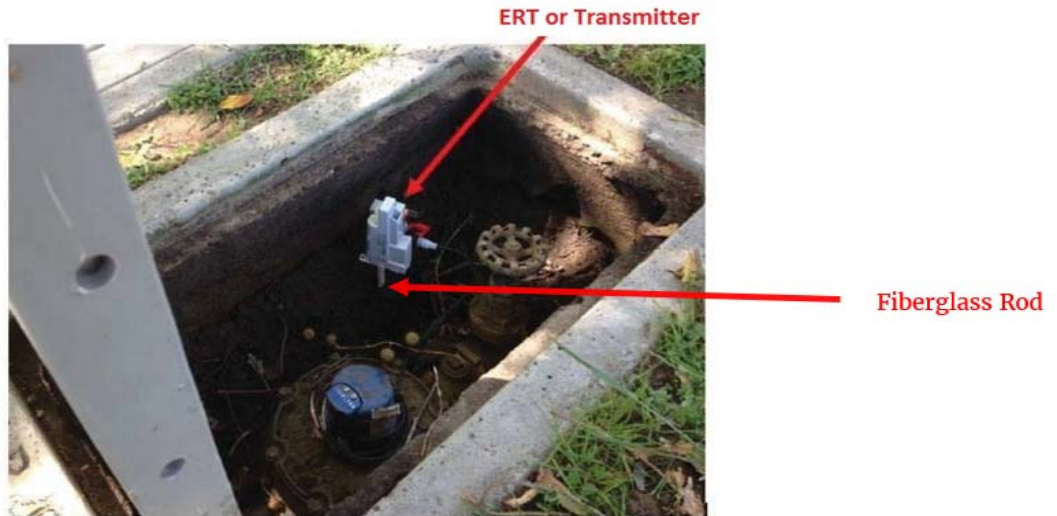


Photo 6 below is an example of disturbance that shall be avoided:

**Photo 6**



**You are responsible when working in and around meter boxes.** If you encounter these endpoints, use proper care and do not disconnect them from the registers on top of the water meter. If the lid has an antenna drilled through, do not change or tamper with the lid and inform the Resident Engineer immediately about the location of that lid. Refer to Photo 7 below:

**Photo 7**



Another component of the AMI system are the Network Devices. The Network Devices are strategically placed units (mainly on street light poles) that collect interval meter reading data from multiple meters for transmission to the Department Control Computer. **If you come across any of these devices on street lights that will be removed or replaced (refer to Photos 8 and 9 below), notify AMI Project Manager Arwa Sayed at (619) 362-0121 immediately.**

Photo 8 shows an installed network device on a street light. On the back of each Network Device is a sticker with contact information. See Photo 9. **Call PUD Water Emergency Repairs at 619-515-3525 if your work will impact these street lights.** These are assets that belong to the City of San Diego and you shall be responsible for any costs of disruption of this network.

**Photo 8**



**Network Device**

**Photo 9**



**If you encounter any bad installations, disconnected/broken/buried endpoints, or inadvertently damage any AMI devices or cables, notify the Resident Engineer immediately. The Resident Engineer will then immediately contact the AMI Project Manager, Arwa Sayed, at (619) 362-0121.**

**ATTACHMENT F**  
**INTENTIONALLY LEFT BLANK**

**ATTACHMENT G**  
**CONTRACT AGREEMENT**

## CONTRACT AGREEMENT

---

### CONSTRUCTION CONTRACT

This contract is made and entered into between THE CITY OF SAN DIEGO, a municipal corporation, herein called "City", and West Coast General, Corporation, herein called "Contractor" for construction of **Palm Avenue Transitional Housing**; Bid No. **K-18-1746-DBB-3**; in the amount of **Five Million Three Hundred Ninety-Seven Thousand Seventy-Three Dollars and Zero Cents (\$5,397,073.00)**, which is comprised of the Base Bid plus Alternate A.

IN CONSIDERATION of the payments to be made hereunder and the mutual undertakings of the parties hereto, City and Contractor agree as follows:

1. The following are incorporated into this contract as though fully set forth herein:
  - (a) The attached Faithful Performance and Payment Bonds.
  - (b) The attached Proposal included in the Bid documents by the Contractor.
  - (c) Reference Standards listed in the Instruction to Bidders and the Supplementary Special Provisions (SSP).
  - (d) That certain documents entitled **Palm Avenue Transitional Housing**, on file in the office of the Public Works Department as Document No. **S-18003**, as well as all matters referenced therein.
2. The Contractor shall perform and be bound by all the terms and conditions of this contract and in strict conformity therewith shall perform and complete in a good and workmanlike manner **Palm Avenue Transitional Housing**, Bid Number: **K-18-1746-DBB-3**, San Diego, California.
3. For such performances, the City shall pay to Contractor the amounts set forth at the times and in the manner and with such additions or deductions as are provided for in this contract, and the Contractor shall accept such payment in full satisfaction of all claims incident to such performances.
4. No claim or suit whatsoever shall be made or brought by Contractor against any officer, agent, or employee of the City for or on account of anything done or omitted to be done in connection with this contract, nor shall any such officer, agent, or employee be liable hereunder.
5. This contract is effective as of the date that the Mayor or designee signs the agreement.

**CONTRACT AGREEMENT (continued)**

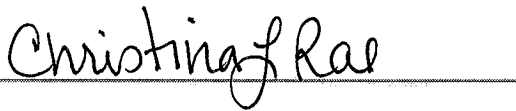
**IN WITNESS WHEREOF**, this Agreement is signed by the City of San Diego, acting by and through its Mayor or designee, pursuant to Municipal Code §22.3102 authorizing such execution.

**THE CITY OF SAN DIEGO**

**APPROVED AS TO FORM**

By 

Mara W. Elliott, City Attorney

By 

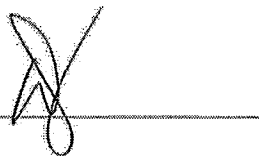
Print Name: Stephen Samara  
Interim Deputy Director

Print Name: Christina L. Rae  
Deputy City Attorney

Date: 7/13/2018

Date: 7/18/18

**CONTRACTOR**

By 

Print Name: David E. Davey

Title: President

Date: 6/28/18

City of San Diego License No.: B1992002309

State Contractor's License No.: 479019

DEPARTMENT OF INDUSTRIAL RELATIONS (DIR) REGISTRATION NUMBER: 1000002666

## CERTIFICATIONS AND FORMS

**The Bidder / Proposer, by submitting its electronic bid or proposal, agrees to and certifies under penalty of perjury under the laws of the State of California, that the certifications, forms and affidavits submitted as part of this submission are true and correct.**



## **BIDDER'S GENERAL INFORMATION**

To the City of San Diego:

Pursuant to "Notice Inviting Bids", specifications, and requirements on file with the City Clerk, and subject to all provisions of the Charter and Ordinances of the City of San Diego and applicable laws and regulations of the United States and the State of California, the undersigned hereby proposes to furnish to the City of San Diego, complete at the prices stated herein, the items or services hereinafter mentioned. The undersigned further warrants that this bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

The undersigned bidder(s) further warrants that bidder(s) has thoroughly examined and understands the entire Contract Documents (plans and specifications) and the Bidding Documents therefore, and that by submitting said Bidding Documents as its bid proposal, bidder(s) acknowledges and is bound by the entire Contract Documents, including any addenda issued thereto, as such Contract Documents incorporated by reference in the Bidding Documents.

**NON-COLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED  
WITH BID UNDER 23 UNITED STATES CODE 112 AND PUBLIC CONTRACT CODE  
7106**

State of California

County of San Diego

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

## CONTRACTOR CERTIFICATION

---

### DRUG-FREE WORKPLACE

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-17 regarding Drug-Free Workplace as outlined in the WHITEBOOK, Section 7-13.3, "Drug-Free Workplace", of the project specifications, and that;

This company\_has in place a drug-free workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of subdivisions a) through c) of the policy as outlined.

## **CONTRACTOR CERTIFICATION**

---

### **AMERICAN WITH DISABILITIES ACT (ADA) COMPLIANCE CERTIFICATION**

I hereby certify that I am familiar with the requirements of San Diego City Council Policy No. 100-4 regarding the American With Disabilities Act (ADA) outlined in the WHITEBOOK, Section 7-13.2, "American With Disabilities Act", of the project specifications, and that:

This company has in place workplace program that complies with said policy. I further certify that each subcontract agreement for this project contains language which indicates the subcontractor's agreement to abide by the provisions of the policy as outlined.

## **CONTRACTOR CERTIFICATION**

---

### **CONTRACTOR STANDARDS – PLEDGE OF COMPLIANCE**

I declare under penalty of perjury that I am authorized to make this certification on behalf of the company submitting this bid/proposal, that as Contractor, I am familiar with the requirements of City of San Diego Municipal Code § 22.3004 regarding Contractor Standards as outlined in the WHITEBOOK, Section 7-13.4, ("Contractor Standards"), of the project specifications, and that Contractor has complied with those requirements.

I further certify that each of the Contractor's subcontractors has completed a Pledge of Compliance attesting under penalty of perjury of having complied with City of San Diego Municipal Code § 22.3004.

## CONTRACTOR CERTIFICATION

---

### EQUAL BENEFITS ORDINANCE CERTIFICATION

I declare under penalty of perjury that I am familiar with the requirements of and in compliance with the City of San Diego Municipal Code § 22.4300 regarding Equal Benefits Ordinance.

## **CONTRACTOR CERTIFICATION**

---

### **EQUAL PAY ORDINANCE CERTIFICATION**

Contractor shall comply with the Equal Pay Ordinance (EPO) codified in the San Diego Municipal Code (SDMC) at section 22.4801 through 22.4809, unless compliance is not required based on an exception listed in SDMC section 22.4804.

Contractor shall require all of its subcontractors to certify compliance with the EPO in their written subcontracts.

Contractor must post a notice informing its employees of their rights under the EPO in the workplace or job site.

By signing this Contract with the City of San Diego, Contractor acknowledges the EPO requirements and pledges ongoing compliance with the requirements of SDMC Division 48, section 22.4801 et seq., throughout the duration of this Contract.

## **AFFIDAVIT OF DISPOSAL**

(To be submitted upon completion of Construction pursuant to the contracts Certificate of Completion)

**WHEREAS**, on the \_\_\_\_\_ DAY OF \_\_\_\_\_, 2\_\_\_\_ the undersigned entered into and executed a contract with the City of San Diego, a municipal corporation, for:

**Palm Avenue Transitional Housing**  
(Name of Project)

as particularly described in said contract and identified as Bid No. **K-18-1746-DBB-3**; SAP No. (WBS/IO/CC) **S-18003**; and **WHEREAS**, the specification of said contract requires the Contractor to affirm that "all brush, trash, debris, and surplus materials resulting from this project have been disposed of in a legal manner"; and **WHEREAS**, said contract has been completed and all surplus materials disposed of:

\_\_\_\_\_  
\_\_\_\_\_

**NOW, THEREFORE**, in consideration of the final payment by the City of San Diego to said Contractor under the terms of said contract, the undersigned Contractor, does hereby affirm that all surplus materials as described in said contract have been disposed of at the following location(s)

\_\_\_\_\_  
\_\_\_\_\_

and that they have been disposed of according to all applicable laws and regulations.

Dated this \_\_\_\_\_ DAY OF \_\_\_\_\_, \_\_\_\_\_.

By: \_\_\_\_\_  
Contractor

**ATTEST:**

State of \_\_\_\_\_ County of \_\_\_\_\_

On this \_\_\_\_\_ DAY OF \_\_\_\_\_, 2\_\_\_\_, before the undersigned, a Notary Public in and for said County and State, duly commissioned and sworn, personally appeared \_\_\_\_\_ known to me to be the \_\_\_\_\_ Contractor named in the foregoing Release, and whose name is subscribed thereto, and acknowledged to me that said Contractor executed the said Release.

Notary Public in and for said County and State



**LIST OF SUBCONTRACTORS**

**\*\*\* PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY \*\*\* TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY \*\*\* SEE INSTRUCTIONS TO BIDDERS FOR FURTHER INFORMATION**

In accordance with the requirements of the "Subletting and Subcontracting Fair Practices Act", Section 4100, of the California Public Contract Code (PCC), the Bidder is to list below the name, address and license number of each Subcontractor who will perform work, labor, render services or specially fabricate and install a portion [type] of the work or improvement, in an amount of or in excess of 0.5% of the Contractor's total Bid. Failure to comply with this requirement may result in the Bid being rejected as non-responsive. The Contractor is to list only one Subcontractor for each portion of the Work. The Bidder's attention is directed to the Special Provisions - General; Paragraph 2-3 Subcontracts, which stipulates the percentage of the Work to be performed with the Bidder's own forces. The Bidder is to also list all SLBE, ELBE, DBE, DVBE, MBE, WBE, OBE, SDB, WoSB, HUBZone, and SDVOSB Subcontractors for which the Bidders are seeking recognition towards achieving any mandatory, voluntary, or both subcontracting participation percentages.

NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	DIR Registration Number	CONSTRUCTOR OR DESIGNER	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB <sup>Ⓚ</sup>	WHERE CERTIFIED <sup>②</sup>	CHECK IF JOINT VENTURE PARTNERSHIP
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____								
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____								

- ① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):
- |   |        |  |         |
|---|--------|--|---------|
| Certified Minority Business Enterprise        | MBE    | Certified Woman Business Enterprise            | WBE     |
| Certified Disadvantaged Business Enterprise   | DBE    | Certified Disabled Veteran Business Enterprise | DVBE    |
| Other Business Enterprise                     | OBE    | Certified Emerging Local Business Enterprise   | ELBE    |
| Certified Small Local Business Enterprise     | SLBE   | Small Disadvantaged Business                   | SDB     |
| Woman-Owned Small Business                    | WoSB   | HUBZone Business                               | HUBZone |
| Service-Disabled Veteran Owned Small Business | SDVOSB |  |         |
- ② As appropriate, Bidder shall indicate if Subcontractor is certified by:
- |  |        |  |          |
|--|--------|--|----------|
| City of San Diego                                    | CITY   | State of California Department of Transportation | CALTRANS |
| California Public Utilities Commission               | CPUC   |  |          |
| State of California's Department of General Services | CADoGS | City of Los Angeles                              | LA       |
| State of California                                  | CA     | U.S. Small Business Administration               | SBA      |

**The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.**

**NAMED EQUIPMENT/MATERIAL SUPPLIER LIST**

**\*\*\* PROVIDED FOR ILLUSTRATIVE PURPOSES ONLY \*\*\* TO BE SUBMITTED IN ELECTRONIC FORMAT ONLY \*\*\* SEE INSTRUCTIONS TO BIDDERS FOR FURTHER INFORMATION**

NAME, ADDRESS AND TELEPHONE NUMBER OF VENDOR/SUPPLIER	DIR Registration Number	MATERIALS OR SUPPLIES	DOLLAR VALUE OF MATERIAL OR SUPPLIES	SUPPLIER (Yes/No)	MANUFACTURER (Yes/No)	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WoSB, HUBZone, OR SDVOSB <sup>①</sup>	WHERE CERTIFIED <sup>②</sup>
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____							
Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____							

- ① As appropriate, Bidder shall identify Vendor/Supplier as one of the following and shall include a valid proof of certification (except for OBE,SLBE and ELBE):
- |   |        |  |         |
|---|--------|--|---------|
| Certified Minority Business Enterprise        | MBE    | Certified Woman Business Enterprise            | WBE     |
| Certified Disadvantaged Business Enterprise   | DBE    | Certified Disabled Veteran Business Enterprise | DVBE    |
| Other Business Enterprise                     | OBE    | Certified Emerging Local Business Enterprise   | ELBE    |
| Certified Small Local Business Enterprise     | SLBE   | Small Disadvantaged Business                   | SDB     |
| Woman-Owned Small Business                    | WoSB   | HUBZone Business                               | HUBZone |
| Service-Disabled Veteran Owned Small Business | SDVOSB |  |         |
- ② As appropriate, Bidder shall indicate if Vendor/Supplier is certified by:
- |  |        |  |          |
|--|--------|--|----------|
| City of San Diego                                    | CITY   | State of California Department of Transportation | CALTRANS |
| California Public Utilities Commission               | CPUC   |  |          |
| State of California's Department of General Services | CADoGS | City of Los Angeles                              | LA       |
| State of California                                  | CA     | U.S. Small Business Administration               | SBA      |

**The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.**

**SUBCONTRACTORS ADDITIVE/DEDUCTIVE ALTERNATE**

Alternate A

ADDITIVE/DEDUCTIVE ALTERNATE	NAME, ADDRESS AND TELEPHONE NUMBER OF SUBCONTRACTOR	CONSTRUCTOR OR DESIGNER	DIR Registration Number	SUBCONTRACTOR LICENSE NUMBER	TYPE OF WORK	DOLLAR VALUE OF SUBCONTRACT	MBE, WBE, DBE, DVBE, OBE, ELBE, SLBE, SDB, WOSB, HUBZone, OR SDVOSB	WHERE CERTIFIED	CHECK IF JOINT VENTURE PARTNER SHIP
A-11	Name: <u>M Biny C Construction</u> Address: <u>674 Kanchens Dr.</u> State: <u>CA</u> City: <u>San Marcos</u> Zip: <u>92069</u> Phone: <u>760-744-4131</u> Email: <u>joey.dyn@cmbarconline.com</u>	C	100001297	809960	perform at solar and tunnels	527,9608			
	Name: _____ Address: _____ City: _____ State: _____ Zip: _____ Phone: _____ Email: _____								

① As appropriate, Bidder shall identify Subcontractor as one of the following and shall include a valid proof of certification (except for OBE, SLBE and ELBE):

- Certified Minority Business Enterprise
- Certified Disadvantaged Business Enterprise
- Other Business Enterprise
- Certified Small Local Business Enterprise
- Woman-Owned Small Business
- Service-Disabled Veteran Owned Small Business
- Certified Woman Business Enterprise
- Certified Disabled Veteran Business Enterprise
- Certified Emerging Local Business Enterprise
- Small Disadvantaged Business
- HUBZone Business

② As appropriate, Bidder shall indicate if Subcontractor is certified by:

- MBE
- DBE
- OBE
- SLBE
- WOSB
- SDVOSB
- CITY
- CPUC
- LA
- SBA
- WBE
- DVBE
- ELBE
- SDB
- HUBZone
- CALTRANS
- CADoGS
- CA

The Bidder will not receive any subcontracting participation percentages if the Bidder fails to submit the required proof of certification.

## **ELECTRONICALLY SUBMITTED FORMS**

### **THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF FORMAT WITH BID SUBMISSION**

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

- A. BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions**
- B. CONTRACTOR’S CERTIFICATION OF PENDING ACTIONS**
- C. Lobby Prohibition, Certification and Disclosure**
- D. Disclosure of Lobbying Activities**

**Bids will not be accepted until ALL the above-named forms are submitted as part of the bid submittal**

**BID BOND**

**See Instructions to Bidders, Bidder Guarantee of Good Faith  
(Bid Security)**

KNOW ALL MEN BY THESE PRESENTS,

That West Coast General Corporation as Principal,  
and Fidelity and Deposit Company of Maryland as Surety, are held  
and firmly bound unto The City of San Diego hereinafter called "OWNER," in the sum  
of **10% OF THE TOTAL BID AMOUNT** for the payment of which sum, well and truly to be made, we  
bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally,  
firmly by these presents.

WHEREAS, said Principal has submitted a Bid to said OWNER to perform the WORK required under  
the bidding schedule(s) of the OWNER's Contract Documents entitled

PALM AVENUE TRANSITIONAL HOUSING, Bond No. K-18-1746-DBB-3

NOW THEREFORE, if said Principal is awarded a contract by said OWNER and, within the time and in  
the manner required in the "Notice Inviting Bids" enters into a written Agreement on the form of  
agreement bound with said Contract Documents, furnishes the required certificates of insurance, and  
furnishes the required Performance Bond and Payment Bond, then this obligation shall be null and  
void, otherwise it shall remain in full force and effect. In the event suit is brought upon this bond by  
said OWNER and OWNER prevails, said Surety shall pay all costs incurred by said OWNER in such suit,  
including a reasonable attorney's fee to be fixed by the court.

SIGNED AND SEALED, this 8th day of May, 2018

West Coast General Corporation (SEAL)     Fidelity and Deposit Company of Maryland (SEAL)  
(Principal)     (Surety)

By:  David E. Davey,  
(Signature)     President

By:  Jose Lemus,  
(Signature)     Attorney-in-Fact

(SEAL AND NOTARIAL ACKNOWLEDGEMENT OF SURETY)

# CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

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 that document.

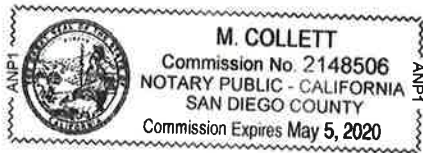
STATE OF CALIFORNIA

County of San Diego

On MAY 08 2018 before me, M. Collett, Notary Public,  
Date Insert Name of Notary exactly as it appears on the official seal

personally appeared Jose Lemus  
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/~~are~~ subscribed to the within instrument and acknowledged to me that he/~~she/they~~ executed the same in his/~~her/their~~ authorized capacity(~~ies~~), and that by his/~~her/their~~ signature(~~s~~) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.



Place Notary Seal Above

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

Witness my hand and official seal.

Signature M. Collett  
Signature of Notary Public M. Collett

## OPTIONAL

Though the information below is not required by law, it may prove valuable to persons relying on the document and could prevent fraudulent removal and reattachment of the form to another document.

### Description of Attached Document

Title or Type of Document: \_\_\_\_\_

Document Date: \_\_\_\_\_ Number of Pages: \_\_\_\_\_

Signer(s) Other Than Named Above: \_\_\_\_\_

### Capacity(ies) Claimed by Signer(s)

Signer's Name: \_\_\_\_\_

- Individual
- Corporate Officer — Title(s): \_\_\_\_\_
- Partner  Limited  General
- Attorney in Fact
- Trustee
- Guardian or Conservator
- Other: \_\_\_\_\_

RIGHT THUMBPRINT  
OF SIGNER  
Top of thumb here

Signer is Representing:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signer's Name: \_\_\_\_\_

- Individual
- Corporate Officer — Title(s): \_\_\_\_\_
- Partner  Limited  General
- Attorney in Fact
- Trustee
- Guardian or Conservator
- Other: \_\_\_\_\_

RIGHT THUMBPRINT  
OF SIGNER  
Top of thumb here

Signer is Representing:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**ZURICH AMERICAN INSURANCE COMPANY  
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY  
FIDELITY AND DEPOSIT COMPANY OF MARYLAND  
POWER OF ATTORNEY**

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Maryland, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Maryland (herein collectively called the "Companies"), by **DAVID MCVICKER, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Richard HALLETT, Aidan SMOCK, Tim MCCLELLAN, Marta COLLETT and Jose LEMUS, all of San Diego, California, EACH** its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: **any and all bonds and undertakings**, and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies, and is now in force.

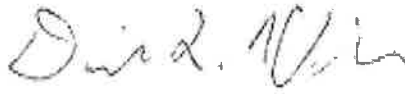
IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 3rd day of August, A.D. 2017.

ATTEST:

**ZURICH AMERICAN INSURANCE COMPANY  
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY  
FIDELITY AND DEPOSIT COMPANY OF MARYLAND**



By:   
Assistant Secretary  
Joshua Lecker

  
Vice President  
David McVicker

State of Maryland  
County of Baltimore

On this 3rd day of August, A.D. 2017, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **DAVID MCVICKER, Vice President, and JOSHUA LECKER, Assistant Secretary**, of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.





Constance A. Dunn, Notary Public  
My Commission Expires: July 9, 2019

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify or revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Vice President of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this \_\_\_ day of MAY 08 2018, 20\_\_.



*Michael Bond*

Michael Bond, Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT ALL REQUIRED INFORMATION TO:

Zurich American Insurance Co.  
Attn: Surety Claims  
1299 Zurich Way  
Schaumburg, IL 60196-1056



## CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS

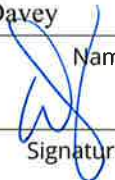
As part of its bid or proposal (Non-Price Proposal in the case of Design-Build contracts), the Bidder shall provide to the City a list of all instances within the past 10 years where a complaint was filed or pending against the Bidder in a legal or administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers, and a description of the status or resolution of that complaint, including any remedial action taken.

**CHECK ONE BOX ONLY.**

- The undersigned certifies that within the past 10 years the Bidder has NOT been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers.
- The undersigned certifies that within the past 10 years the Bidder has been the subject of a complaint or pending action in a legal administrative proceeding alleging that Bidder discriminated against its employees, subcontractors, vendors or suppliers. A description of the status or resolution of that complaint, including any remedial action taken and the applicable dates is as follows:

DATE OF CLAIM	LOCATION	DESCRIPTION OF CLAIM	LITIGATION (Y/N)	STATUS	RESOLUTION/REMEDIAL ACTION TAKEN

Contractor Name: West Coast General Corporation

Certified By David E. Davey Title President  
Name  
 Date 5/15/18  
Signature

**USE ADDITIONAL FORMS AS NECESSARY**

## **LOBBY PROHIBITION, CERTIFICATION AND DISCLOSURE**

In acknowledgment that funds received under this agreement have been provided pursuant to a Federal grant, recipient hereby recognizes the prohibitions against lobbying the Federal government with any of these funds. Recipient agrees that it shall comply with the laws set forth at 31 U.S.C. § 1352 (1989) and 24 C.F.R. part 87, to wit:

### **A. Conditions on use of funds**

Recipient shall not expend any funds received pursuant to this agreement to pay any person to influence an officer or employee of Federal agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with any of the following Covered Federal actions:

- (1) The awarding of any federal contract
- (2) The making of any Federal grant
- (3) The making of any Federal Loan
- (4) The entering into of any cooperative agreement
- (5) The extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

For purposes of defining the terms of this part of the agreement, the definitions set forth in 24 C.F.R. § 87.105 are hereby adopted and incorporated herein by reference.

### **B. Certification and Disclosure**

Each recipient at every tier under this agreement shall file a certification regarding lobbying, and a Disclosure Form-LLL, where required by 24 C.F.R. § 87.110. The certification form and Disclosure Form-LLL are attached to this agreement.

### **C. Certifications must be filed:**

- (1) By any person upon each submission that initiates agency consideration for an award of a Federal contract, grant, or cooperative agreement exceeding \$100,000, or a Federal loan or loan guarantee exceeding \$150,000.
- (2) Upon receipt by any person of a Federal contract, grant, or cooperative agreement exceeding \$100,000, or upon receipt of a Federal loan or loan guarantee exceeding \$150,000.
- (3) By any person who requests or receives from a person referred to in subsections 1 and 2 of this paragraph:
  - a. A subcontract exceeding \$100,000 at any tier under a Federal contract;
  - b. A subgrant, contract or subcontract exceeding \$100,000 at any tier under a Federal grant;
  - c. A contract or subcontract exceeding \$100,000 at any tier under a Federal loan exceeding \$150,000;
  - d. A contract or subcontract exceeding \$100,000 at any tier under a Federal cooperative agreement.

D. Disclosure Forms-LLL must be filed in every instance when a person applies for, requests, or receives Federal appropriations exceeding \$100,000 pursuant to a contract, subcontract, grant, subgrant, loan, or cooperative agreement when such person has paid or expects to pay any sum, in cash or in kind, to influence or attempt to influence any officer or employee of an agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress. Further, Disclosure Form-LLL must be filed by recipients at any tier at the end of each calendar quarter in which there occurs any event that requires disclosure or materially affects information submitted in prior disclosures. Such events include:

- (1) 1. An increase of \$25,000 in the amount paid or expected to be paid for influencing or attempting to influence a covered Federal action;
- (2) 2. A change in the person(s) influencing or attempting to influence a covered action;
- (3) 3. A change in the officer(s), employee(s), or member(s) contacted to influence a covered action.

All disclosure Forms-LLL, but not certifications, shall be forwarded from tier to tier until received by the principal recipient, which in turn will file them with the appropriate Federal agency.

## INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Use the SF-LLLA Continuation Sheet for additional information if the space on the form is inadequate. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a follow up report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing this report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying entity engaged by the reporting entity identified in item 4 to influence the covered Federal action.  
(b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. Enter the amount of compensation paid or reasonably expected to be paid by the reporting entity (item 4) to the lobbying entity (item 10). Indicate whether the payment has been made (actual) or will be made (planned). Check all boxes that apply. If this is a material change report, enter the cumulative amount of payment made or planned to be made.
12. Check the appropriate box(es). Check all boxes that apply. If payment is made through an in-kind contribution, specify the nature and value of the in-kind payment.
13. Check the appropriate box(es). Check all boxes that apply. If other, specify nature.
14. Provide a specific and detailed description of the services that the lobbyist has performed, or will be expected to perform, and the date(s) of any services rendered. Include all preparatory and related activity, not just time spent in actual contact with Federal officials. Identify the Federal official(s) or employee(s) contacted or the officer(s), employee(s), or Member(s) of Congress that were contacted.
15. Check whether or not a SF-LLLA Continuation Sheet(s) is attached.
16. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 30 minutes per response, including time for reviewing instructions, searching existing datasources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

**\*\*\*\*\* No Lobbying Activities \*\*\*\*\***

**DISCLOSURE OF LOBBYING ACTIVITIES** Approved by OMB  
 Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352  
 (See reverse for public burden disclosure)

0348-0046

<b>1. Type of Federal Action:</b> <input type="checkbox"/> a. Contract a. Grant b. Cooperative agreement c. Loan d. Loan guarantee e. Loan insurance		<b>2. Status of Federal Action:</b> <input type="checkbox"/> a. bid/offer/application b. initial award c. post-award		<b>3. Report Type:</b> <input type="checkbox"/> a. initial finding b. material change <b>For Material Change Only</b> year _____ quarter _____ date of last report _____	
<b>4. Name and Address of Reporting Entity:</b> <input type="checkbox"/> Prime <input type="checkbox"/> Subawardee Tier _____, if known:  Congressional District, if known:			<b>5. If Reporting Entity in No. 4 is a Subawardee, Enter Name and Address of Prime:</b>  Congressional District, if known:		
<b>6. Federal Department/Agency:</b>			<b>7. Federal Program Name/Description:</b>  CFDA Number, if applicable: _____		
<b>8. Federal Action Number, if known:</b>			<b>9. Award Amount, if known:</b> \$		
<b>10. a. Name and Address of Lobbying Entity</b> (if individual, last name, first name, M)  (attach Continuation Sheet(s) SF-LLL4, if necessary)			<b>b. Individuals Performing Services</b> (including address if different from No. 10a) (last name, first name, MI):  (attach Continuation Sheet(s) SF-LLL4, if necessary)		
<b>11. Amount of Payment</b> (check all that apply) \$ _____ <input type="checkbox"/> actual <input type="checkbox"/> planned			<b>13. Type of Payment</b> (check all that apply) <input type="checkbox"/> a. retainer <input type="checkbox"/> b. one-time fee <input type="checkbox"/> c. commission <input type="checkbox"/> d. contingent fee <input type="checkbox"/> e. deferral <input type="checkbox"/> f. other: specify: _____		
<b>12. Form of Payment</b> (check all that apply) <input type="checkbox"/> a. cash <input type="checkbox"/> b. in-kind: specify: nature _____ Value _____					
<b>14. Brief Description of Services Performed or to be Performed and Date(s) of Service, Including officer(s), employee(s), or Member(s), contacted, for Payment indicated in item 11:</b>  (attach Continuation Sheet(s) SF-LLLA, if necessary)					
<b>15. Continuation Sheet(s) SF-LLLA attached:</b> <input type="checkbox"/> Yes <input type="checkbox"/> No					
<b>16.</b> Information requested through this for misauthorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.			Signature: _____ Print Name: <u>West Coast General Corporation</u> Title: <u>David E. Davey, President</u> Telephone No. <u>619.561.4200</u> Date: <u>5/15/18</u> ext. 114		
<b>Federal Use Only:</b>				Authorized for Local Reproduction Standard Form LLL (Rev. 7-07)	

**DISCLOSURE OF LOBBYING ACTIVITIES** Approved by  
**CONTINUATION SHEET**

OMB0348-0046

Reporting Entity: \_\_\_\_\_ Page \_\_\_\_ of \_\_\_\_


**\*\*\*\*\* No Lobbying Activities \*\*\*\*\***

Authorized for Local Reproduction  
Standard Form - LLL-A



**ENGINEER OF WORK**

The engineering Specifications and Special Provisions contained herein have been prepared by or under the direction of the following Registered Architect and Registered Engineer:

  
\_\_\_\_\_

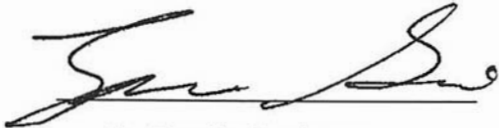
1) Registered Architect

  
\_\_\_\_\_

Date

Seal:



  
\_\_\_\_\_

2) For City Engineer

5/1/2018  
\_\_\_\_\_

Date

Seal:



## **A. CHANGES TO CONTRACT DOCUMENTS**

The following changes to the Contract Documents are hereby made effective as though originally issued with the bid package. Bidders are reminded that all previous requirements to this solicitation remain in full force and effect.

## **B. BIDDER'S QUESTIONS**

- Q1. Upon reviewing the plans, please review both sets and provide each scale applicable to each sheet that is missing. The majority of the sheets provided are missing the scale.
- A1. The Floor Plans on sheets A01.001, A01.002, A02.201, A02.202, A02.601, A02.602, A02.701, and A02.702 are all 1/8"=1'-0". The Furniture Plans on sheets A02.501, A02.502 are already labeled at 1/8"=1'-0".
- Q2. Please provide complete demolition drawings for the site. Based on sheet C-300, there clearly will be Asphalt, driveway, curb & gutter, curb, and sidewalk demolition with no direction as to what the limits of the demolition will be or thicknesses of existing structural sections. Please provide these plan sheets at your earliest convenience.
- A2. Sheet C-200 Existing Conditions shows existing conditions. Sheet C-300 shows new work. Remove existing asphalt (2" thick) in all areas to receive new concrete sidewalks, curbs and gutters. Remove asphalt (2" thick) and class II base (4" thick) in all areas to receive new landscape. Install top soil to meet new grades. Grind 1" of existing asphalt to remain for new 1" of overlay per RFI Question #3 below.
- Q3. What is the existing thickness of the Asphalt Concrete Paving to be removed?
- A3. The existing conditions include 2" of asphalt over 4" of class II base based on the original permitted drawings. On sheet C-300, modify coded note 6 to read: Existing AC pavement to remain, proposed minimum 1" AC grind and 1" overlay.



Q4. Please provide the contact information for all furniture suppliers that are to provide furniture within this project.

A4. All furniture shown on Sheets A02.501 and A02.502 is for reference only except for the following furniture and equipment that is provided by the General Contractor:

Kitchen 103 and 203: Provide refrigerators, microwaves, stoves, hoods and dishwashers as shown on A03.500 and listed in the specifications in 113100 Residential Appliances.

Laundry 105 and 205: Provide washers and dryers as shown on A02.501 and A02.502 and as listed in the specification in 113100 Residential Appliances.

New Manager Suite 114: Provide refrigerator, microwave, stove, hood and dishwasher as shown on A03.501 and listed in the specifications in 113100 Residential Appliances.

New Staff Meeting Room 133: Provide refrigerator, as shown on A03.501 and listed in the specifications in 113100 Residential Appliances.

NOTE: For all Resident Units, relocate bed head boards attached to walls as noted on A07.100. For site work, provide site furnishings as noted on L1.1 and listed in the specifications in 129300.

Q5. Per sheets A02.501 & A02.502, provide a furniture schedule for the project. It is not clear which Furniture items are new to be provided by the contractor.

A5. See response to RFI question #4 above.

Q6. Please provide clear precise ceiling demolition drawings of the 1<sup>st</sup> Floor, 2<sup>nd</sup> Floor, and Attic.

A6. Ceilings are not being demolished. Walls, floors, windows, doors, cabinetry, finishes, etc. to be demolished are shown on Demolition sheets A01.001 and A01.002. Soffits are being added to the existing ceilings per Reflected Ceiling Plans on sheets A02.601 and A02.602. Existing ceilings shall be maintained and patched as required for new construction per specifications 024119 Selective Demolition.

- Q7. Is there any known asbestos in the building currently? Please provide Asbestos report.
- A7. It can be concluded that the current on-site building was constructed in 1987. Commercial use for asbestos was banned after the year of 1978. Therefore, the likelihood for Asbestos-Containing Material (ACM) to be present on the subject site building is minimal.
- Q8. If asbestos is encountered, how will asbestos abatement be paid?
- A8. Abatement will be paid through a change order. See GREENBOOK/WHITEBOOK Section 3-3 "EXTRA WORK".
- Q9. Level 1 New Reception Area, Corridor 140, Corridor 139, please provide a finish plan for these areas.
- A9. Corridor 139 and Corridor 140 shall all have the same finishes as Reception 100 since they are all the same area and connected.
- Q10. Sheets A01.001, A01.002, A02.201, A02.202, A02.501, A02.502, A02.601, A02.602, A02.701, A02.702 do not have a scale shown for quantification purposes. Please provide at you earliest convenience.
- A10. See response to RFI question #1 above.
- Q11. Spec sections 055213 and 323113 have a requirement to "provide comprehensive engineering analysis by a qualified professional engineer". The chain link fence and pipe railings are not listed under the deferred submittals. Please clarify the City wants the Prime Contractor to provide design engineering for the pipe and tube railings and the chain link fence and gates. If the Prime Contractor is to provide engineering, can we use the Engineer of record who already knows this project to provide design for fencing and design for railings.
- A11. Section 055213 for Pipe and Tube Railings applies to the railings and guard around the new interior stair and second floor balcony and the exterior stair railing from the Dining Room to the terrace. The shop drawings shall be signed and sealed by a qualified professional engineer responsible for their preparation as noted in item 1.3. Section 323113 Chain link Fences and Gates applies to the new exterior chain link fence on the west property line. Since the fencing is only 6' high from the walking surface, the chain link fence will NOT require a qualified professional engineer to stamp or seal the drawings.

- Q12. Both plan sets have sheet A10.100. Please confirm that there is one door schedule and that one of these schedules should be deleted from the plan set.
- A12. Delete the duplicated sheet from the second set. The page numbers in the bottom right title block are correct. The Door and Frame Schedule is sheet 60 of 122.
- Q13. The Paint Schedules on A02.701 & A02.702 show PT-01, PT-02, PT-03 to have identical descriptions and remarks. Please clarify if these descriptions and remarks are accurate and should all remain the same.
- A13. The Finish Schedules denote three types of wall paint PT-01, PT-02 and PT-03 to indicate three different paint colors to be determined in the color selection process during construction.
- Q14. Per sheets A02.701, A02.702, (Note PT-05, PT-02, RB-02, & RS-02 Throughout UNO), Is the purpose of this note to direct all contractors to place these finish schedule items throughout every room, office, or corridor unless labeled otherwise on the entire floor? Please provide clarification because there are rooms such as Unit 28 / 217 on sheet A02.702 that does not reference flooring, rubber base, ceiling paint, and wall paint to be placed in this unit throughout. When this occurs should the contractor follow (Note PT-05, PT-02, RB-02, & RS-02 Throughout UNO). Please Advise.
- A14. On Sheets A02.701 and A02.702, the drawings have the following coded notes:
- 03 – Prep smooth and paint door and door frame each side “Throughout UNO”: This indicates the doors on the public Corridors shall be painted both sides. Since signage is being removed from the resident doors per 6/A07.100, we need to prep and paint both sides of the doors.
- 05 – Paint new gypsum board soffit where occurs color (PT05) refer to RCP “throughout UNO”: This indicates the new soffits on the RCP in the Reception and public Corridors shall be painted along with the existing ceilings PT05.
- 06 – Existing stone threshold to remain “Typ UNO”: This indicates the existing stone thresholds for the Corridor doors shall remain.

- Q15. Is the Flooring to be completely removed in both the 1<sup>st</sup> and 2<sup>nd</sup> Levels of the building? Please provide demolition sheets for all flooring to be removed?
- A15. On Demolition Plan sheets A01.001 and A01.002, demolish flooring material in rooms with coded note 6, 7 and 16. Flooring shall remain in rooms without a floor plan demo note.
- Q16. Subcontractors and Suppliers have requested a window schedule per the descriptions on Sheet A10.100, please provide.
- A16. New windows are on the Floor Plans on Sheet A02.201 and A02.202 and Exterior Elevations on Sheet A07.200 and A07.201. The Window types are shown on Sheet A10.100 and specified in Section 084113 Aluminum Framed Entrances and Storefronts and Section 085313 Vinyl Windows. A schedule is not necessary.
- Q17. Drawing C-300 item #3 is a call out for "Proposed landscape area, see landscape plans". L1.1 has a note to "Refer to pool demolition package for pool demolition" There is no "pool demolition package". Please clarify if the pool is to be removed. Please provide the Pool Demolition Package or information on how this pool is to be removed and what is used for infill.
- A17. Per Addendum A, the General Contractor will be responsible for obtaining a Pool Demolition Permit. Follow the Information Bulletin 710 for the removal of the pool which is 3½' to 5' deep. Please see link below:

<https://www.sandiego.gov/sites/default/files/dsdib710.pdf>

It was built in 1985. Fill soil shall have an expansion index less than 20 and shall be compacted in 6" lifts up to 90% compaction for the entire fill area. Install landscape per landscape drawings and new 4" concrete sidewalk per RSD SDG-155, level with existing slab. General Contractor shall provide shop drawing information and location of fill soil material data. Owner will engage a qualified independent testing and inspecting agency to test the soil and the concrete per specifications section 833000 cast in place concrete.

- Q18. Drawing page E00.302 detail 3 shows a Future EV Charging station. Please clarify the charging station is N.I.C, just empty conduit to the future location.
- A18. Only the conduit and infrastructure are required. The EV Charging station is NOT in the scope of work.
- Q19. Will details be provided for the new stairs case?
- A19. The design intent for the stairs and second floor guardrails are shown on A00.300, A00.302, A02.201, A02.202, A03.505, A05.100 and in specifications 055213 Pipe and Tube Railings. The General Contractor is responsible for engineering the stair and obtaining a permit as a deferred submittal.
- Q20. Will details for the demolition of the pool be provided?
- A20. See RFI#17 above.
- Q21. Sheet L1.1 shows C.I.P Concrete Type 2 – Exposed Aggregate Finish to be placed in the existing pool. Please provide details regarding this scope.
- A21. Pool to be filled in per civil drawings, provide hardscape / landscape per Landscape drawings.
- Q22. Is there a hazardous materials report for the property?
- A22. See RFI#7 above.
- Q23. Will draining the pool be part of the contract?
- A23. The General Contractor shall be responsible for draining the pool.
- Q24. On the job walk it was noticed that there are multiple areas with damage drywall and associated joints. Will the contractor be responsible for fixing existing gypsum board surface damage that would not otherwise be replaced per the contract?
- A24. This will be addressed through a future change order if requested by the client (City).

- Q25. Walls do not appear to match in quantity from page to page. Specifically, there are some wing/entry walls shown in rooms 231, 232 and 233 on sheets A02.602 and S2.13 but not S22.2 (Level 2 Framing Plan). Which sheet is correct? Which sheets should we be using? Will there be a correction to the drawings made?
- A25. For Rooms 231, 232 and 233, the second floor demolition plan A01.002, Second Floor Plan A02.202, Second Floor Reflected Ceiling Plan A02.602 and Structural Demo Roof Framing Plan (second floor walls) S2.03 and New Roof Framing Plan (second floor walls) S2.13 are all consistent. Sheet S2.02 Demo Level 2 Framing Plan shows the walls for level 1. The demolition is consistent with the architectural Demo Plan on sheet A01.001.
- Q26. There is sprayed acoustic ceiling texture (popcorn) in the second-floor utility room (future space for stair case and electrical closet [142]). Is this texture to be removed or matched?
- A26. The ceiling above the open stair shall match the existing finish in Hallway 200, Corridor 236 and 235 as noted in the specifications 092900, item 3.4.E.5.
- Q27. There are numerous other cracks and spalls in existing concrete sidewalks and structures that are called to remain. Specifically, there is large corner of side walk on the North West side of the building that is broke off. Are these areas to be repaired?
- A27. This will be addressed through a future change order if requested by the client (City).
- Q28. The chain-link fence on the West side of the building is called out to be replaced but there is no callout to demolish the existing chain-link fence. Does this section of fence get replaced? Will the owner be removing the existing fence prior to the contractor starting work?
- A28. The existing fence on the west elevation shall be removed by the General Contractor.

- Q29. There is a bunch of furniture stored on a second level room above the lobby that is visible from the outside. The furniture is stored haphazardly. Being that we didn't not have access to all the spaces during the job walk, when construction starts will all of the rooms be as they are shown on the drawings?
- A29. All loose furniture will be removed by the Owner prior to the start of construction.
- Q30. Will the new fascia be coated in the same stucco coating as the existing fascia? If the stucco coating is not used on the new fascia will we be replacing the existing fascia throughout the building to receive the new finish?
- A30. The new fascia shall match the existing as noted on detail 20/A05.100.
- Q31. Note 22 on sheet A07.201 indicates that the fascia and all wood soffits are to be painted per the schedule. Is there a complete finish schedule which includes all the exterior finishes?
- A31. The exterior finishes are included on the elevations on A07.200 and A07.201. Paint all new and existing stucco per note 21 and all new and existing soffits and fascia per note 22. Colors will be selected during the shop drawing phase when the selected manufacturer is identified.
- Q32. Is exterior painting part of the contract?
- A32. See RFI#31 above.
- Q33. Will details with dimensions etc. be provided for the smoking structure?
- A33. Dimensions of the smoking structure are shown on plans and sections on A03.503.
- Q34. Please provide details and supplier for the two Bike Lockers shown on Sheet L1.1.
- A34. Please refer to sheet L1.2 for bike locker manufacturer info. Please refer to manufacturer's installation manual for installation instructions/details and hardware info.

- Q35. There is no specification for the solar as to what is required or equipment wanted, is the solar design build? Please provide a specification referencing the required equipment, details for installation, and qualification requirements where applicable that are required for this project?
- A35. See PV Spec Section 26 31 00, and Electrical Sheets for PV System performance requirements. Per Architect's direction, final design of the PV system is a design-build alternate, to be submitted for review by design team prior to order and release. (MWE-AL 05.01.2018).
- Q36. EMT is called out for underground conduits for Solar, would this be rigid conduit? EMT tends to corrode underground, unless its coded or wrapped, please clarify the underground conduits the City requires?
- A36. See Spec section 26 05 33 for Raceway Requirements. EMT conduit is for aboveground installation only, and only exposed installation heights greater than 4' AFF (MWE-AL 05.01.2018).
- Q37. Sheet Note 1/P01.001 and Note 1/P01.002 states "Demo existing fixtures, cap existing associated piping above ceiling and **below slab.**" There is cross hatch shading on these areas as well as some areas with Sheet Note 3 that does not indicate slab removal. Are we to figure shaded areas as areas where slab on grade is to be removed and replaces or just the areas noted with Sheet Note 1? Furthermore, Sheet Note 1/P01.002 has "below slab" reference for Level 2 and Structural Sheet S2.12 indicates 5/8" Sheathing for Level 2 not slab. Please advise.
- A37. Remove existing plumbing fixture as shown and cap existing piping above ceiling or at finished floor.
- Q38. L1.1 indicates Future Electric Charging Station Location. Will the footing be installed in this phase of construction? Is the Electrical Charging Station part of this contract? If so can a detail be provided?
- A38. See RFI#18. The Electrical Charging Station and footing are not in the scope of work.



- Q39. R12B, R12C, R18 Landscape noted on Materials & Products Schedule refers you to Arch and the Arch are lacking detail for this item. Please provide.
- A39. The pedestrian gate and sliding gate are shown on G02.000 and covered in specifications 323119.53 Decorative Metal Security Fences and Gates. The terrace stair and handrail are shown on G02.000, A03.502 and A03.503.
- Q40. L1.1 has a note stating "Refer to pool Demo package for pool demo" however, this was not provided. Please provide.
- A40. See RFI#17 above.
- Q41. P1 shown on the Landscape Materials & Products Schedule describes 12"x12" detectable warning tile by Armor Tile. Armor Tile no longer makes 12"x12" detectable warning tile even though they are still showing it on their website. Per Sergio Lopreiato Armor Tile Sales Rep. Construction Note 25/C300 detectable warning tiles per SDG-130 that is 3' wide and shall extend to the full width of curb ramp as well as being stainless steel.
- A41. Please see below from the City's approved material list. Since the 12"x12" tiles are not available, the 36"x48" tiles (highlighted in yellow below) would be acceptable. Refer to SDG-130 for detectable warning detail.

Type of Detectable Tactile Warning Tile	Specifications Reference	Manufacturer	Additional Requirements	Manufacturer Literature
Cast In Place Detectable Warning (Vitrified Polymer Composite)	Section 216, City of San Diego Supplement	Armor Tile Tactile Systems by Engineered Plastics Inc., 300 International Drive Suite 100 Williamsville, NY 14221	SDG-130, City of San Diego Standard Drawings	 ArmorTile_ADA-C-12 12  ArmorTile_ADA-C-36 48

- Q42. Details 2&4/L-1.3 Notes 4 &5 references you to Civils for reinforcing. Note 4/C300 sidewalk is per SDG-155 no reinforcing or sand required for City Sidewalk. Please provide reinforcing requirements for flatwork and is sand required?
- A42. The City of San Diego standard drawings referenced do not require reinforcing or sand for the sidewalks.

- Q43. C1 shown on Landscape Materials & Products Schedule L-1.2 notes Davis Colors under Manuf/Supplier however, C1 on sheet L -1.1 Materials & Products Schedule indicates Natural Grey. What one is correct?
- A43. The note for Davis Colors is incorrect. C1 shall be Natural Grey.
- Q44. C1 & C2 Sheet L-1.2 under Remarks calls for 3/8" Carrol Canyon Rock and the Carrol Canyon plant is no longer in operation. Carrol Canyon rock is no longer available. Santee Aggregate produced at the Santee Hanson Aggregates Plant is from the same conglomerate as Carroll Canyon known as the Stadium Conglomerate. Therefore, the aggregates have the same geological makeup and appearance from what I am told by my supplier. Will 3/8" Santee Aggregate be acceptable?
- A44. Yes.
- Q45. What is the existing ceiling height from floor to ceiling?
- A45. Floor to ceiling heights are shown on A05.100, A07.100, A07.201 and A09.100
- Q46. What is the existing ceiling height from 1<sup>st</sup> floor foundation to 2<sup>nd</sup> floor Slab?
- A46. Floor to ceiling heights are shown on A05.100, A07.100, A07.201 and A09.100.
- Q47. Sheet S2.12, Note reads: APA Rated Sheathing W/ 10d @ 4" O.C. B. N. 6" O.C. E.N. & 12" O.C. F.N (Blocked), TYP for the second floor, however there is a conflicting detail showing S4.01 / 3 which calls out for the slab to be concrete with a footing. Please clarify the design scope for the second floor.
- A47. Detail shown on S2.12 should say 4/S5.01 in lieu of S4.01.
- Q48. S2.11 calls out F3.0 footing per 1/S4.01 and that detail states per schedule and the footing schedule cannot be found. Please provide F3.0 footing schedule.
- A48. The footing information for Type F3.0 is located in the legend on Sheet S2.11.

- Q49. E00.302 item #13 calls for a deduct alternate for the PV system. Other bid documents call the PV system as an additive alternate.
- A49. The PV system is an additive alternate.
- Q50. Please clarify the PV panels, controllers, inverters, conduit, are part of additive alternate #1.
- A50. The PV panels, controllers, inverters and conduit are part of additive alternate #1.
- Q51. Please clarify if the carports are part of the PV alternate or carports are part of base bid.
- A51. The carports are part of the PV alternate.
- Q52. Drawing E00.303 item # 4 ask for alternate pricing for site poles. The bid documents don't have a second alternate listed. Please clarify these alternates.
- A52. If the additive PV alternate is accepted, then it shall include in the pricing the cost for adding site poles as noted to provide adequate light to replace the lights that will not be installed under the PV carport.
- Q53. Please provide specifications on what type of materials you would like the countertops to be.
- A53. The countertop finishes are noted on Finish Plans A02.701 and A02.702. The solid surfacing material is specified in 064023, item 2.1.I. SS-01, SS-02 and SS-03 represent the use of three different colors.
- Q54. Please confirm the type of flooring on each unit and bathrooms.
- A54. Floor finishes are shown on A02.701 and A02.702. Most of the resident rooms and resident bathrooms will maintain the existing floor and base. The flooring material shall only be replaced in rooms with the flooring symbol RS-02, RS-03 or TL-01.
- Q55. Please provide details regarding the pool renovation.
- A55. See RFI#17 above.
- Q56. Please provide the pool demolition package.
- A56. See RFI#17 above.

Q57. Who is the current company that services the fire alarms?

A57. Metro Fire & Safety Inc.

Q58. Please provide specification on Electric Drive Motor for the Entry Gate.

A58. The gate operator is specified in 323119.53, item 2.4.

### C. CLARIFICATIONS

1. The **90 Day** Plant Establishment Period has been removed from the contract time. Refer to Greenbook and Whitebook Part 8 for planting requirements.
2. Sheet A10.100 has been duplicated. **DELETE** sheet from second set of plans.

### D. ATTACHMENTS

1. To Attachment A, Scope Of Work, page 22, item 3, Contract Time, **DELETE** in its entirety and **SUBSTITUTE** with the following:

**CONTRACT TIME:** The contract time for completion of the Work shall be **132 Working Days**.

### E. SUPPLEMENTARY SPECIAL PROVISIONS

1. To Section 1, Term, Definitions, Abbreviations, Units of Measure and Symbols, Subsection 1-2 Terms and Definitions, page 87, **DELETE** in its entirety and **SUBSTITUTE** with the following:

**1-2 TERMS AND DEFINITIONS.** To the "WHITEBOOK", item 54, "Normal Working Hours", ADD the following:

The **Normal Working Hours** are **7:00 AM to 7:00 PM**.

Accelerated working schedules are encouraged.

2. To Section 3, Changes in Work, page 88, **ADD** the following:

**3-3.2.3 Markup.** To the "WHITEBOOK", DELETE in its entirety and SUBSTITUTE with the following:

1. Work paid under Allowance Bid items for permits, governmental fees, or direct payments specified in

the Contract Documents shall not be subject to any markups.

2. The allowance for overhead and profit shall not exceed the values listed in the table below:

<b>Component</b>	<b>Overhead</b>	<b>Profit</b>
Labor	10%	10%
Material	10%	5%
Equipment	10%	5%

3. Markups for materials shall be applied to the actual cost of the material before applying the sales tax.
4. When a Subcontractor is performing Extra Work, the allowance for overhead and profit shall be applied to the labor, materials, and equipment costs of the Subcontractor as follows:
  - a) Regardless of the number of Subcontractor tasks for Extra Work, you may only apply 10% for the first \$50,000 of the Subcontractor's portion of accumulated total cost.
  - b) If the accumulated costs of single or subsequent tasks exceed the \$50,000 threshold, you shall instead only apply 5% to any amounts in excess of the \$50,000.
  - c) You shall not apply 10% to any costs after the first \$50,000 of accumulated total costs from performing Extra Work.
  - d) Regardless of the number of hierarchical tiers of Subcontractors, you may only markup a Subcontractor's Work once.

3. To Section 6, Prosecution, Progress and Acceptance of Work, Subsection 6-1.1, Construction Schedule, page 92, paragraph 2, item 20, **DELETE** in its entirety.
4. To Section 7, Responsibilities of the Contractor, Subsection 7-13.4, Contractor Standards and Pledge of Compliance, Item 4, page 100, **DELETE** in its entirety.
5. To Section 9, Measurement and Payment, Subsection 9-3.1, item 7, General, page 101, **DELETE** in its entirety and **SUBSTITUTE** with the following:
  7. The **Alternate** Lump Sum Bid item for **“Photo Voltaic Panels for Parking Lot Trellis and Roof”** shall include and not limited to photo voltaic panels for coverage at parking lot trellis and roof, controllers, inverters, conduit and site poles to provide adequate lighting as specified in the Plans, Contract Documents, and Technicals.
6. To Section 9, Measurement and Payment, Subsection 9-3.1, General, page 101, **ADD** the following:
  8. The Bid item for each **“19/32 inch, 4 feet by 8 feet, Structural 1 Plywood (40/20) Roof Sheet”** shall be used for the payment of unsalvageable or damaged sheeting encountered during roof repair and replacement as specified in the Plans, Contract Documents, and Technicals.
7. To Technicals, Section 07 31 13, Asphalt Shingles, Subsection 2.3, UNDERLAYMENT MATERIALS , item A, page 212, **ADD** the following:
  2. **“30# Felt Underlayment”**

## **F. CERTIFICATIONS AND FORMS**

1. To Certifications and Forms, Electronically Submitted Forms, page 909, **DELETE** in its entirety and **SUBSTITUTE** with page 19 of this Addendum.
2. To Certifications and Forms, Electronically Submitted Forms, **ADD** Mandatory Disclosure of Business Interests form with page 20 of this Addendum.

**G. ADDITIONAL CHANGES**

1. The following are additional changes to the Line Items in the PlanetBids Tab:

For clarity where applicable, **ADDITIONS**, if any, have been **Underlined** and **DELETIONS**, if any, have been **~~Stricken out.~~**

Section	Item Code	Description	UoM	Quantity	Payment Reference
<u>Main Bid</u>	<u>238160</u>	<u>19/32 inch, 4 feet by 8 feet, Structural 1 Plywood (40/20) Roof Sheet</u>	<u>EA</u>	<u>133</u>	<u>9-3.1</u>

**H. PLANS**

1. To Drawing sheet numbers 40498-1-D, 40498-3-D, 40498-31-D, 40498-35-D, 40498-47-D, 40498-50-D, 40498-58-D, 40498-76-D, 40498-93-D, 40498-94-D, 40498-97-D, 40498-98-D and 40498-106-D, **DELETE** in their entirety and **REPLACE** with pages 21 through 33 of this Addendum.

James Nagelvoort, Director  
Public Works Department

Dated: *May 4, 2018*  
San Diego, California

JN / RWB / cc

## **ELECTRONICALLY SUBMITTED FORMS**

### **THE FOLLOWING FORMS MUST BE SUBMITTED IN PDF FORMAT WITH BID SUBMISSION**

The following forms are to be completed by the bidder and submitted (uploaded) electronically with the bid in PlanetBids.

- A. BID BOND – See Instructions to Bidders, Bidders Guarantee of Good Faith (Bid Security) for further instructions**
- B. CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS**
- C. MANDATORY DISCLOSURE OF BUSINESS INTERESTS FORM**
- D. LOBBY PROHIBITION, CERTIFICATION AND DISCLOSURE**
- E. DISCLOSURE OF LOBBYING ACTIVITIES**

**Bids will not be accepted until ALL the above-named forms are submitted as part of the bid submittal**



## Mandatory Disclosure of Business Interests Form

### BIDDER/PROPOSER INFORMATION

West Coast General Corporation

Legal Name 13700 Stowe Drive, Suite 100	Poway	DBA CA	92064
Street Address David E. Davey, President	City 619.561.4200 ext. 114	State 619.561.4205	Zip
Contact Person, Title	Phone	Fax	

Provide the name, identity, and precise nature of the interest\* of all persons who are directly or indirectly involved\*\* in this proposed transaction (SDMC § 21.0103).

\* The precise nature of the interest includes:

- the percentage ownership interest in a party to the transaction,
- the percentage ownership interest in any firm, corporation, or partnership that will receive funds from the transaction,
- the value of any financial interest in the transaction,
- any contingent interest in the transaction and the value of such interest should the contingency be satisfied, and
- any philanthropic, scientific, artistic, or property interest in the transaction.

\*\* Directly or indirectly involved means pursuing the transaction by:

- communicating or negotiating with City officers or employees,
- submitting or preparing applications, bids, proposals or other documents for purposes of contracting with the City, or
- directing or supervising the actions of persons engaged in the above activity.

Name Same as noted above	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

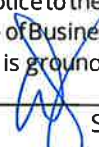
Name	Title/Position
City and State of Residence	Employer (if different than Bidder/Proposer)
Interest in the transaction	

### \* Use Additional Pages if Necessary \*

Under penalty of perjury under the laws of the State of California, I certify that I am responsible for the completeness and accuracy of the responses contained herein, and that all information provided is true, full and complete to the best of my knowledge and belief. I agree to provide written notice to the Mayor or Designee within five (5) business days if, at any time, I learn that any portion of this Mandatory Disclosure of Business Interests Form requires an updated response. Failure to timely provide the Purchasing Agent with written notice is grounds for Contract termination.

David E. Davey, President

Print Name, Title



Signature

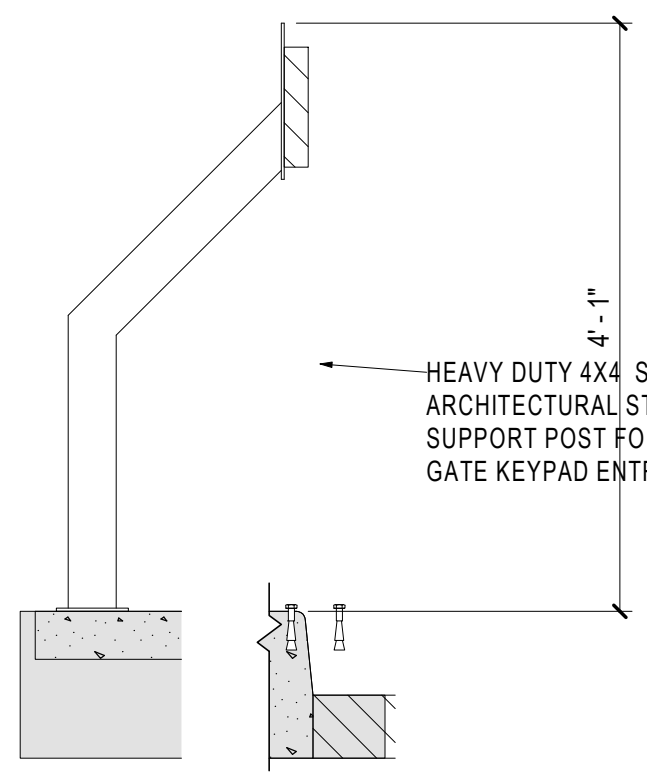
5/15/18

Date

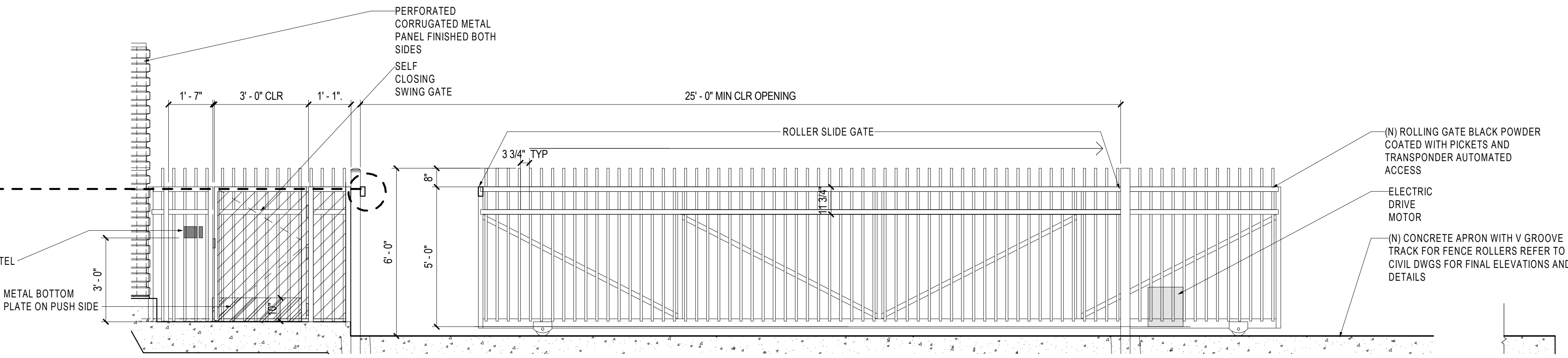
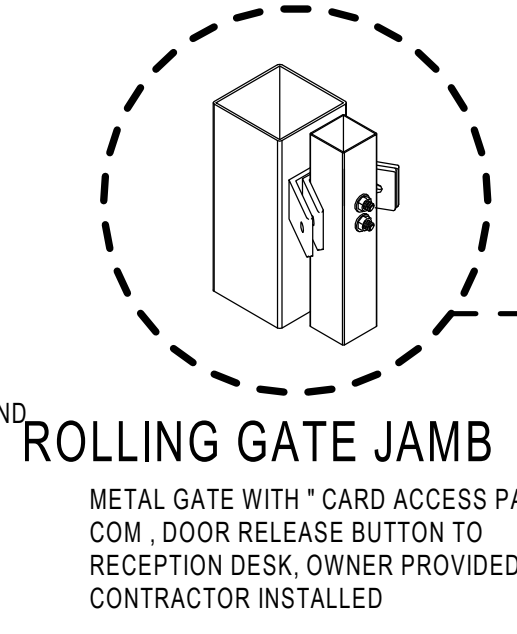
**Failure to sign and submit this form with the bid/proposal shall make the bid/proposal non-responsive. In the case of an informal solicitation, the contract will not be awarded unless a signed and completed Mandatory Disclosure of Business Interests Form is submitted.**



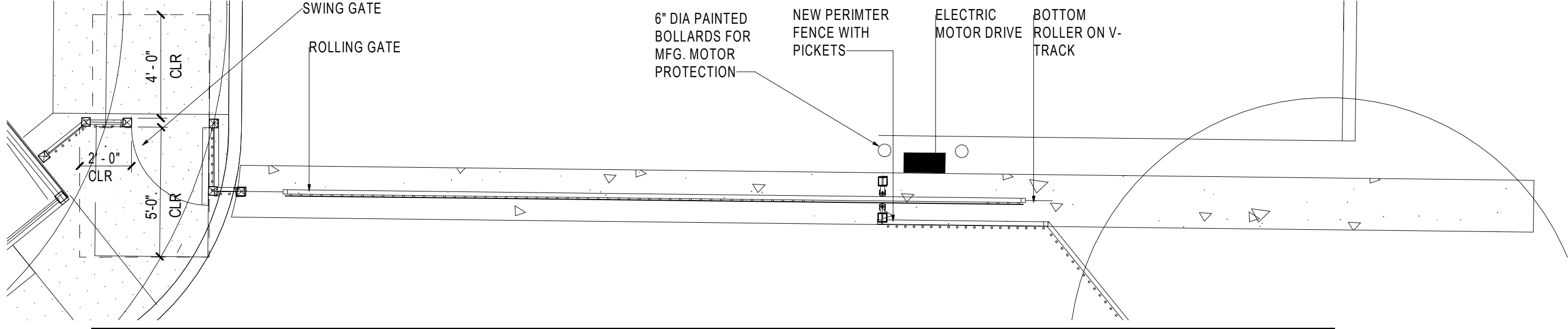




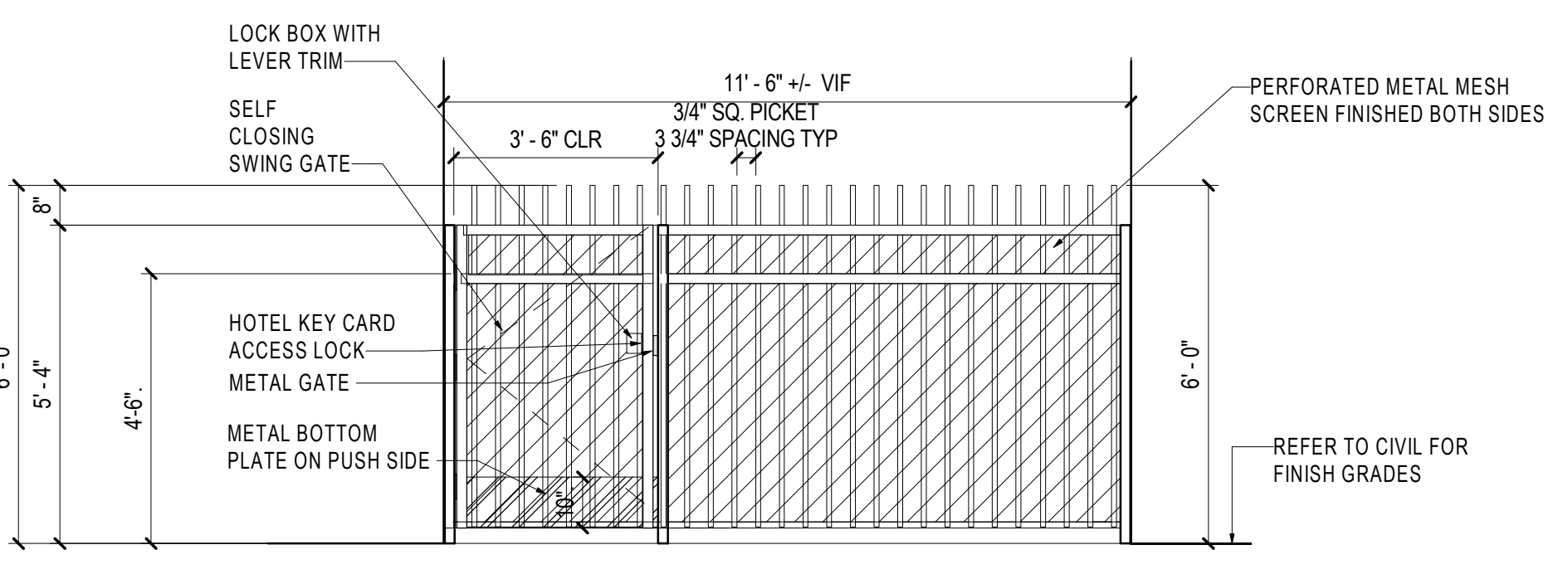
**17 INTERCOM POST AND MOUNT**  
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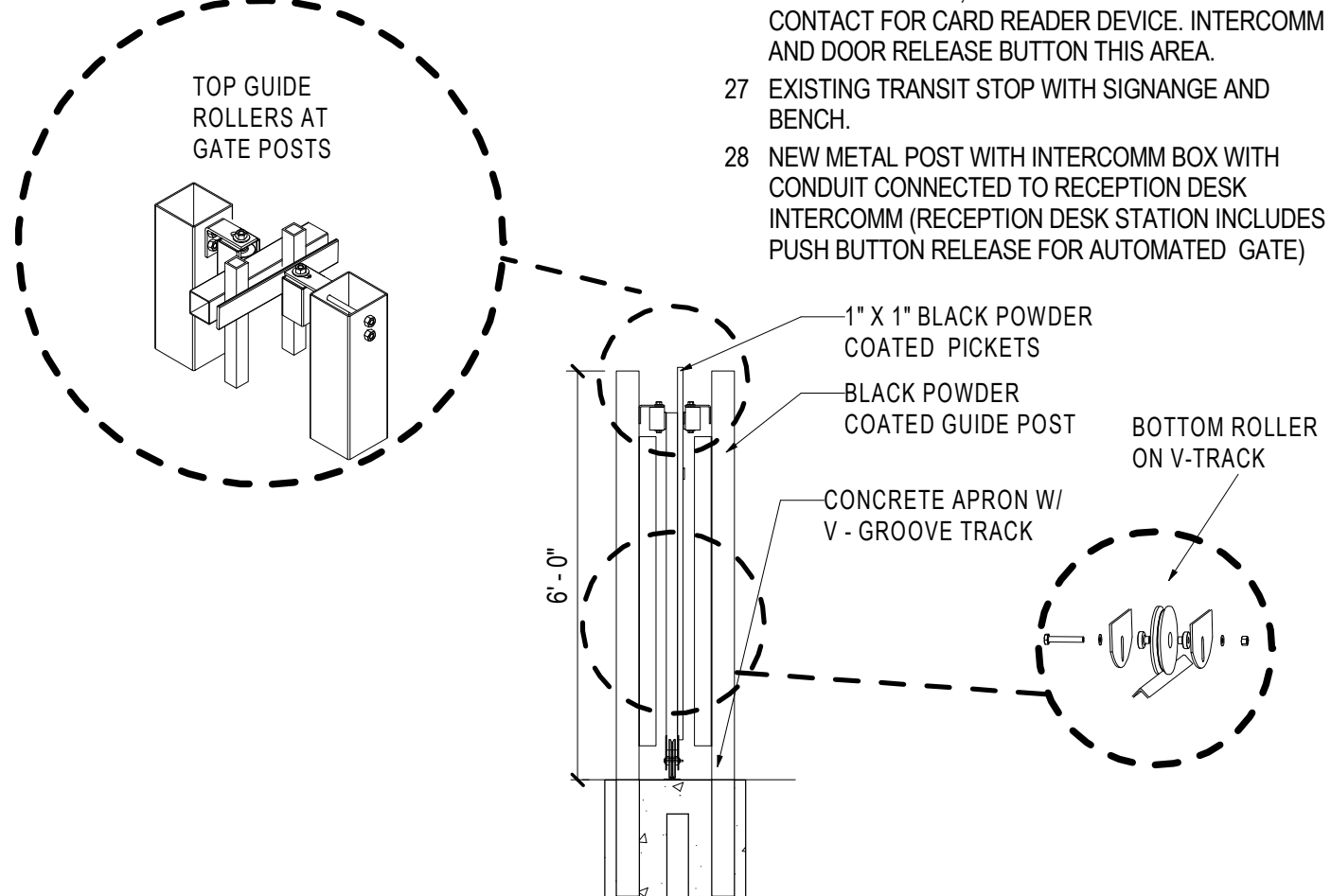
**03 ELEVATION AT ENTRY GATE**  
SCALE: 3/8" = 1'-0"



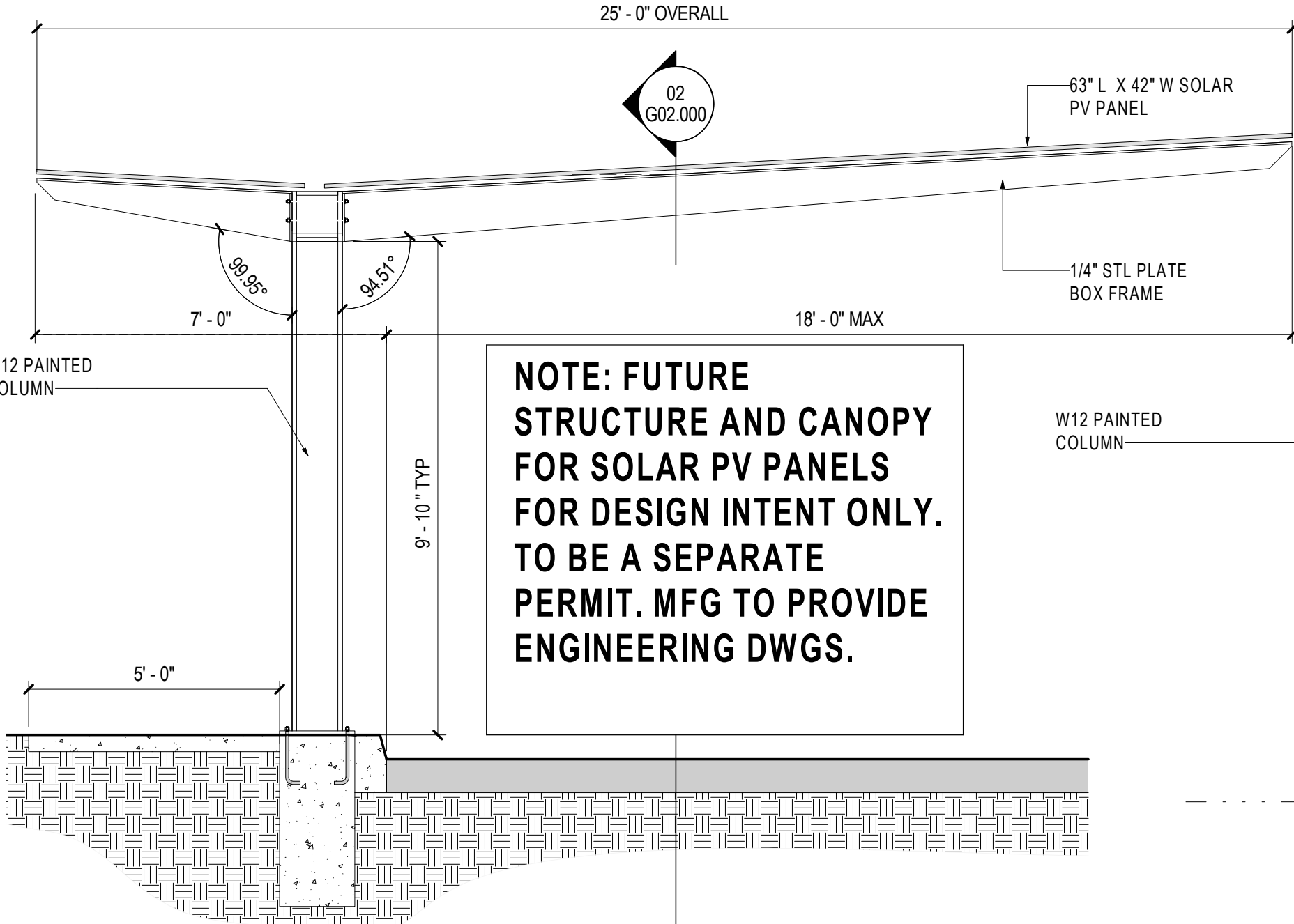
**04.1 ENLARGED PLAN**



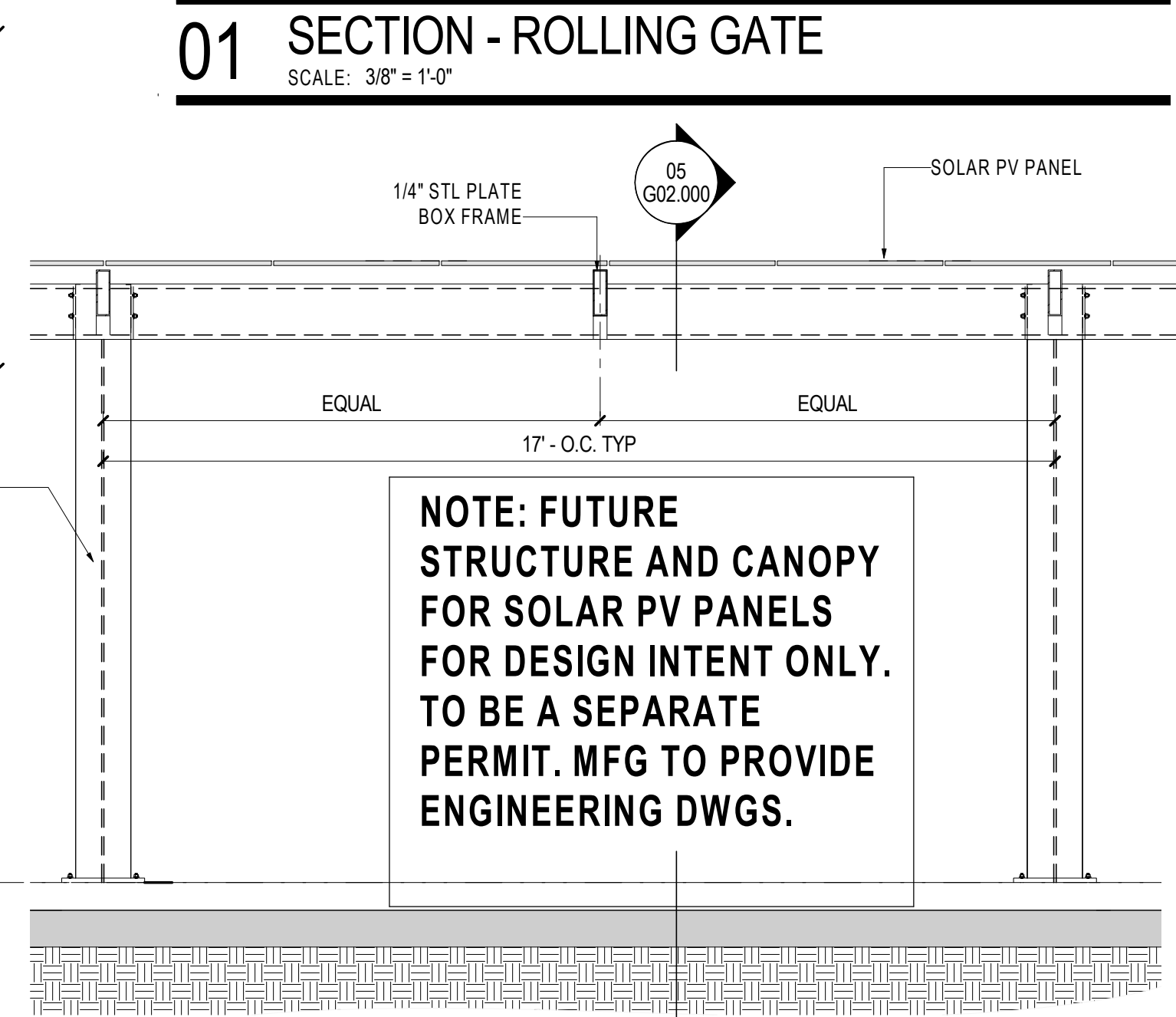
**04 ELEVATION FENCE AND GATE**  
SCALE: 3/8" = 1'-0"



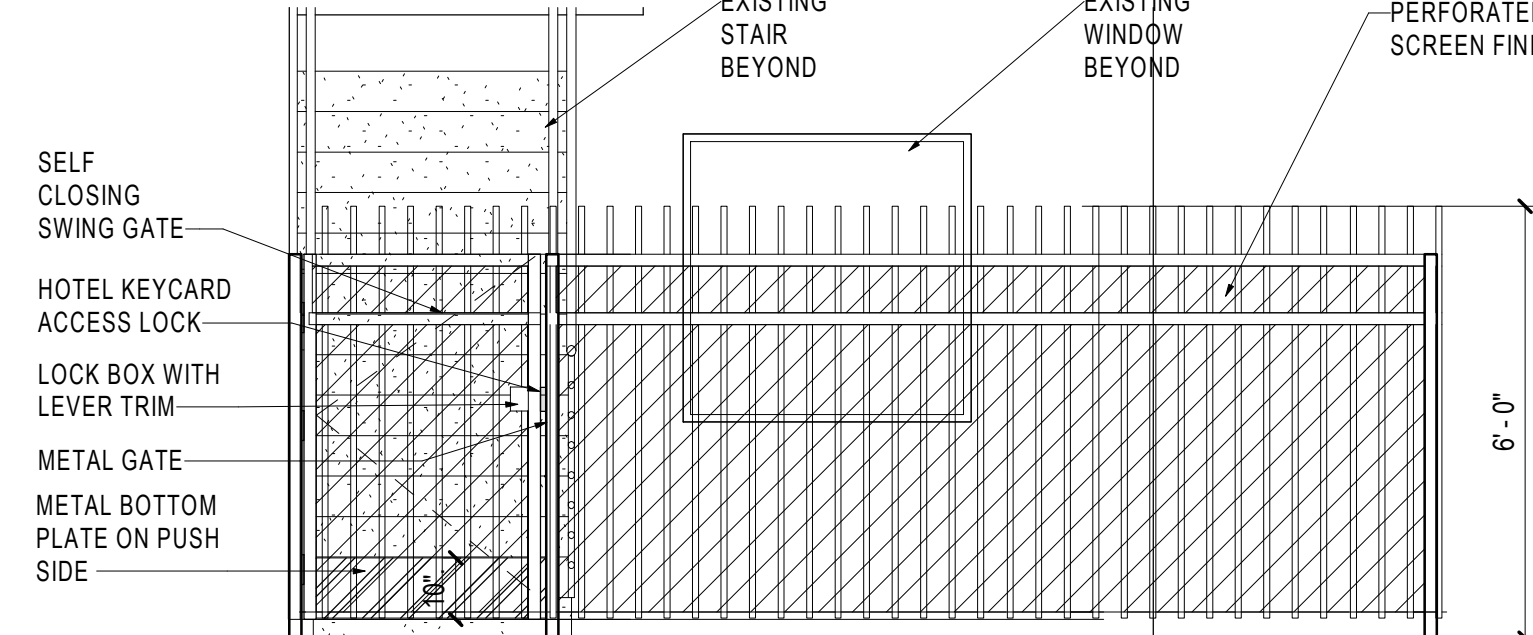
**01 SECTION - ROLLING GATE**  
SCALE: 3/8" = 1'-0"



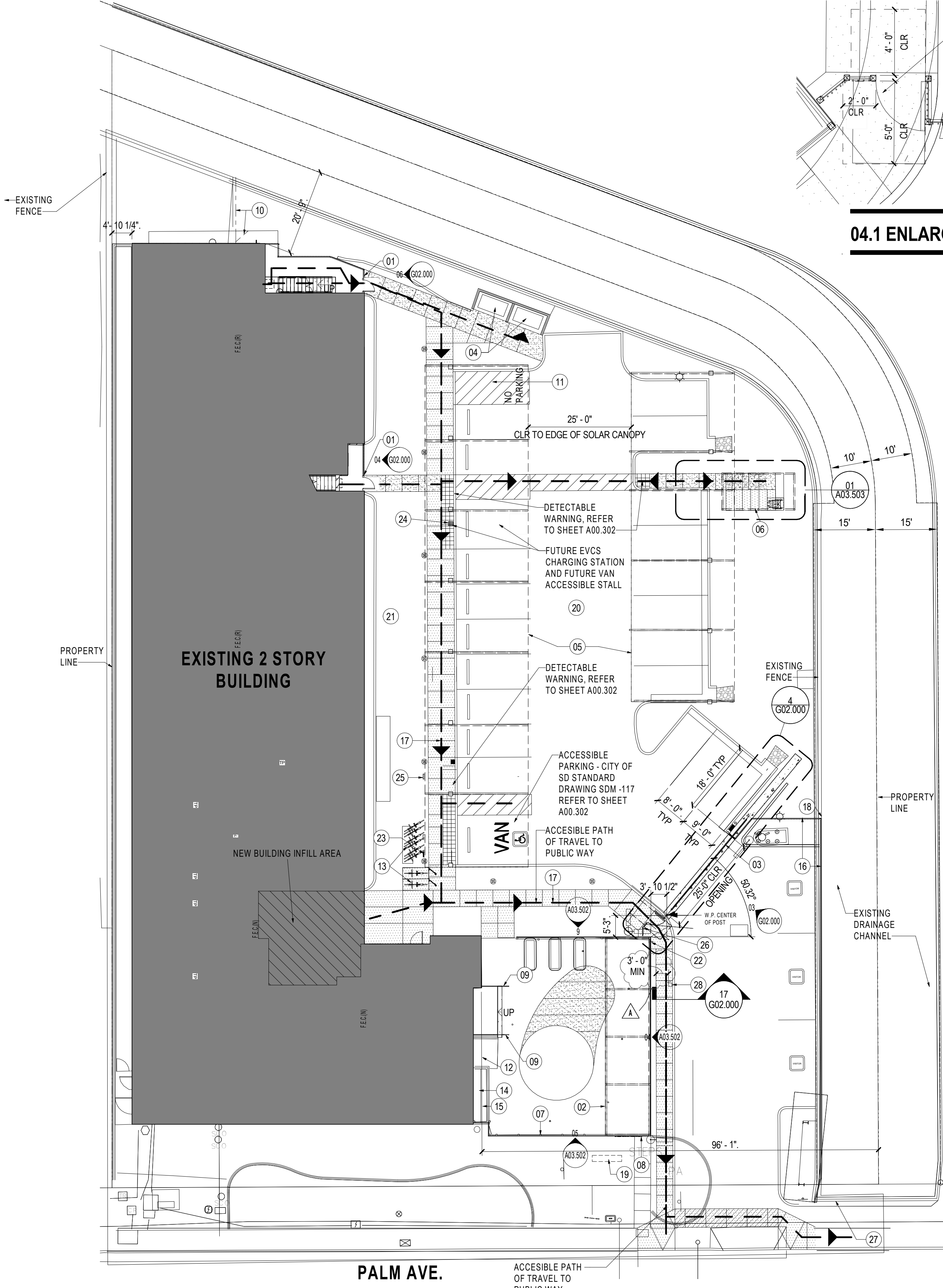
**05 SECTION - CARPORT**  
SCALE: 3/8" = 1'-0"



**02 SECTION - CARPORT**  
SCALE: 3/8" = 1'-0"



**06 ELEVATION FENCE AND GATE**  
SCALE: 3/8" = 1'-0"



**07 CONSTRUCTION PLAN - SITE**  
SCALE: 1/16" = 1'-0"

**SHEET NOTES**

- 01 NEW METAL GATE AND DOOR ASSEMBLY TO INCLUDE CLOSER, AND HOTEL KEY CARD ACCESS. PROVIDED REQUIRED HARDWARE.
- 02 (N) NEW CANOPY SHADE STRUCTURE REFER TO SHEET A00.502
- 03 (N) NEW ROLLER SLIDE AUTOMATED GATE. PROVIDE TRANSDUCER FOR ACTIVATION SYSTEM. PROVIDE NEW CONCRETE APRON. REFER CIVIL DWGS.
- 04 (E) TRASH ENCLOSURE AND GATE. NEW PAINT GATE AND CEMENT PLASTER FOR TRASH ENCLOSURE. BOTH SIDES. ARCHITECT TO SPECIFY COLOR.
- 05 (N) NEW SOLAR ARRAY CANOPY / CARPORT (UNDER SEPARATE PERMIT)
- 06 (N) NEW CANOPY SHADE STRUCTURE
- 07 (N) NEW CORRUGATED PRIVACY SCREEN FENCE
- 08 (N) PATCH AND REPAIR VERTICAL WALL WITH CEMENT PLASTER FINISH WHERE STAIR DEMOLITION EXISTS
- 09 (N) PROVIDE NEW HANDRAILS BOTH SIDES
- 10 REMOVE EXISTING FENCE AND DOOR. PATCH/REPAIR AFFECTED SURFACES.
- 11 STRIPE "NO PARKING"
- 12 EXISTING LOW WALL
- 13 (N) BIKE RACK AND SLAB REFER TO LANDSCAPE DWGS FOR QUANTITY AND TYPE
- 14 EXISTING CONCRETE SLAB
- 15 EXISTING SOIL
- 16 (N) FENCE WITH PICKETS. TO MATCH NEW ROLLING GATE PICKETS HEIGHT AND DETAIL. REMOVE OLD FENCE AND MOUNT ON TOP OC EXIST CONCRETE WALL WHERE EXISTS.
- 17 NEW SIDE WALK. REFER TO CIVIL
- 18 EXISTING SITE FENCE TO REMAIN. NEW FENCE TO BEGIN AT THIS LOCATION
- 19 REMOVE EXISTING SITE SIGNAGE AND FOUNDATION
- 20 REFER TO CIVIL DWGS FOR DRAINAGE
- 21 REFER TO LANDSCAPE PLANS FOR PLANTING AND HARDSCAPES
- 22 SIGN TYPE "P". SEE DETAILS G05.001
- 23 NEW ACCESSIBLE PARKING SIGNAGE REFER TO SHEET A00.302
- 24 FUTURE CAR CHARGER KIOSK. REFER TO ELECTRICAL DWGS.
- 25 FUTURE ADA PARKING SIGNAGE (PER SHEET A00.302) ONCE FUTURE CAR CHARGER KIOSK IS INSTALLED.
- 26 NEW METAL GATE AND DOOR ASSEMBLY TO INCLUDE CLOSER, ELECTRIFIED HINGES AND CONTACT FOR CARD READER DEVICE, INTERCOM AND DOOR RELEASE BUTTON THIS AREA.
- 27 EXISTING TRANSIT STOP WITH SIGNAGE AND BENCH.
- 28 NEW METAL POST WITH INTERCOM BOX WITH CONDUIT CONNECTED TO RECEPTION DESK. INTERCOM (RECEPTION DESK STATION INCLUDES PUSH BUTTON RELEASE FOR AUTOMATED GATE)

Date	Description

**Gensler**  
225 Broadway  
Suite 100  
San Diego, CA 92101  
United States  
Tel 619.557.2500  
Fax 619.557.2520



Project Number  
55.7291.015  
04.04.18  
The City of  
**SAN DIEGO**  
Public Works  
G02.000

**PALM AVE TRANSITIONAL HOUSING**

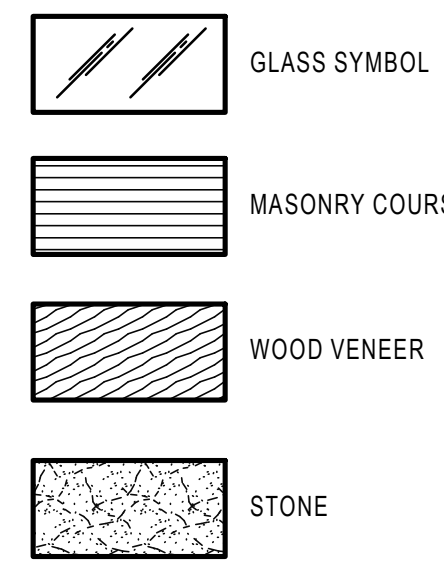
DESCRIPTION		BY	APPROVED	DATE	FILMED
ADDENDUM A		SHS	[Signature]	5/1/2018	

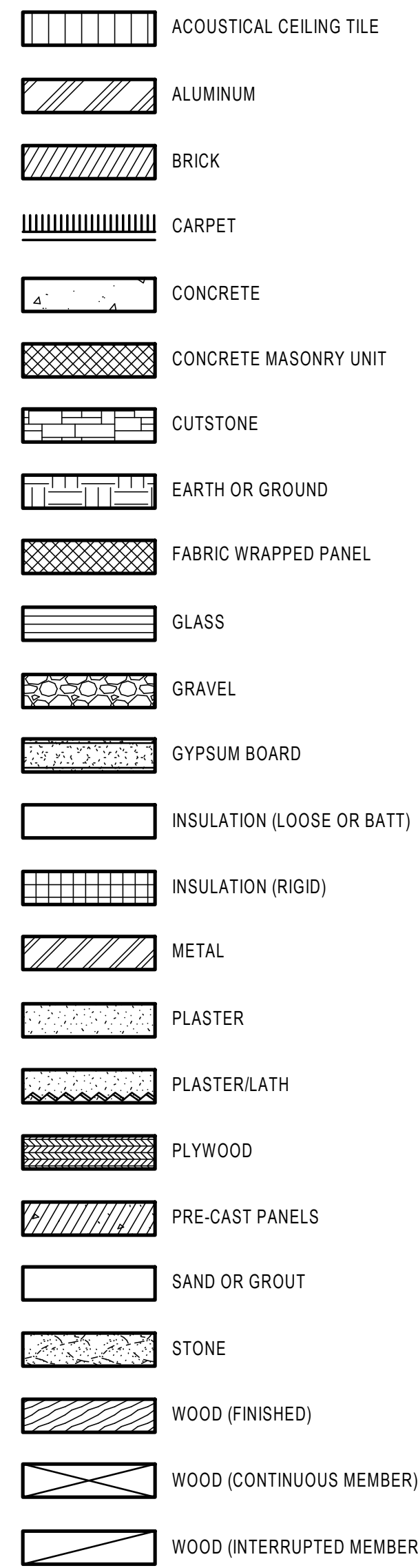
CONTRACTOR INSPECTOR	DATE STARTED	DATE COMPLETED	40498-03-D
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## GRAPHIC SYMBOLS (CONT)

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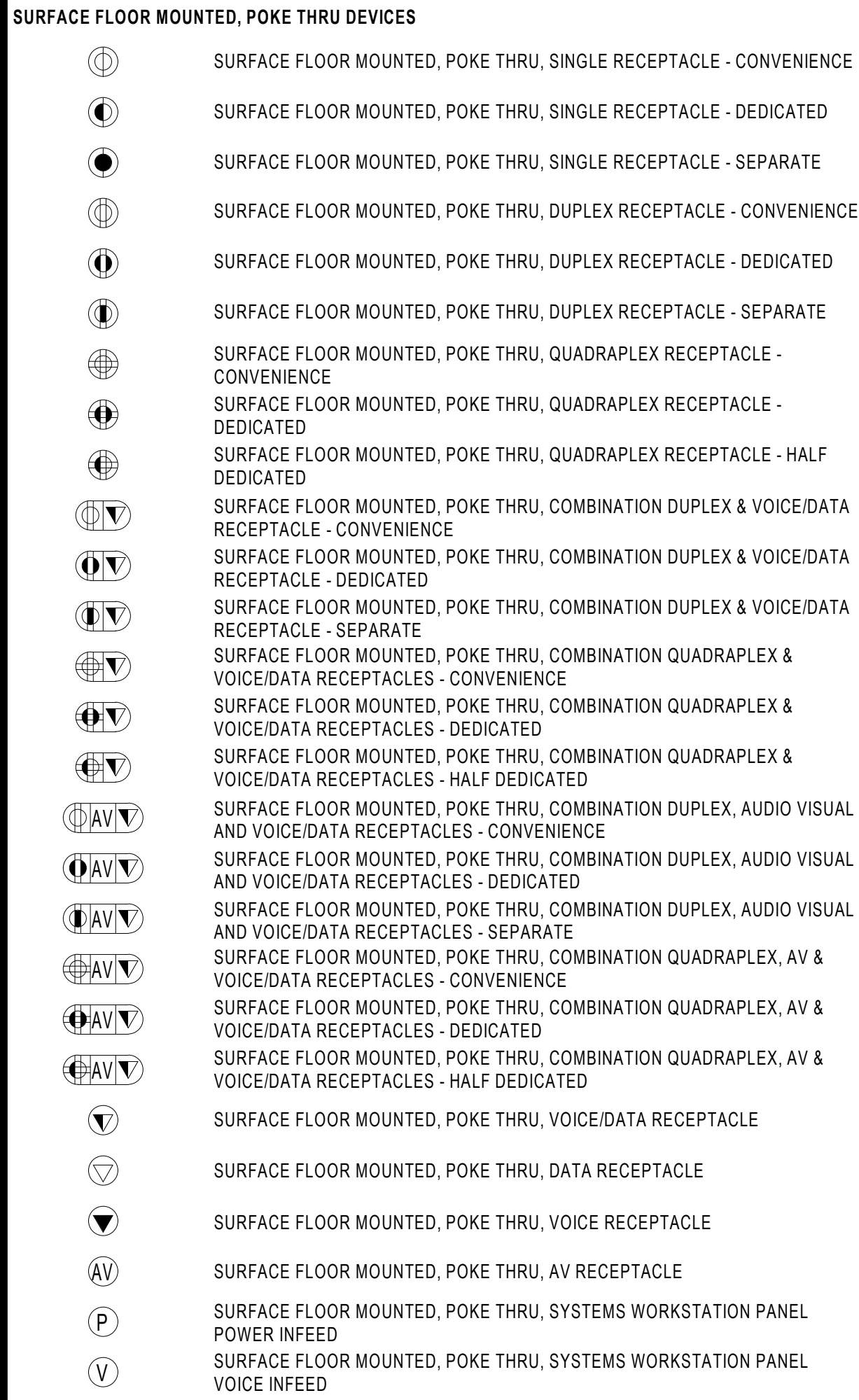


### SECTION INDICATIONS

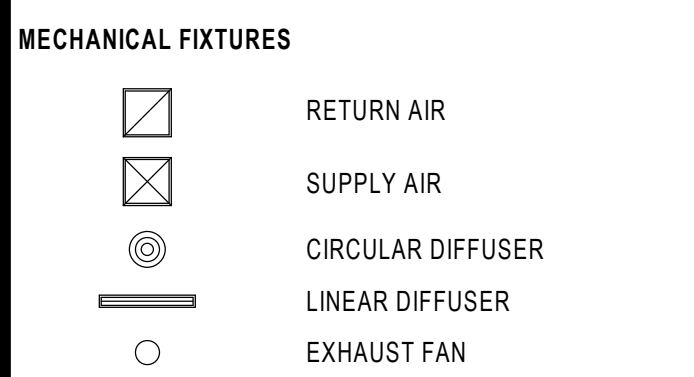
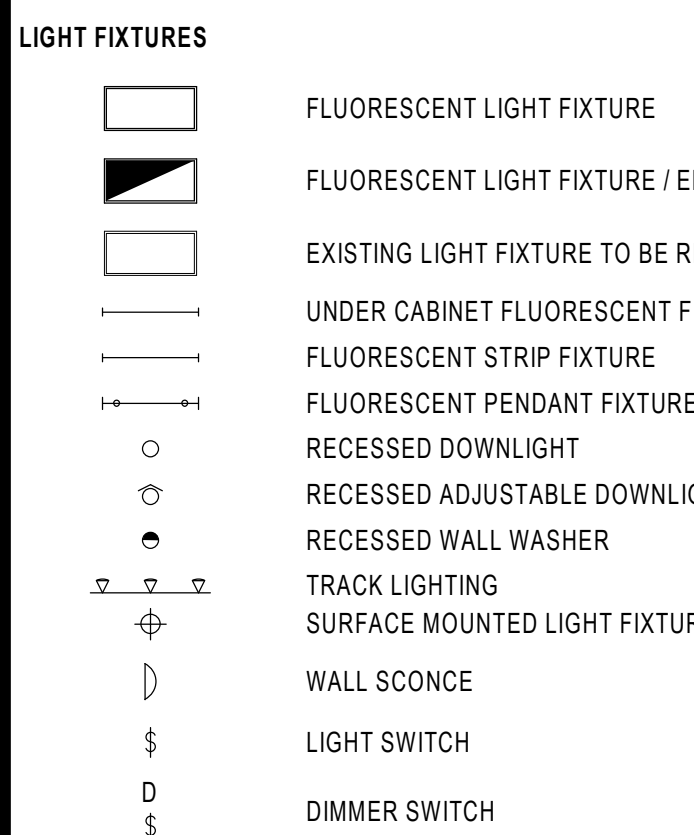
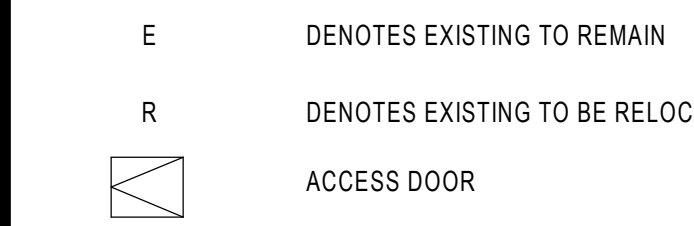
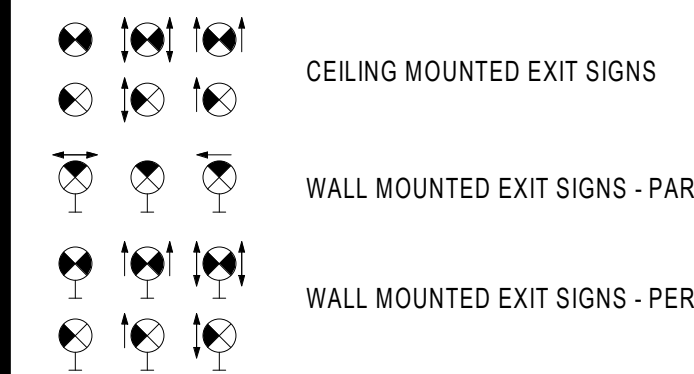
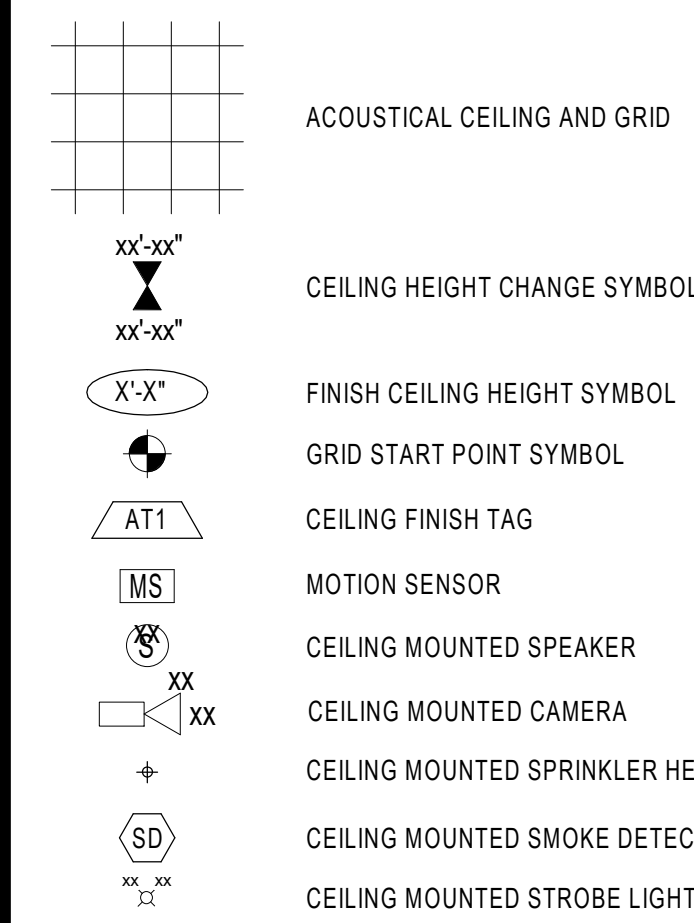


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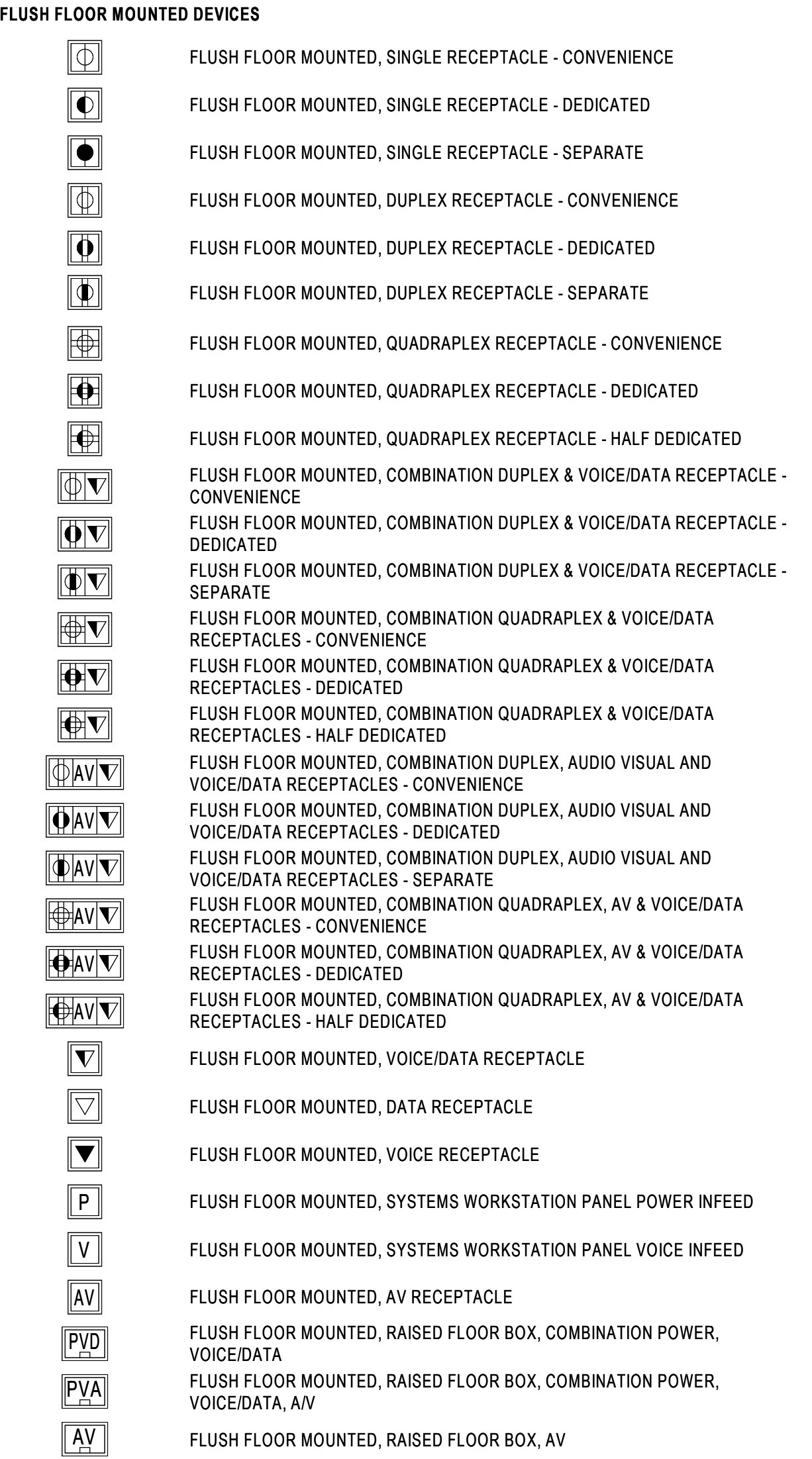


### REFLECTED CEILING

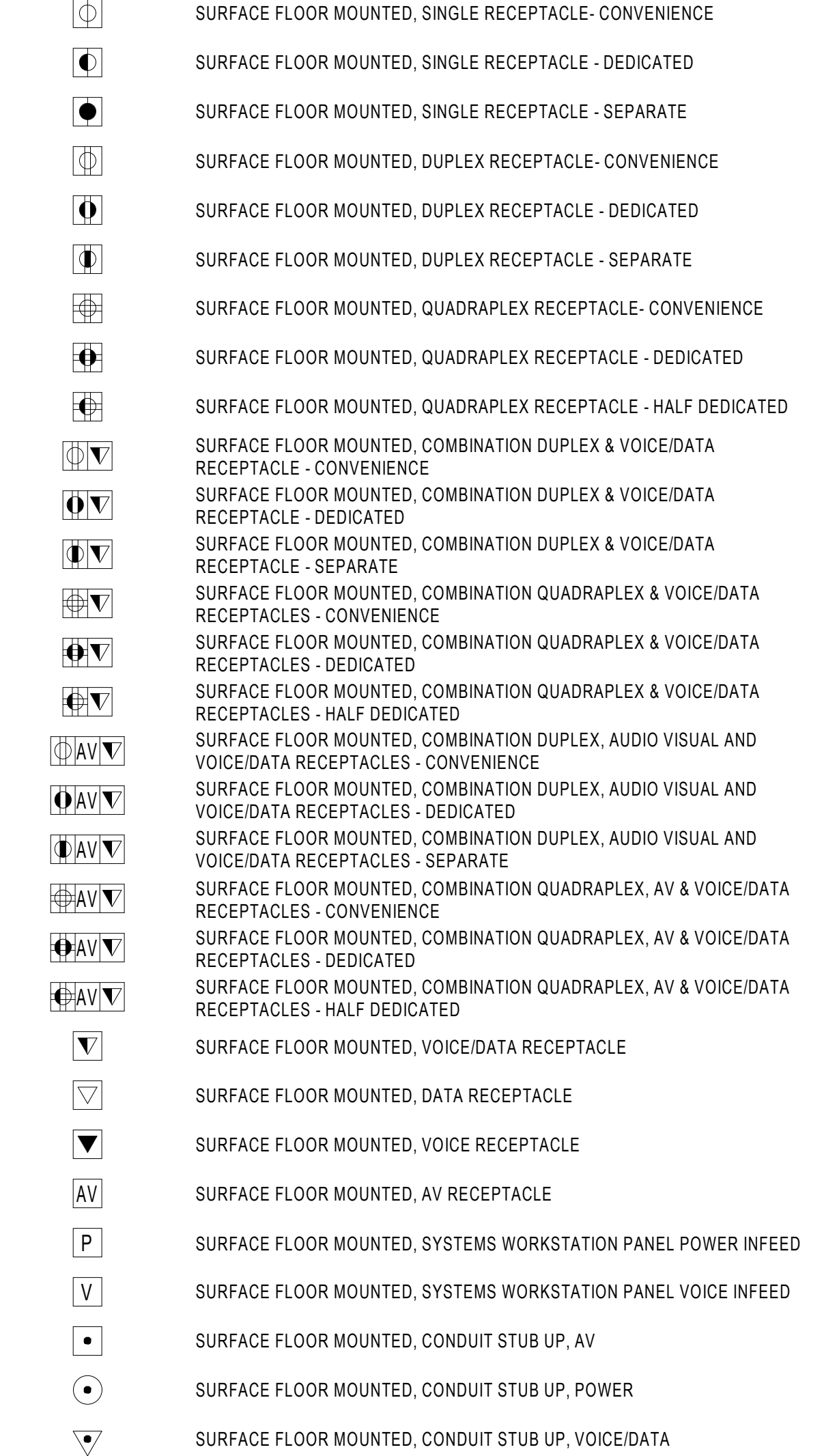


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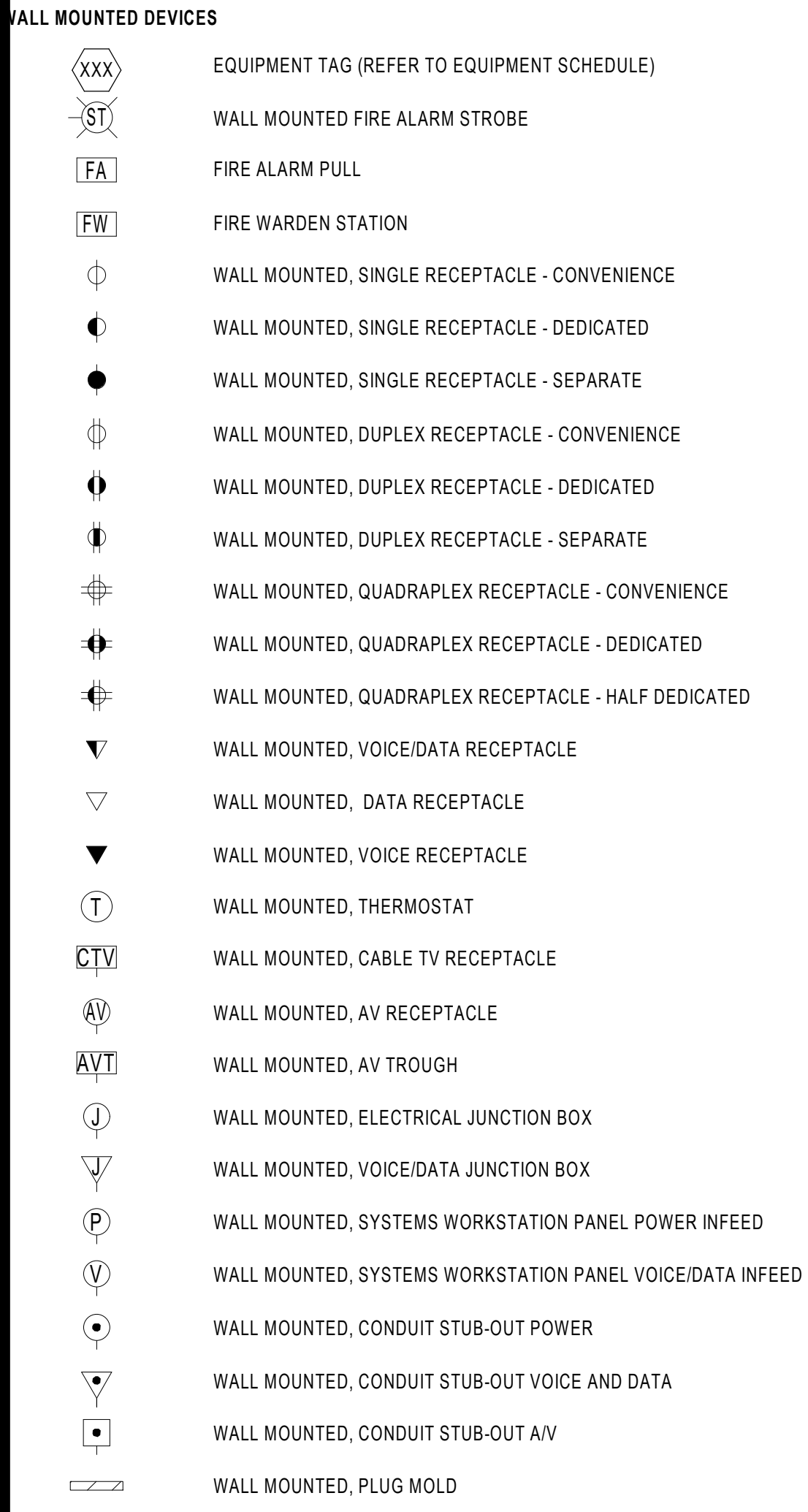


### SURFACE FLOOR MOUNTED DEVICES

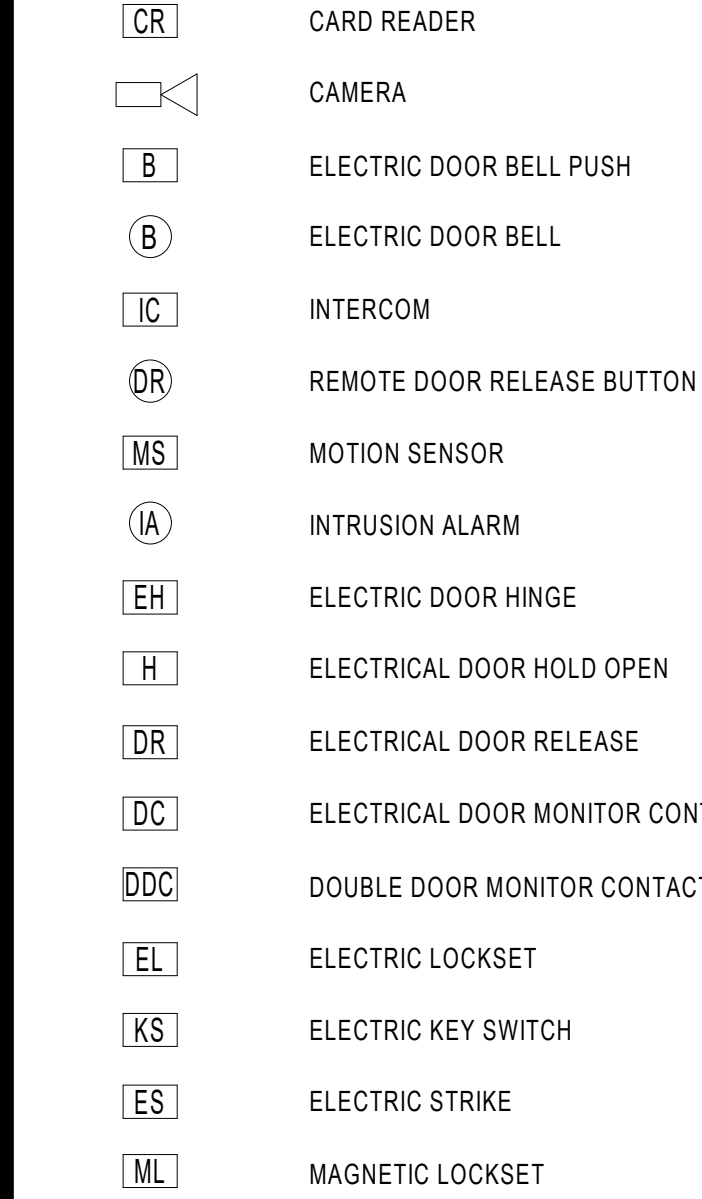


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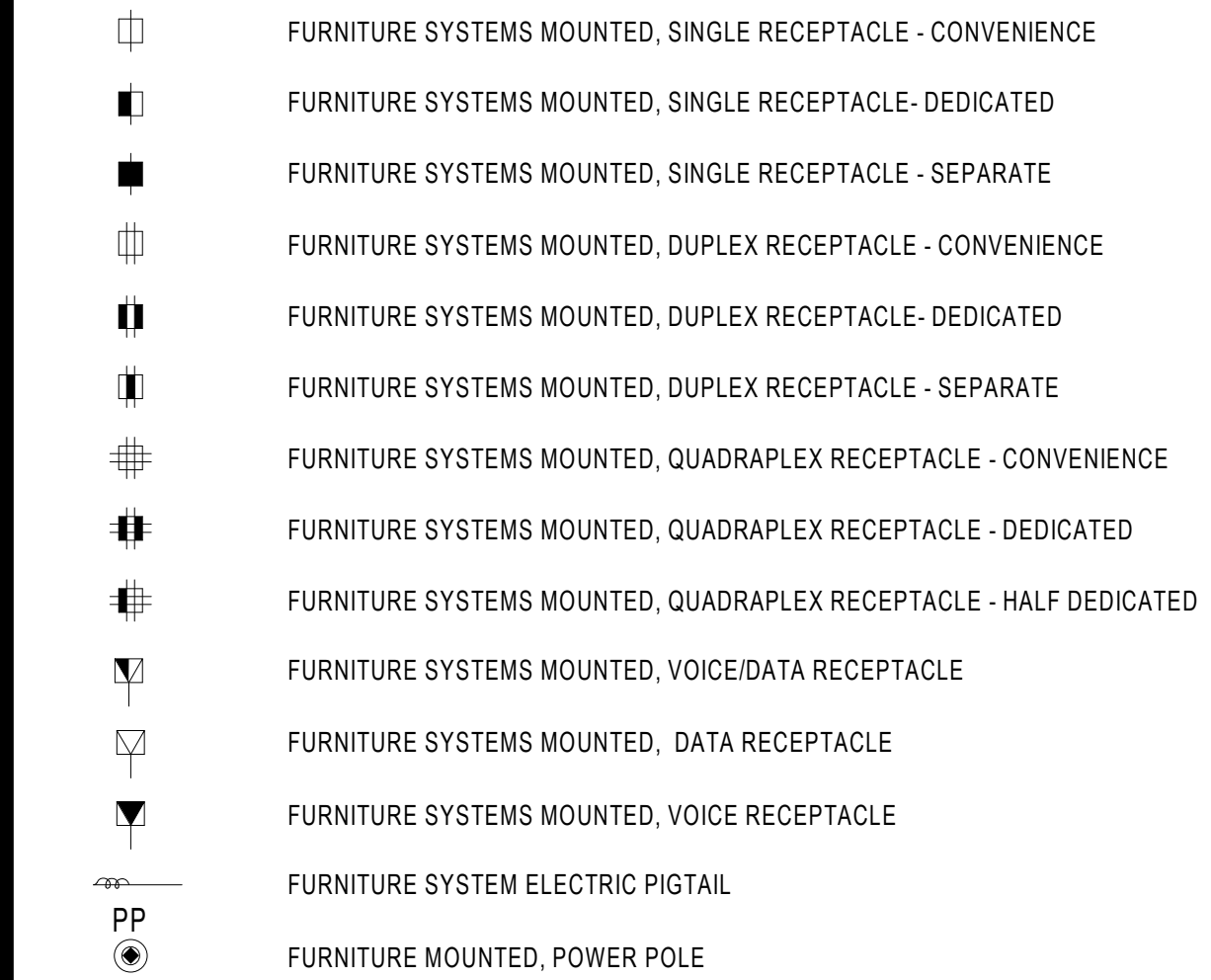
### POWER AND COMMUNICATION



### SECURITY DEVICES

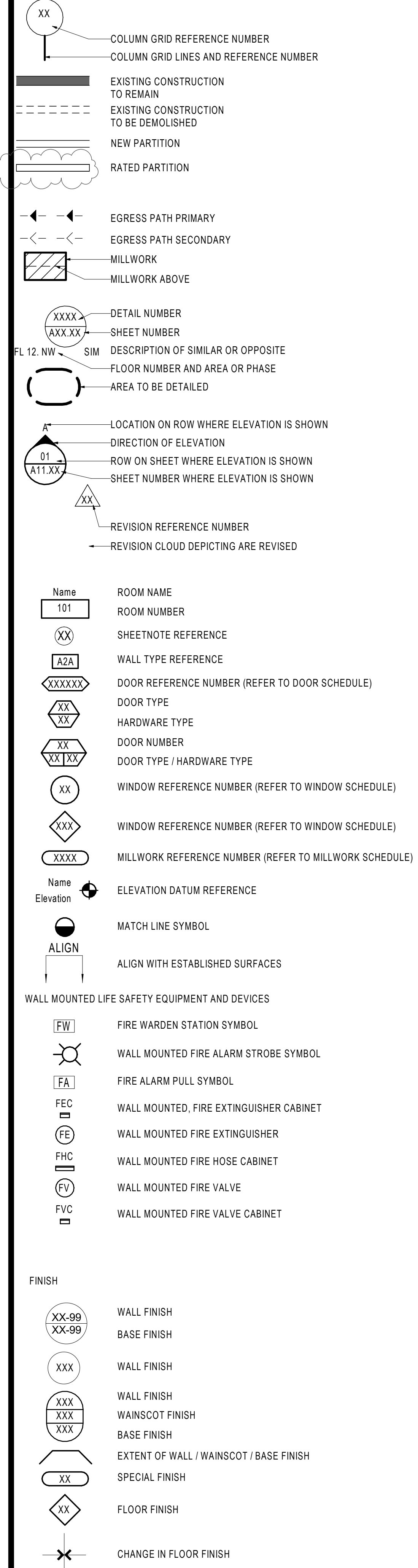


### FURNITURE SYSTEMS MOUNTED DEVICES



## GRAPHIC SYMBOLS

### CONSTRUCTION



Date	Description
------	-------------

**Gensler**  
 225 Broadway  
 Suite 100  
 San Diego, CA 92101  
 United States  
 Tel 619.557.2500  
 Fax 619.557.2520

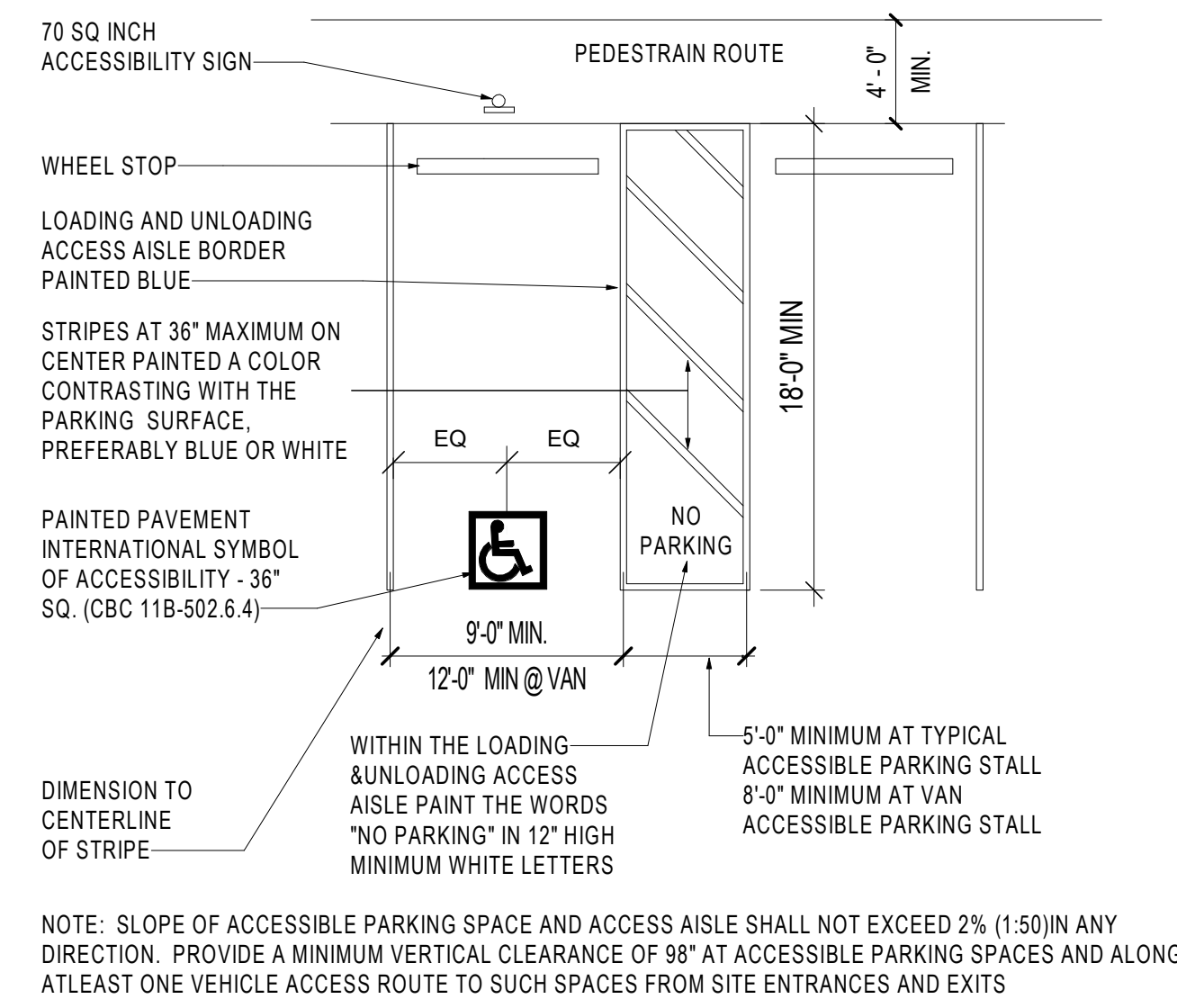


Project Number  
**55.7291.015**  
 04.04.18  
 The City of  
**SAN DIEGO**  
 Public Works  
**A00.101**

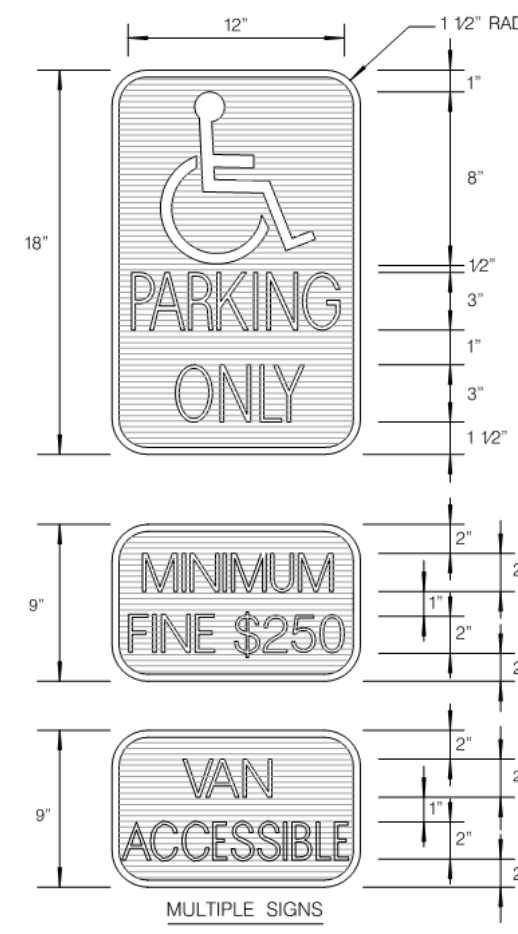
## PALM AVE TRANSITIONAL HOUSING

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 31 OF 122 SHEETS		WBS S-18003
APPROVED: JASON GRANI FOR CITY ENGINEER DATE: 7/3/08 PRINT DCE NAME: RCE#	04.05.18 DATE: 7/3/08 RCE#	SUBMITTED BY: JASIAH NEFF PROJECT MANAGER CHECKED BY: PROJECT ENGINEER
DESCRIPTION: ADDENDUM A	BY: SHS	APPROVED: [Signature]
DATE: 5/1/2018	FILMED:	CCS27 COORDINATE
CONTRACTOR INSPECTOR:	DATE STARTED: DATE COMPLETED:	CCS83 COORDINATE
		40498-31-D



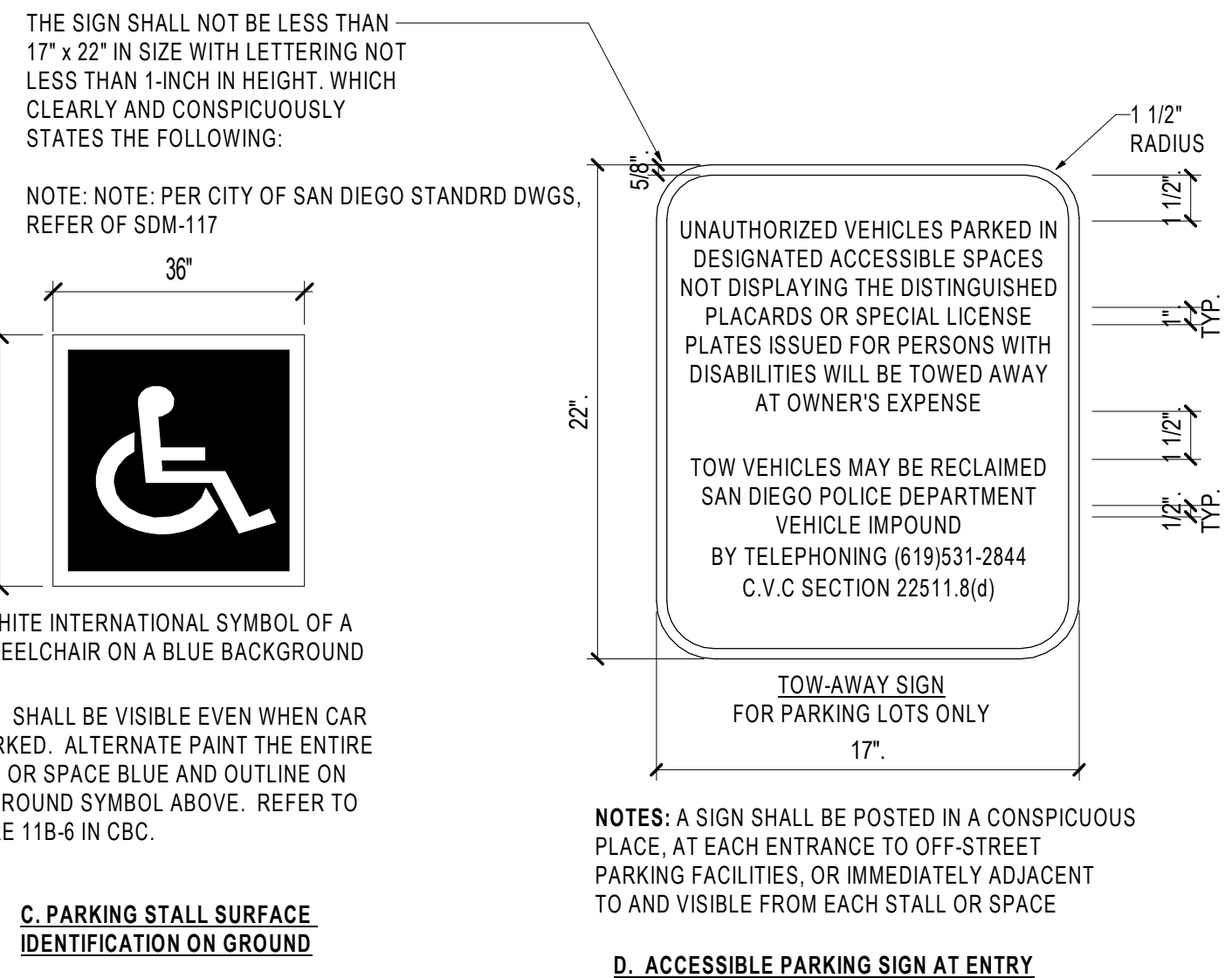


**09 ACCESSIBLE PARKING STALL-SINGLE**  
SCALE: NOT TO SCALE

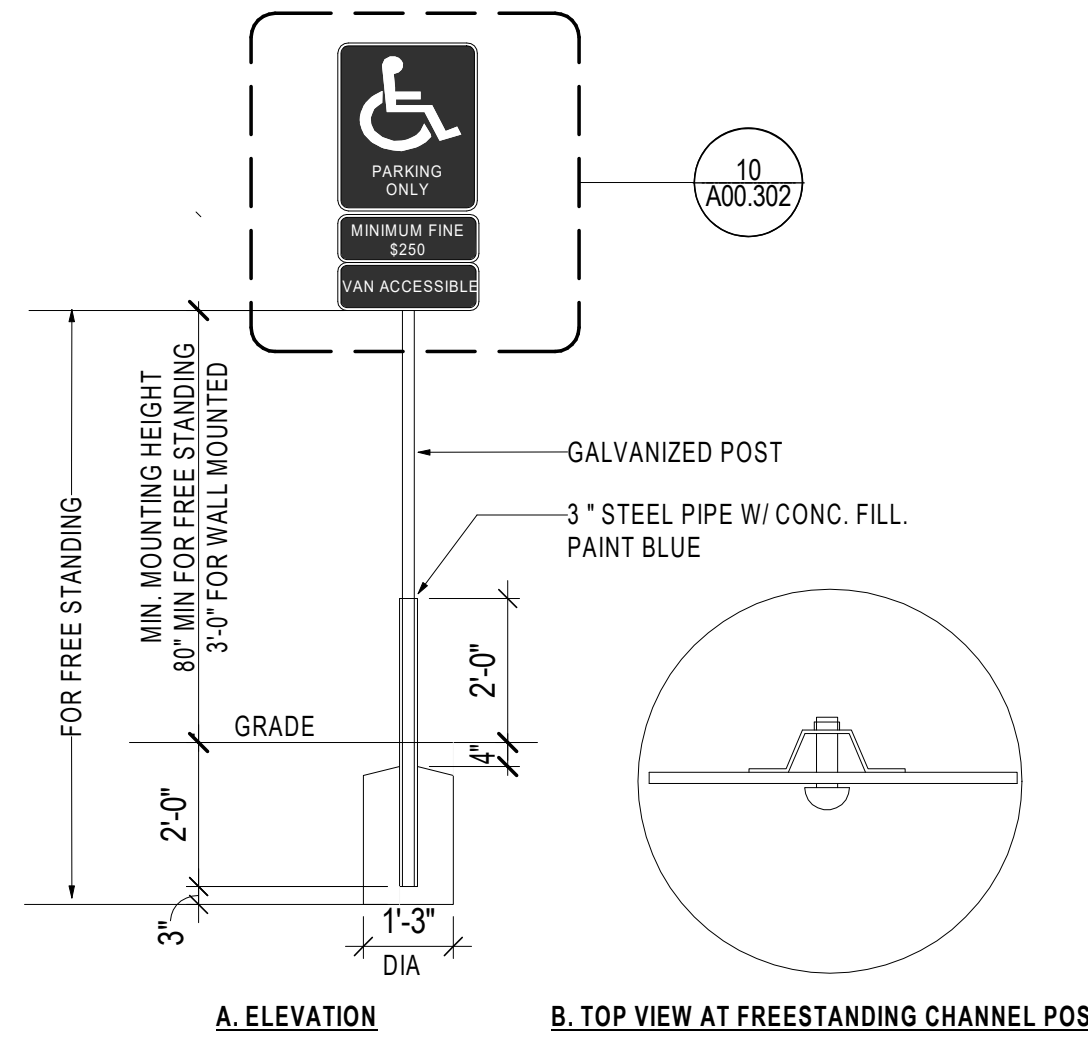


- NOTES:**  
 1. SIGN POST: SEE SDM-104 FOR "BREAK-AWAY SIGN POST"  
 2. SIGNS SHALL BE CONSTRUCTED ON MINIMUM 1/16 INCH THICK ALUMINUM.  
 3. COLORS:  
 PARKING SIGNS: BACKGROUND - BLUE (RETROREFLECTIVE) BORDER, TEXT, AND SYMBOL - WHITE (RETROREFLECTIVE)  
 TOW AWAY SIGN: BACKGROUND - WHITE (RETROREFLECTIVE) BORDER AND LEGEND - BLACK  
 4. FONTS: SAN SERIF CLEARVIEW, 1" MIN. LETTER HEIGHT  
 5. THE BOTTOM OF THE LOWEST SIGN SHALL BE AT LEAST 7'-0" OR HIGHER TO THE SIDEWALK SURFACE.

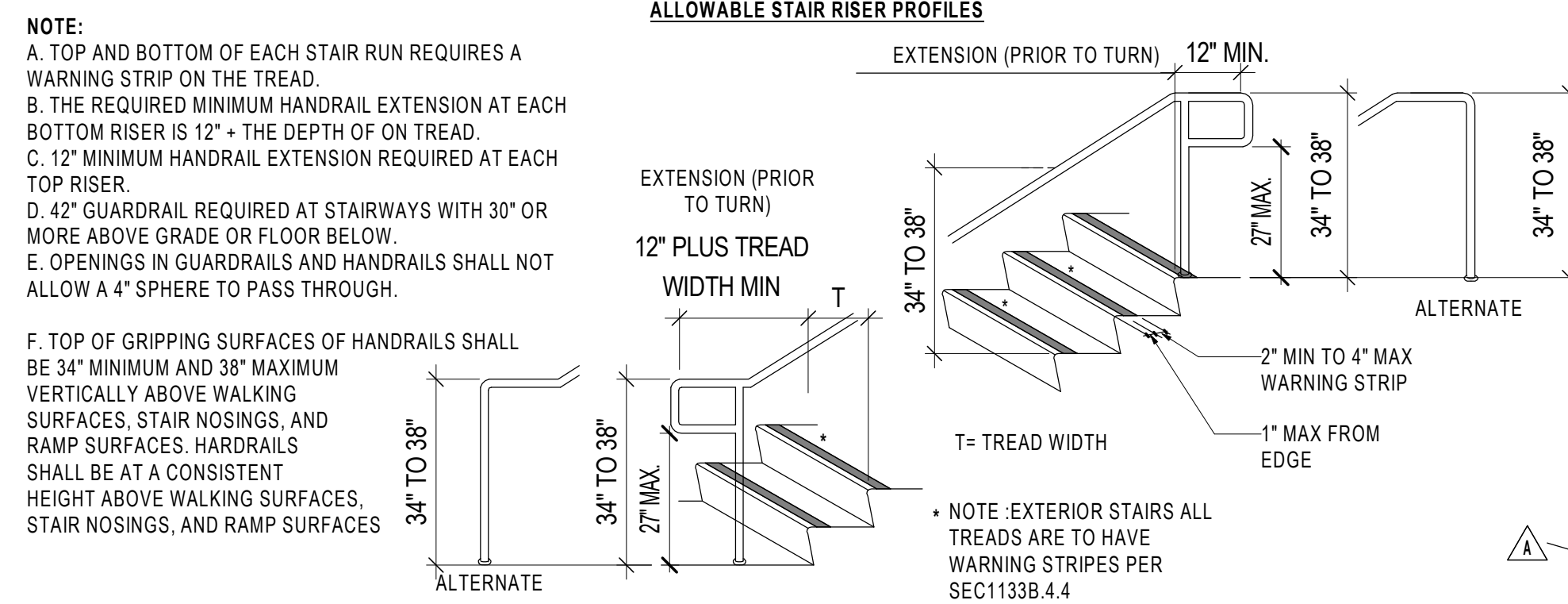
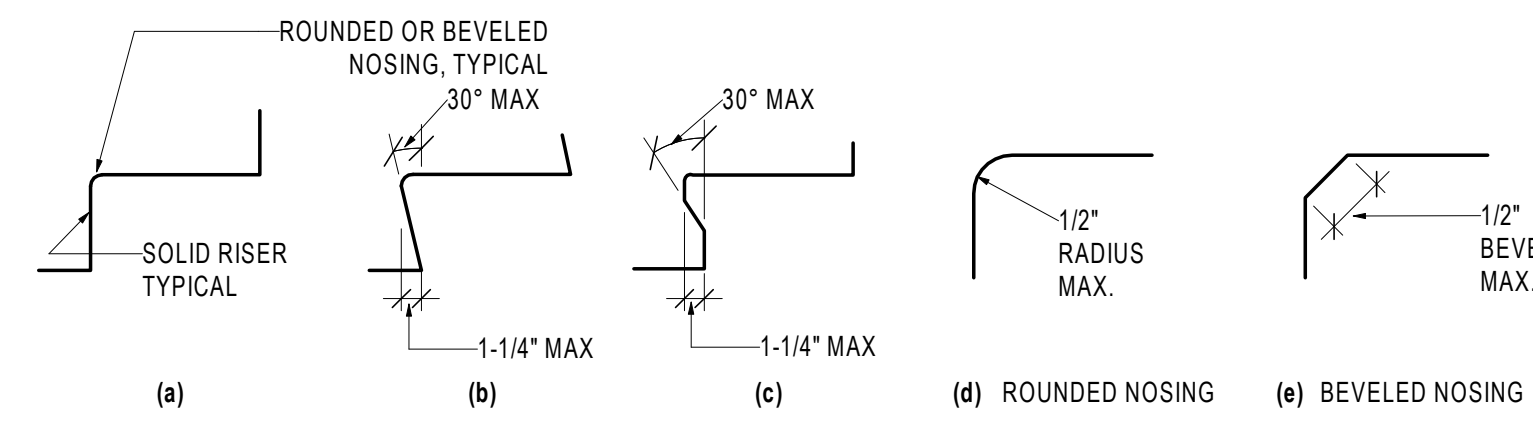
**10 ACCESSIBLE PARKING SIGNAGE DETAIL**  
SCALE: 1/16" = 1'-0"



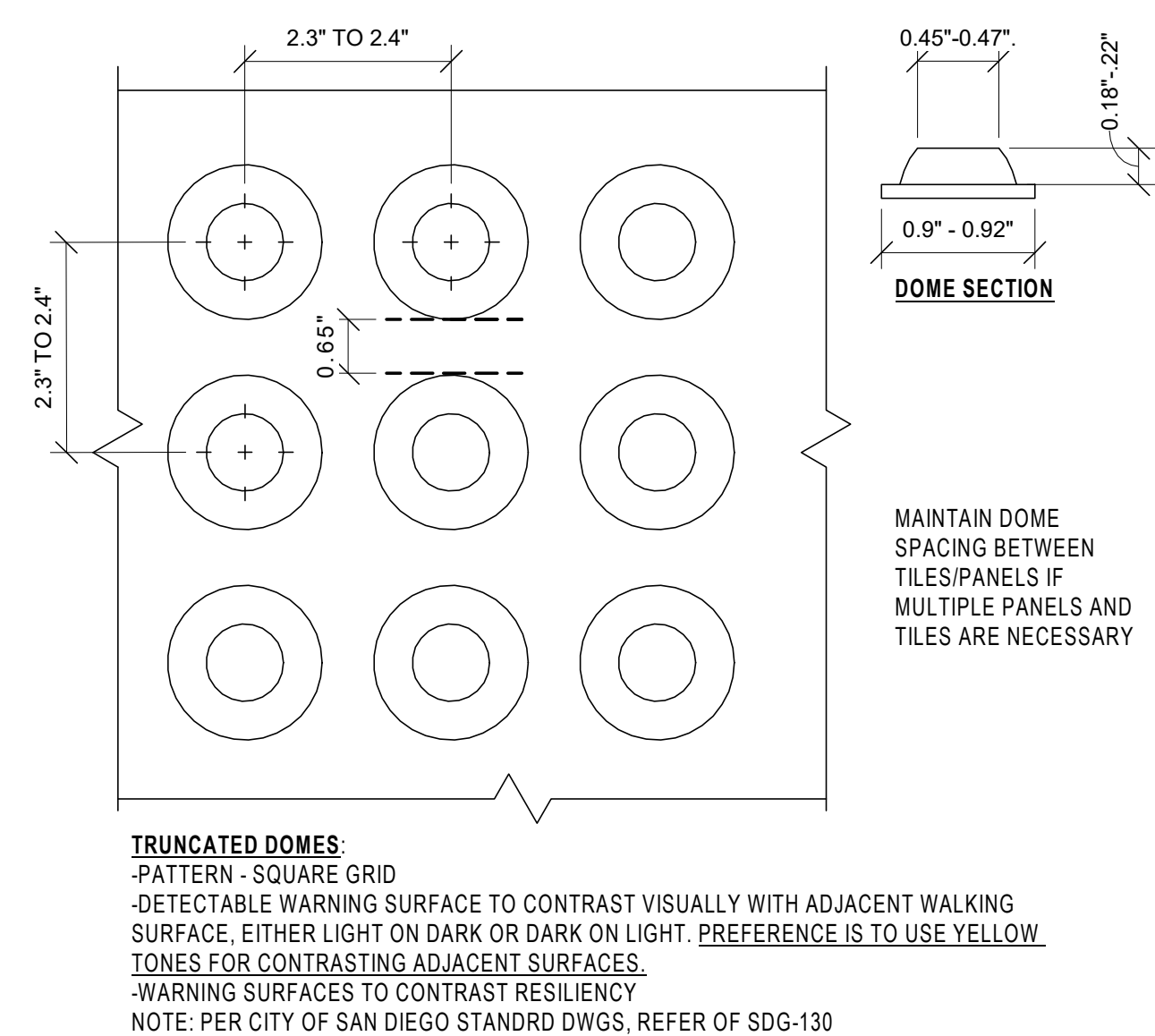
**05 ACCESSIBLE PARKING SIGNAGE**  
SCALE: 1 1/2" = 1'-0"



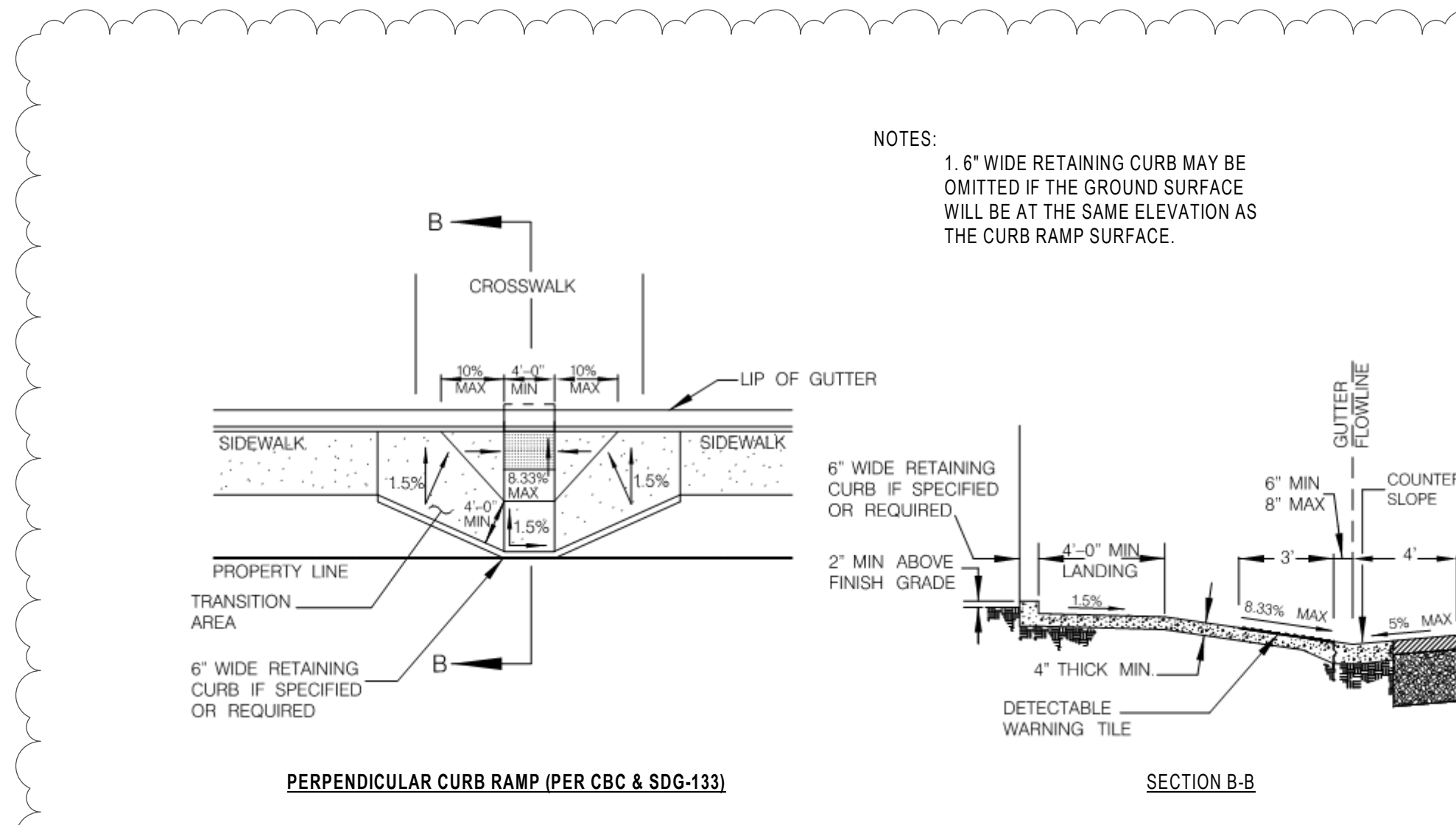
**06 ACCESSIBLE PARKING SIGNAGE**  
SCALE: NOT TO SCALE



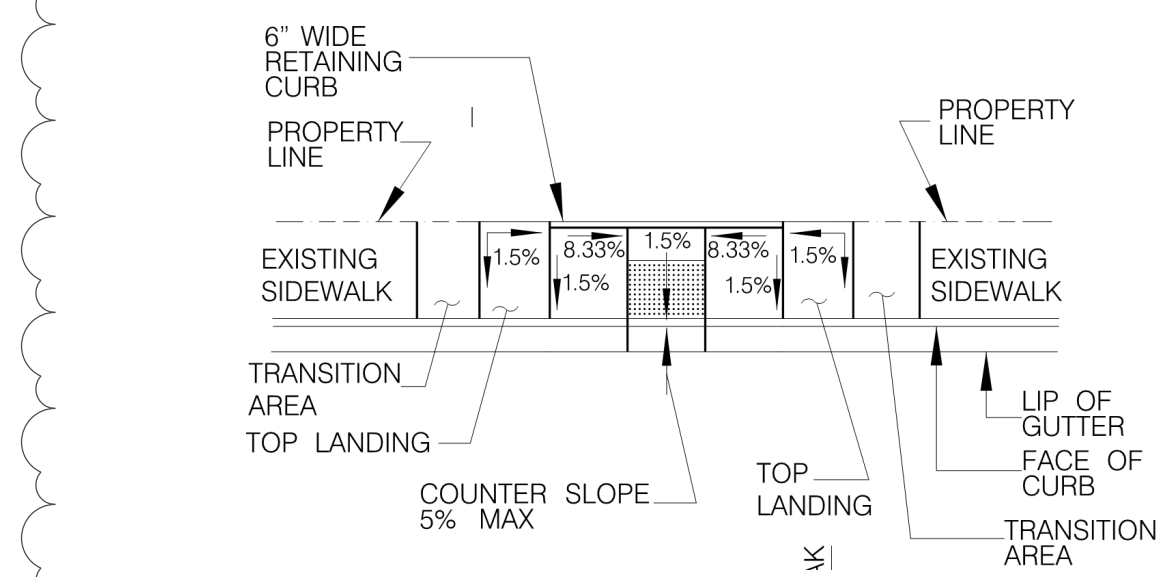
**07 STAIR REQUIREMENTS**  
SCALE: NOT TO SCALE



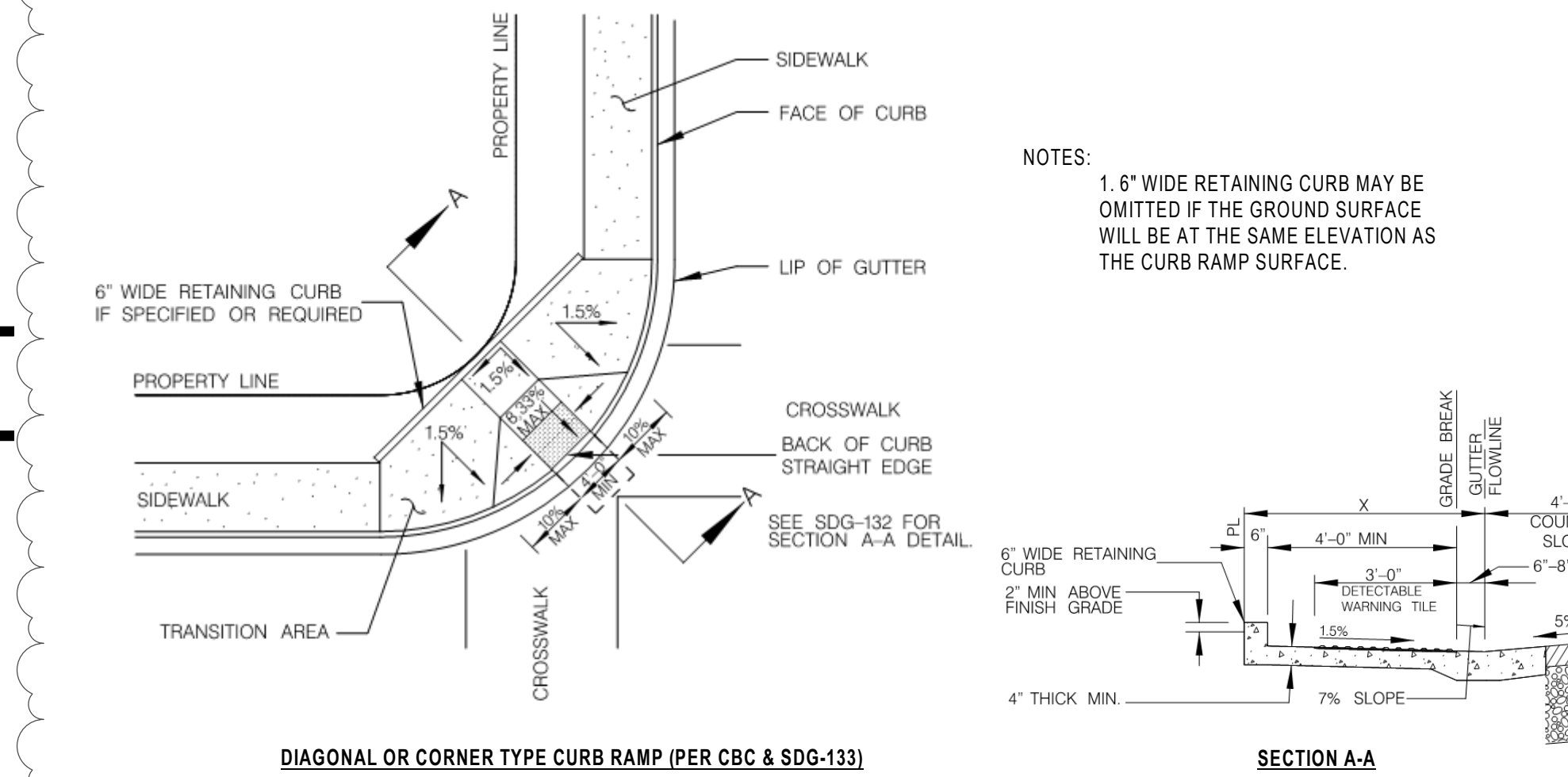
**08 SITE TRUNCATED DOMES**  
SCALE: NOT TO SCALE



PERPENDICULAR CURB RAMP (PER CBC & SDG-133)

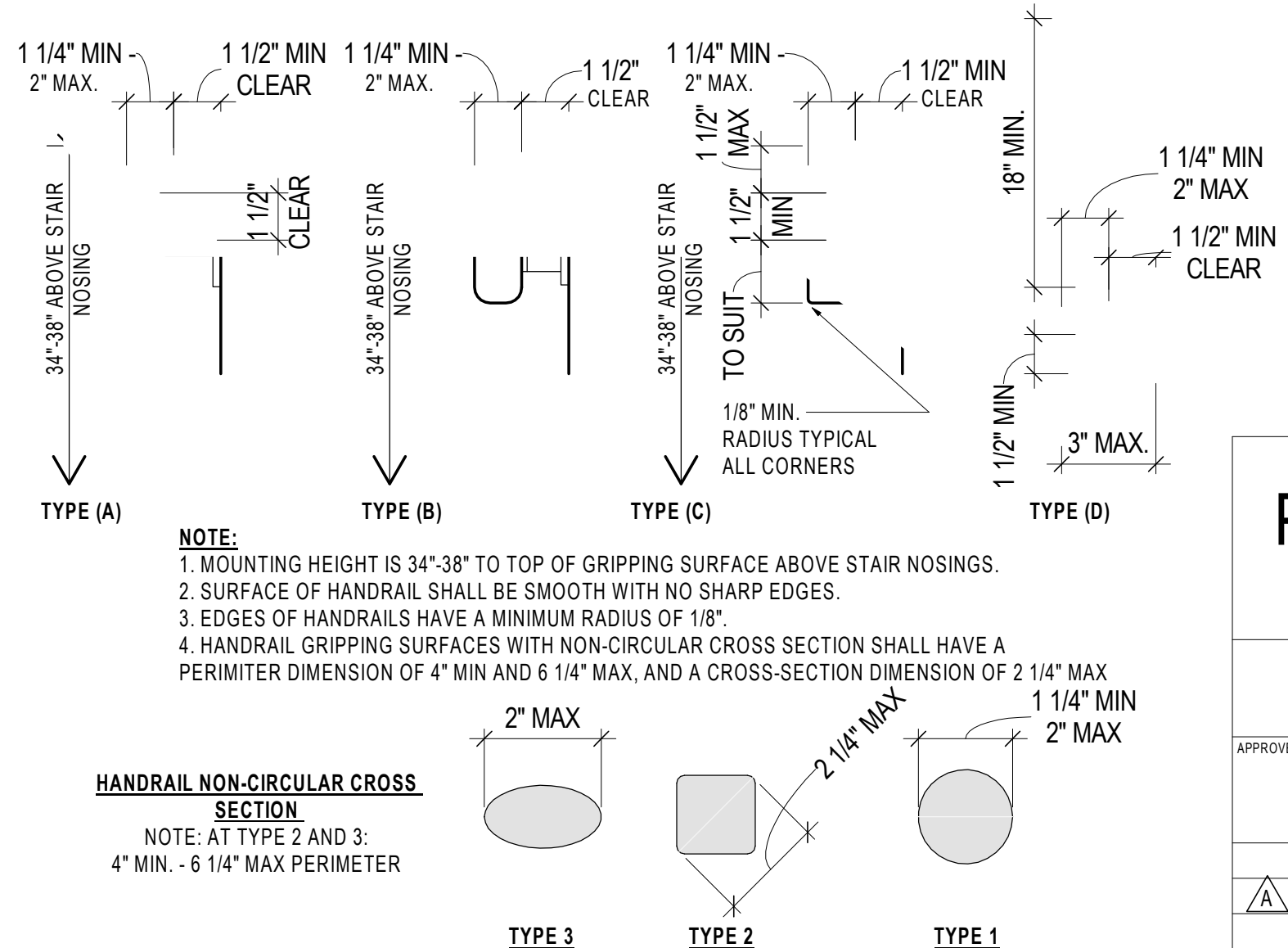


PARALLEL CURB RAMP (PER CBC & SDG-133)



DIAGONAL OR CORNER TYPE CURB RAMP (PER CBC & SDG-133)

**03 TYPICAL CURB CUT RAMPS**  
SCALE: NOT TO SCALE



**04 STAIR HANDRAIL REQUIREMENTS**  
SCALE: NOT TO SCALE

UPDATED TYPICAL CURB CUT RAMPS

**FOR REFERENCE ONLY**

Date	Description
------	-------------

**Gensler**  
225 Broadway  
Suite 100  
San Diego, CA 92101  
United States  
Tel 619.557.2500  
Fax 619.557.2520

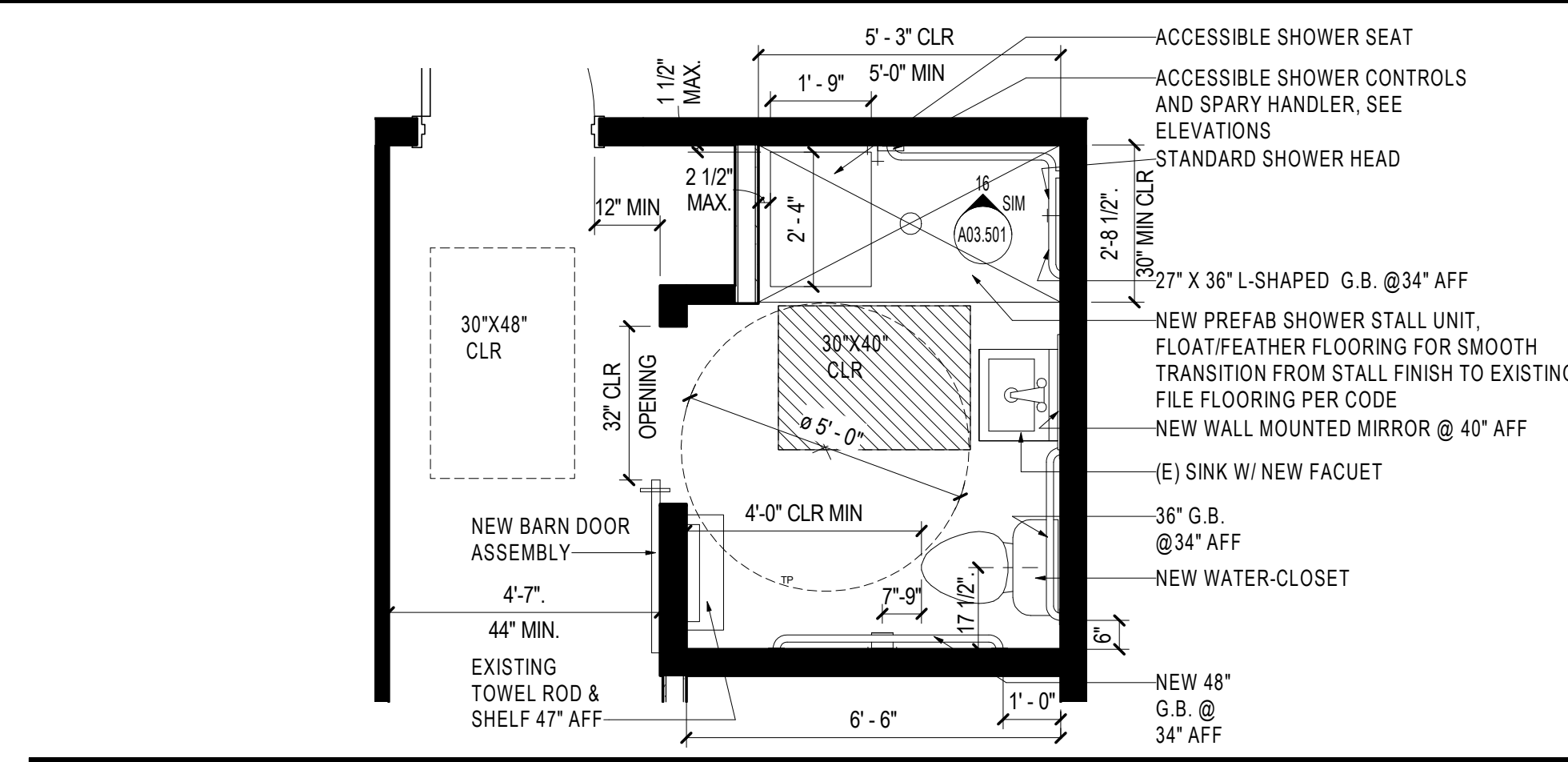


Project Number  
55.7291.015  
04.04.18  
The City of  
**SAN DIEGO**  
Public Works  
A00.302

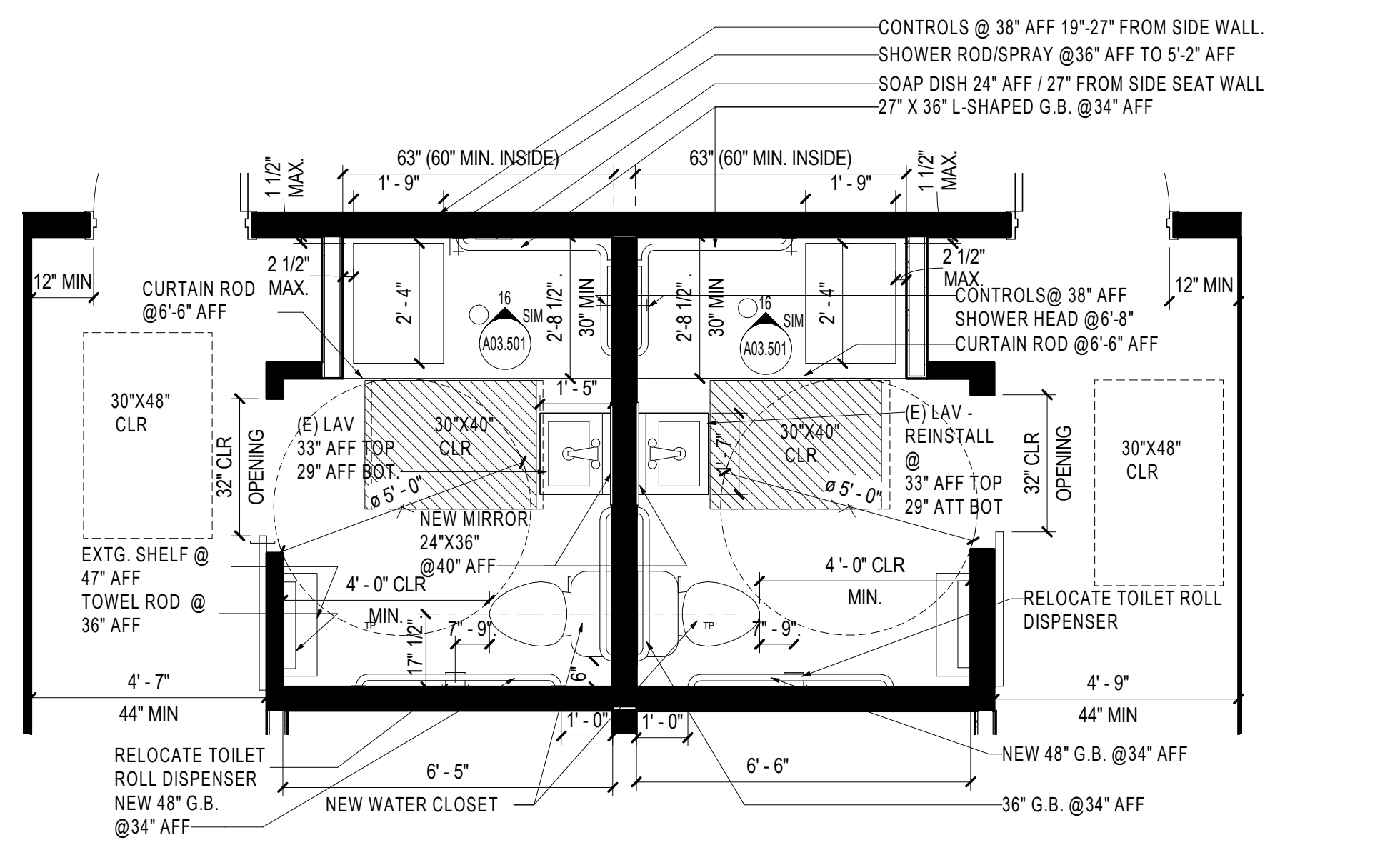
**PALM AVE TRANSITIONAL HOUSING**  
SITE ACCESSIBILITY CODE REQUIREMENTS & DETAILS

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 36 OF 122 SHEETS		WBS S-18003
APPROVED: [Signature]	DATE: 04.05.18	SUBMITTED BY: JASIAH NEFF
FOR CITY ENGINEER: JASON GRANI	DATE: 7/3/08	PROJECT MANAGER
PRINT DCE NAME: [Signature]	RC#:	CHECKED BY:
DESCRIPTION: ADDENDUM A	BY: SHS	APPROVED: [Signature]
		DATE FILMED: 5/1/2018
		PROJECT ENGINEER: CCS27 COORDINATE
		CONTRACTOR INSPECTOR: [Signature]
		DATE STARTED: [Blank]
		DATE COMPLETED: [Blank]
		PROJECT NUMBER: 40498-35-D

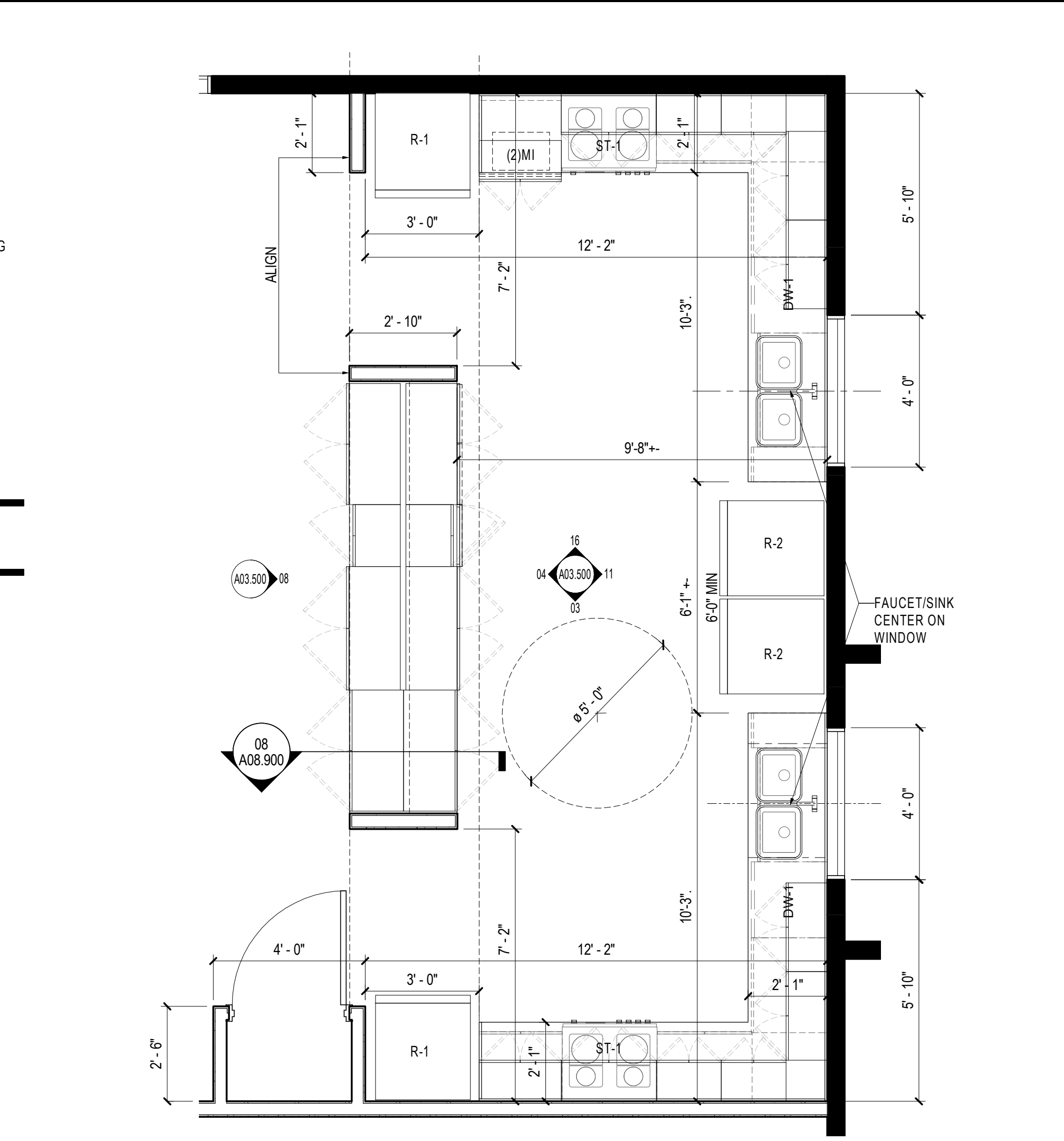
ADDENDUM A



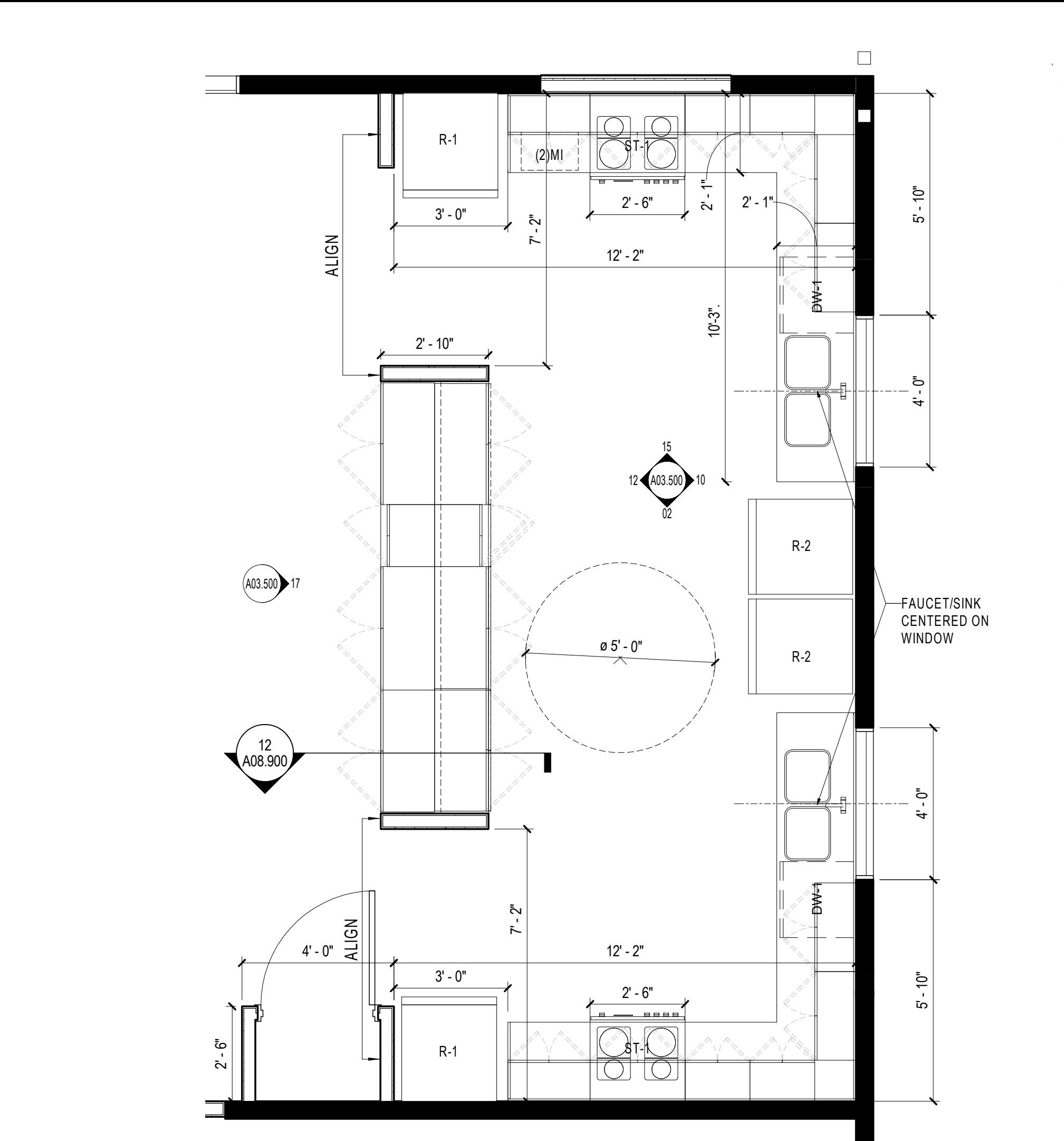
**13 ENLARGED PLAN - 111 (REWORK (E) ACCESSIBLE RESTROOM)**  
SCALE: 3/8" = 1'-0"



**14 ENLARGED PLAN - 113+112 (REWORK (E) ACCESSIBLE RESTROOM)**  
SCALE: 3/8" = 1'-0"

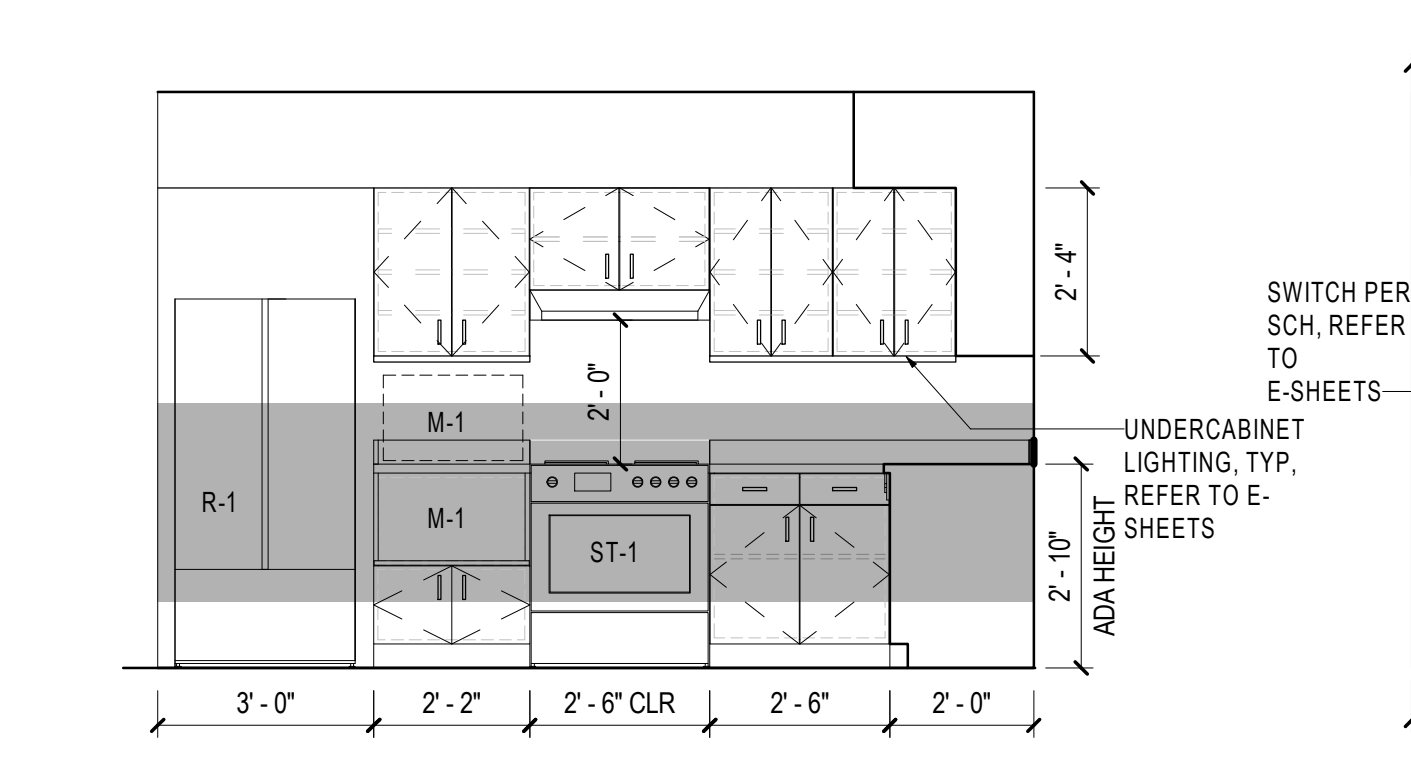


**09 ENLARGED PLAN - LEVEL 02 - KITCHEN**  
SCALE: 3/8" = 1'-0"

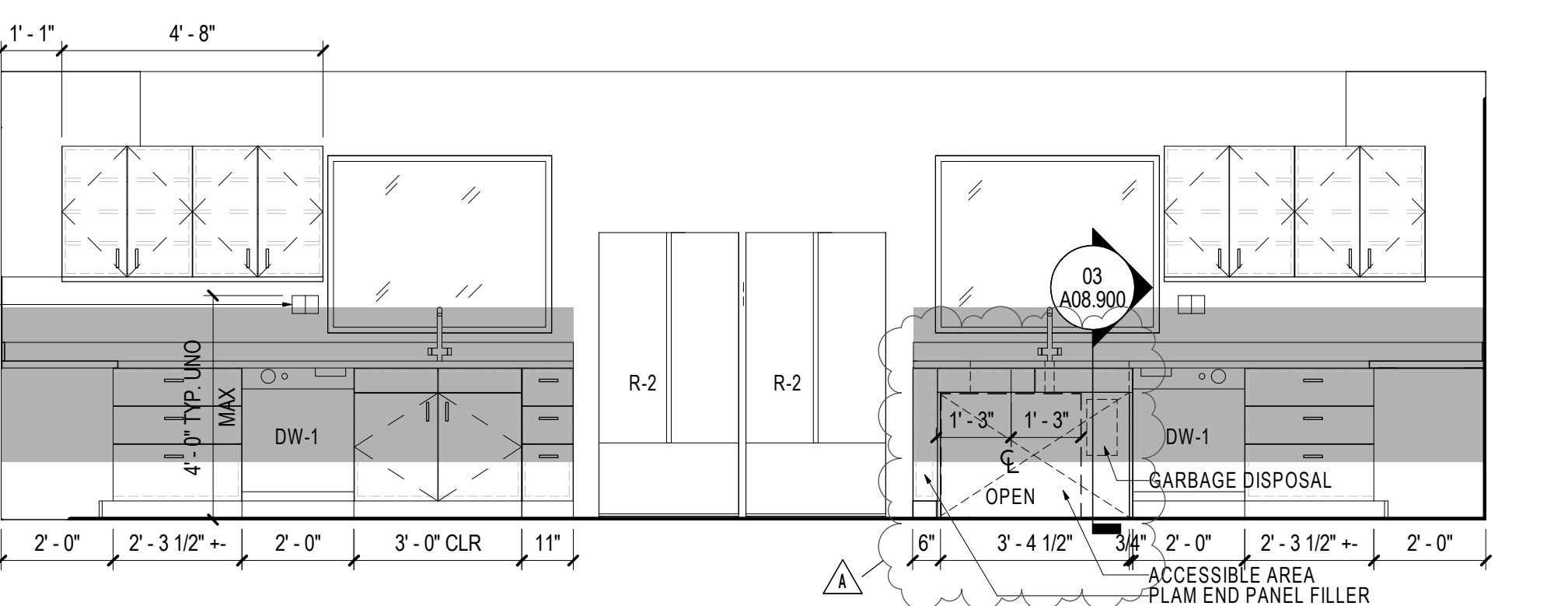


**01 ENLARGED PLAN - LEVEL 01 - KITCHEN**  
SCALE: 3/8" = 1'-0"

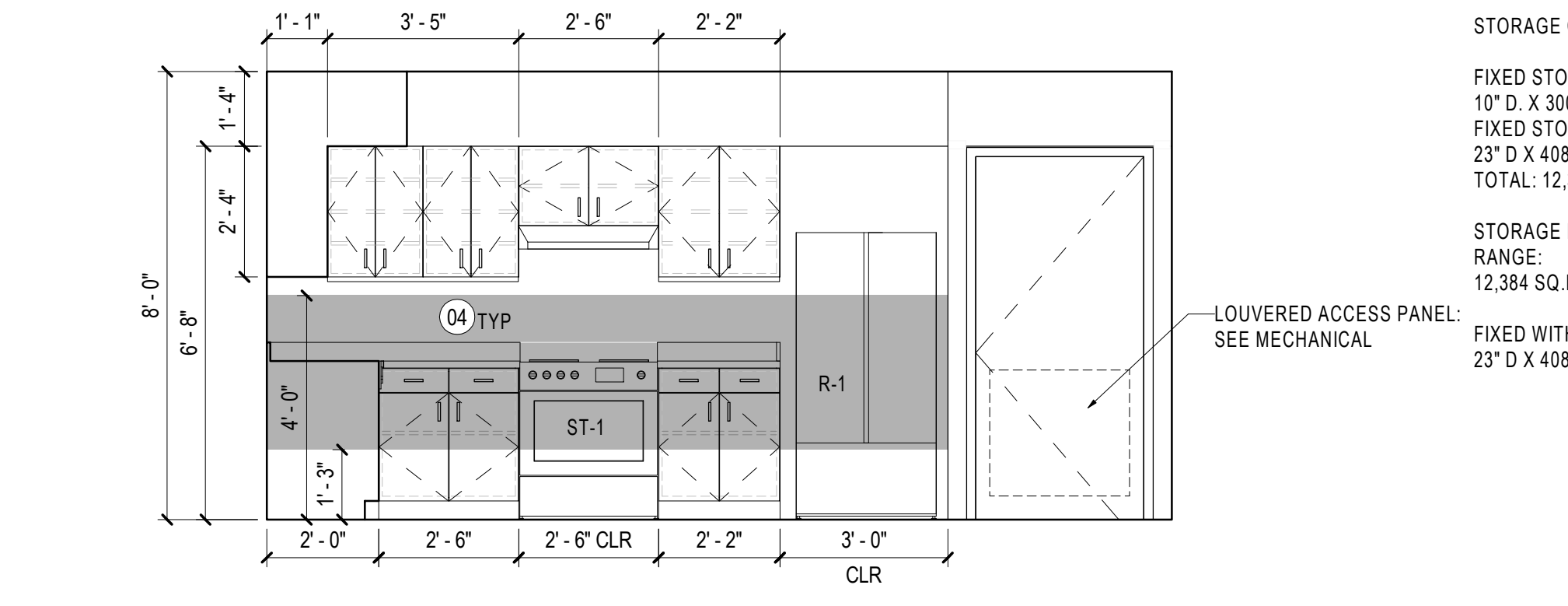
- SHEET NOTES**
- EATING COUNTER ON BACK ELEVATION
  - FINISHED CABINET BACK. MATCH SURROUNDING CABINET FACES
  - INDIVIDUAL TRASH/RECYCLE PULL-OUT BINS W/REMOVABLE TRASH LINER. WITH EITHER TRASH OR RECYCLE LOGOS MOUNTED AT CABINET. (1/8" X 1 1/2" DIAMETER ETCHED SATIN STAINLESS STEEL DISKS TO BE RECESSED FLUSH WITH FACE OF CABINET DOOR. MFR: ARCHITECTURAL HARDWARE OR EQUAL. RECYCLED PART #RC-10, TRASH PART #TR-10
  - LOCATION OF ELECTRICAL OUTLETS PER E-SHEET. OUTLETS ABOVE COUNTERTOP SHALL BE INSTALL PER CODE AT 42" AFF TO CENTERLINE OF DEVICE.



**15 KITCHEN 103 - NORTH ELEVATION**  
SCALE: 3/8" = 1'-0"

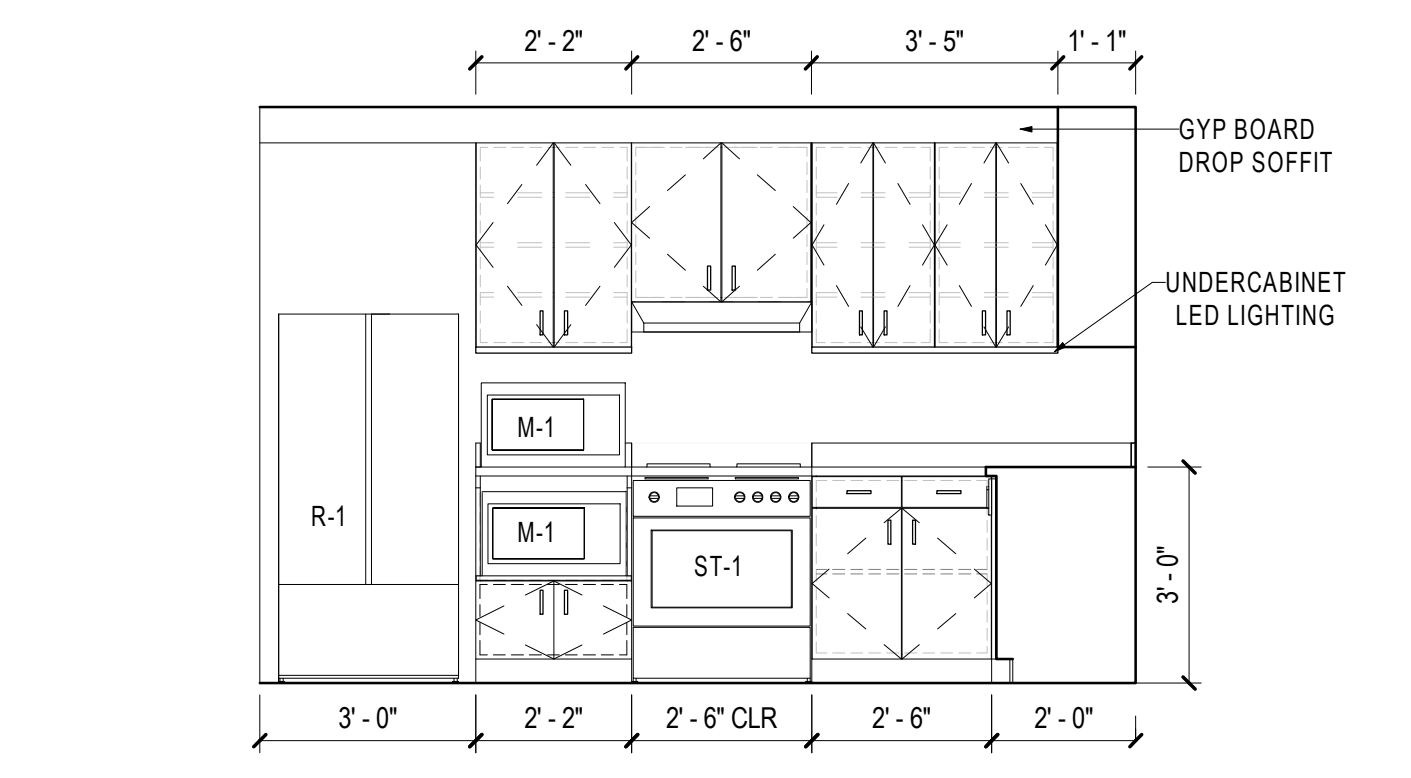


**10 KITCHEN 103 - EAST ELEVATION**  
SCALE: 3/8" = 1'-0"

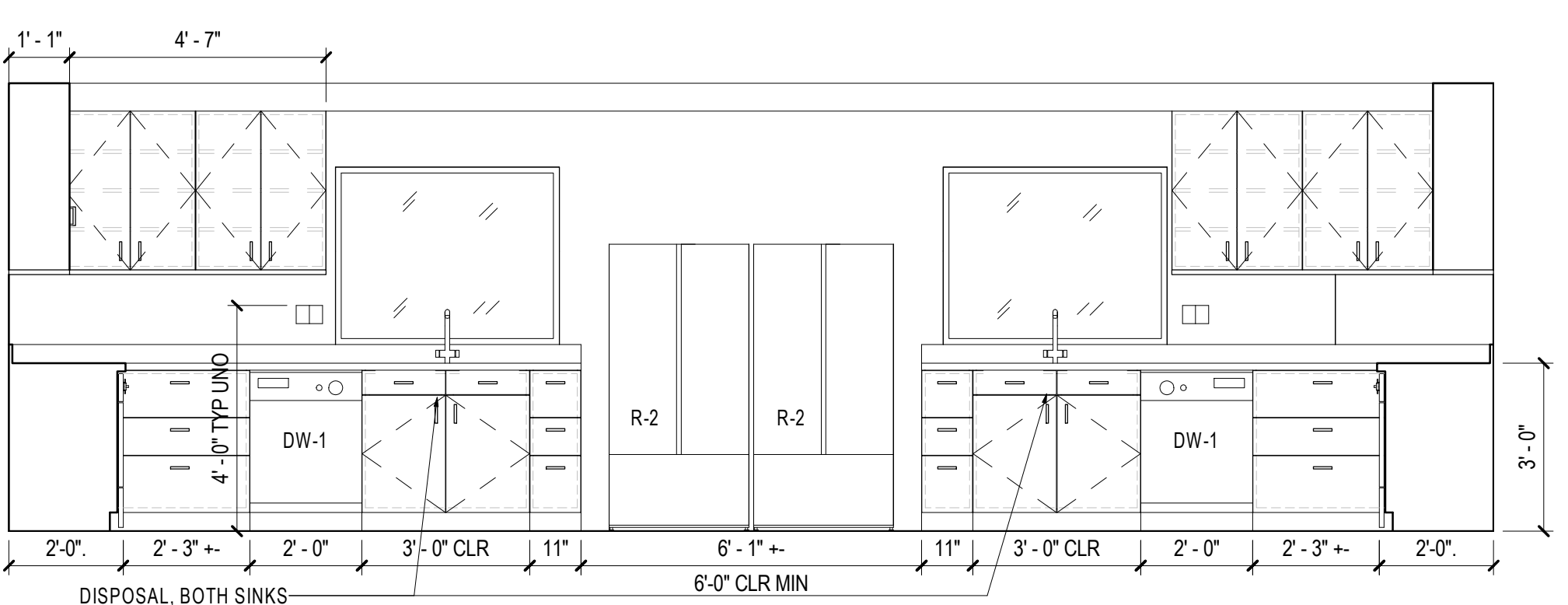


**02 KITCHEN 103 - SOUTH ELEVATION**  
SCALE: 3/8" = 1'-0"

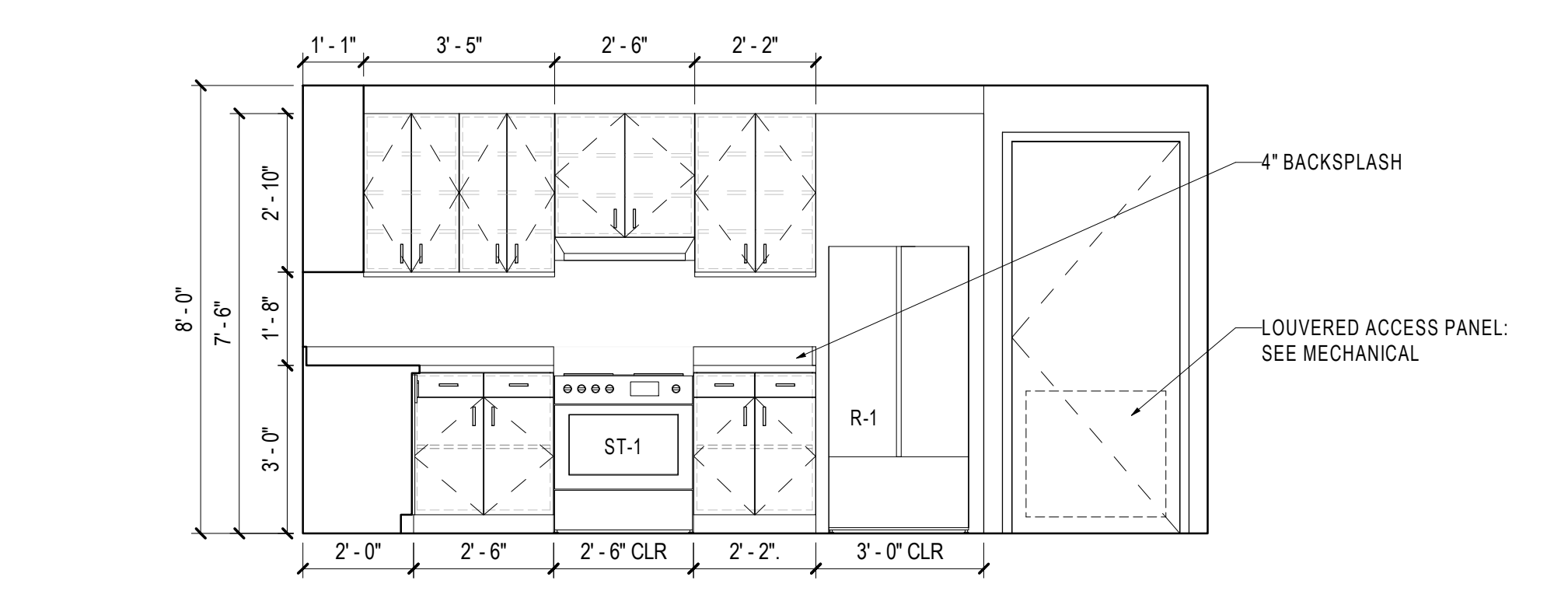
STORAGE CALCULATION KITCHEN #103:  
FIXED STORAGE UPPER CABINETS:  
10' D. X 300" = 3,000 SQ. IN.  
FIXED STORAGE BASE CABINETS:  
23' D X 408" = 9,384 SQ. IN.  
TOTAL: 12,384 SQ. IN.  
STORAGE REQUIRED WITHIN REACH RANGE:  
12,384 SQ. IN X 50% = 6,192 SQ. IN.  
FIXED WITHIN REACH RANGE:  
23' D X 408" = 9,384 SQ. IN.



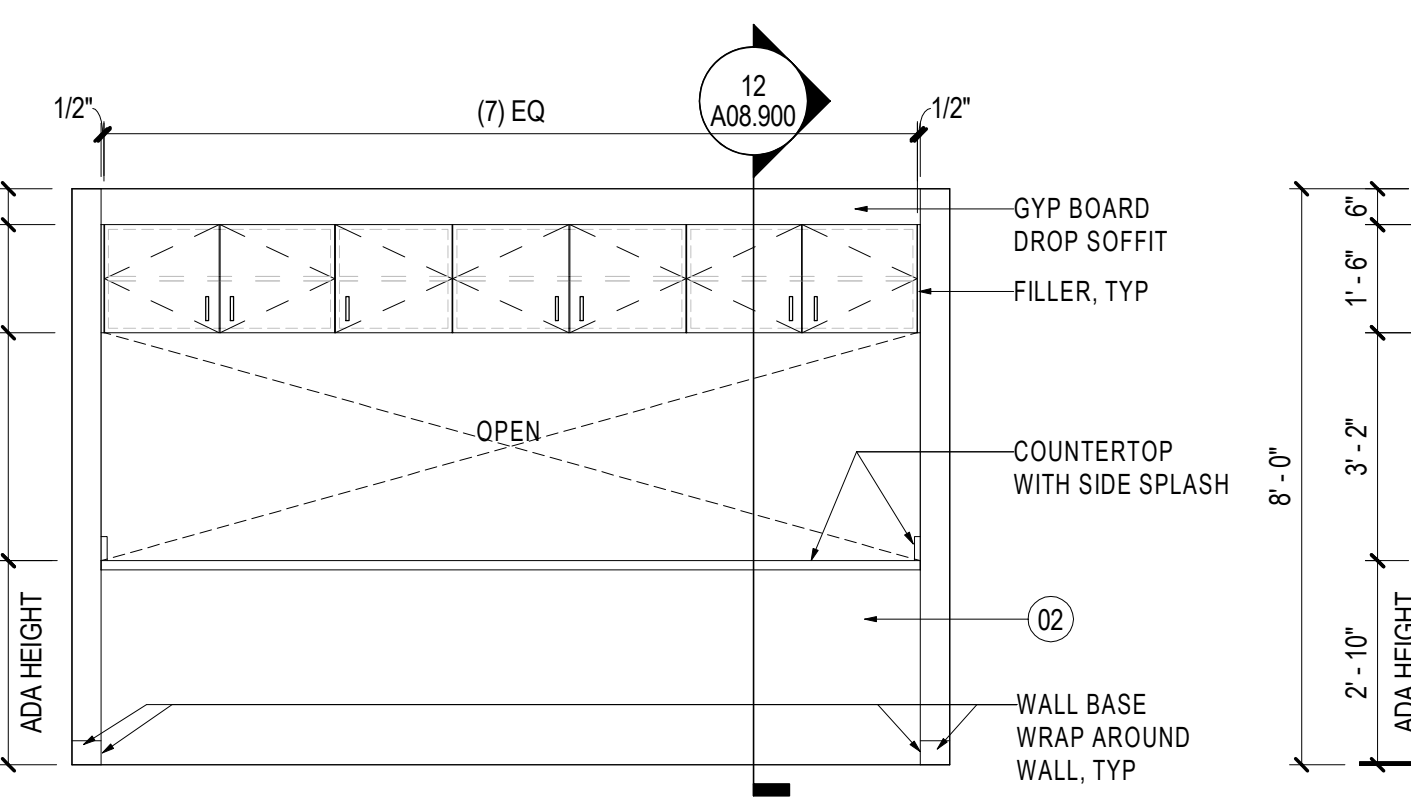
**16 KITCHEN 203 - NORTH ELEVATION**  
SCALE: 3/8" = 1'-0"



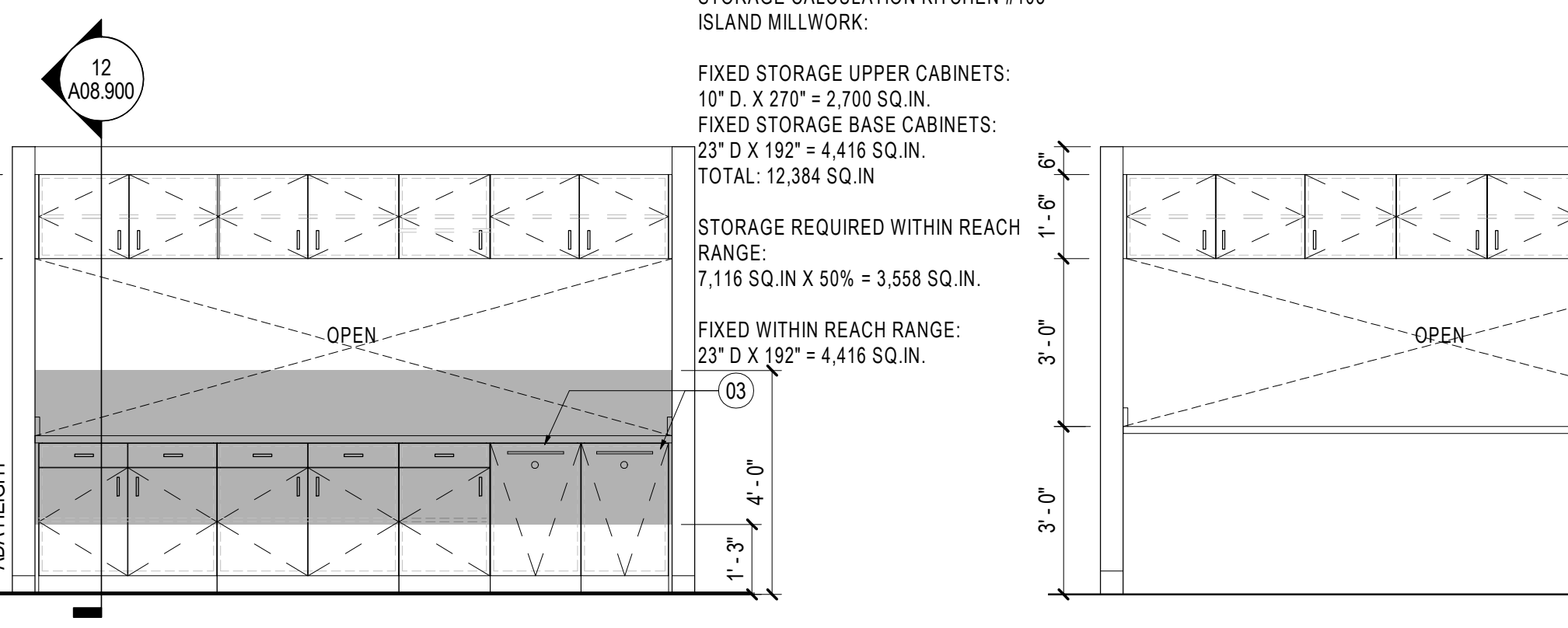
**11 KITCHEN 203 - EAST ELEVATION**  
SCALE: 3/8" = 1'-0"



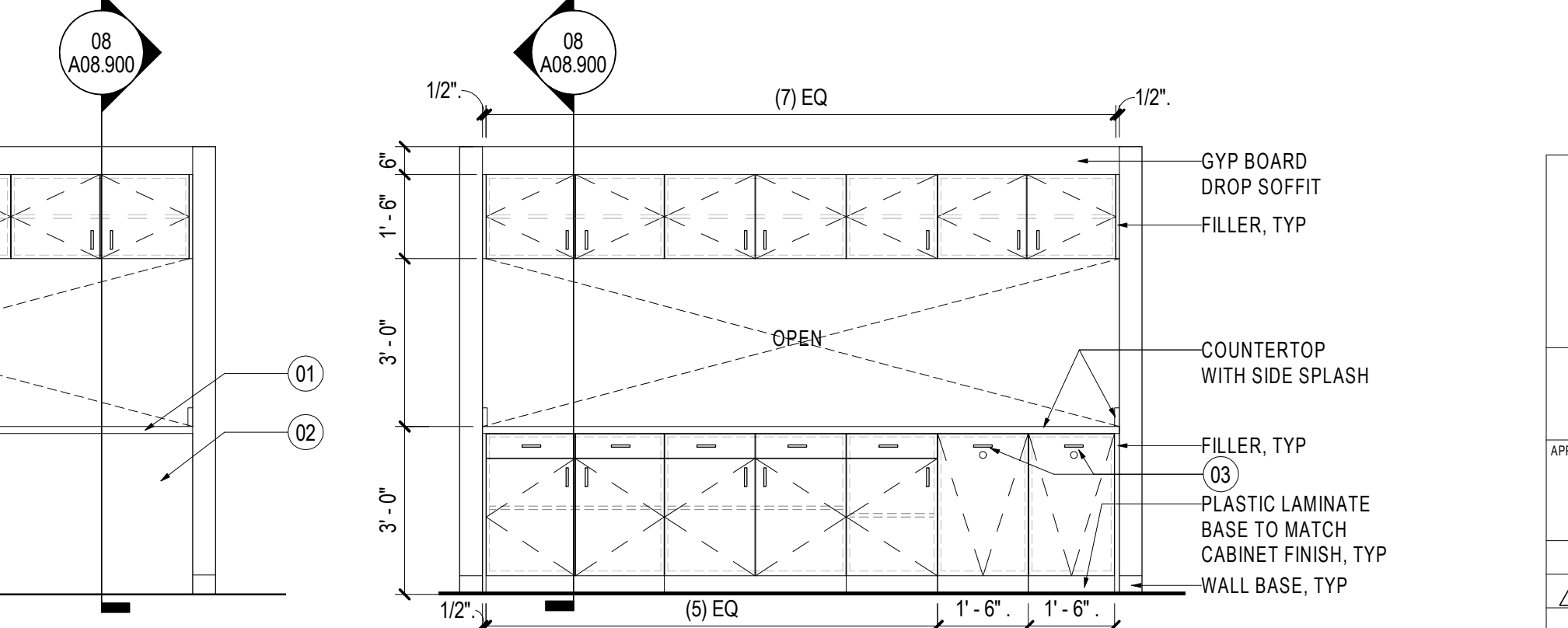
**03 KITCHEN 203 - SOUTH ELEVATION**  
SCALE: 3/8" = 1'-0"



**17 ISLAND COUNTER ELEVATION - LEVEL 01**  
SCALE: 3/8" = 1'-0"



**12 ISLAND MAIN ELEVATION - LEVEL 01**  
SCALE: 3/8" = 1'-0"



**08 ISLAND COUNTER ELEVATION - LEVEL 02**  
SCALE: 3/8" = 1'-0"

**PALM AVE TRANSITIONAL HOUSING**  
ENLARGED PLANS & INTERIOR ELEVATIONS

CITY OF SAN DIEGO, CALIFORNIA  
PUBLIC WORKS DEPARTMENT  
SHEET 47 OF 122 SHEETS

APPROVED: [Signature] FOR CITY ENGINEER  
DATE: 04.05.18  
PROJECT MANAGER: JASON GRANI  
PROJECT ENGINEER: [Signature]

DESCRIPTION: ADDENDUM A  
BY: SHS  
APPROVED: [Signature]  
DATE: 5/1/2018  
FILMED: [ ]

WBS S-18003  
DATE STARTED: [ ]  
DATE COMPLETED: [ ]  
CONTRACTOR INSPECTOR: [ ]  
COORDINATOR: CCS27  
COORDINATOR: CCS83  
NUMBER: 40498-47-D

Date Description

**Gensler**  
225 Broadway  
Suite 100  
San Diego, CA 92101  
United States  
Tel 619.557.2500  
Fax 619.557.2520

LICENSED ARCHITECT  
THOMAS P. HUFFMAN  
NOV. 6/2015  
STATE OF CALIFORNIA

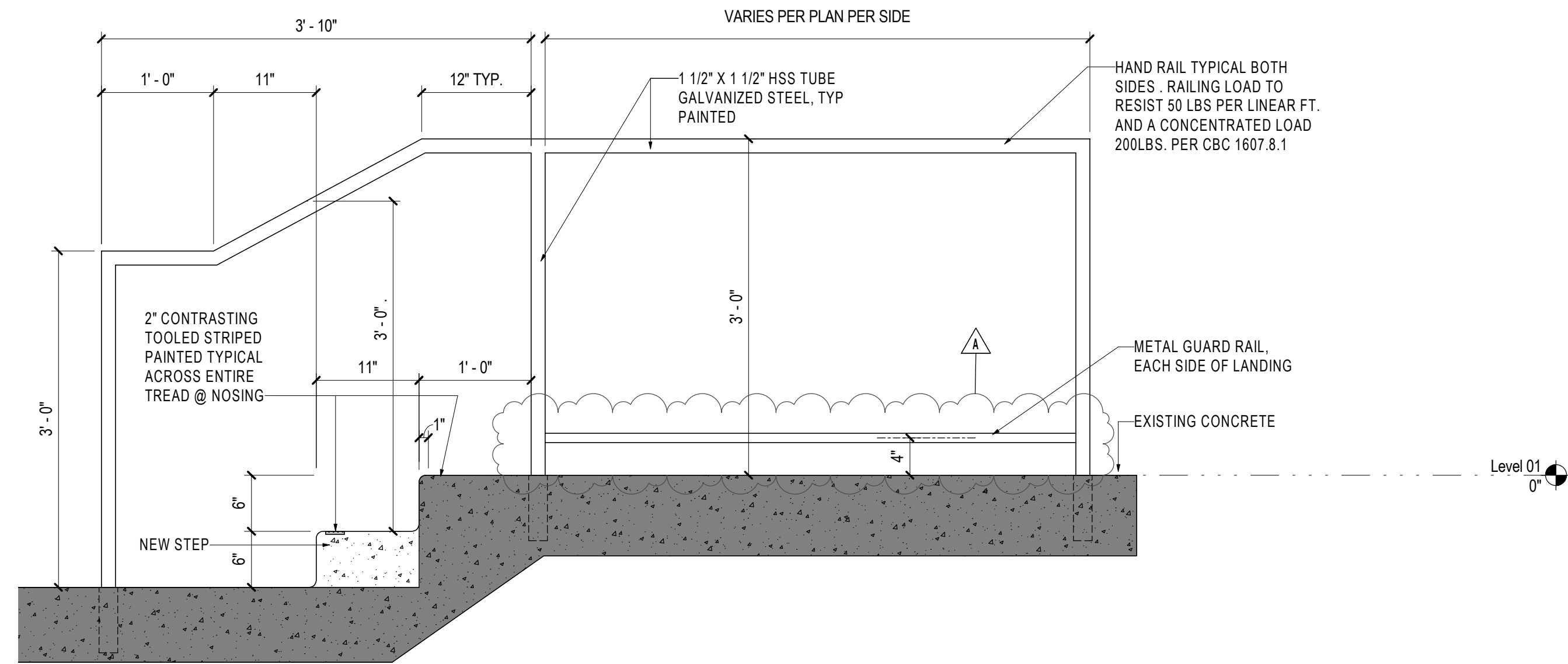
Project Number  
55.7291.015  
04.04.18

The City of  
**SAN DIEGO**  
Public Works

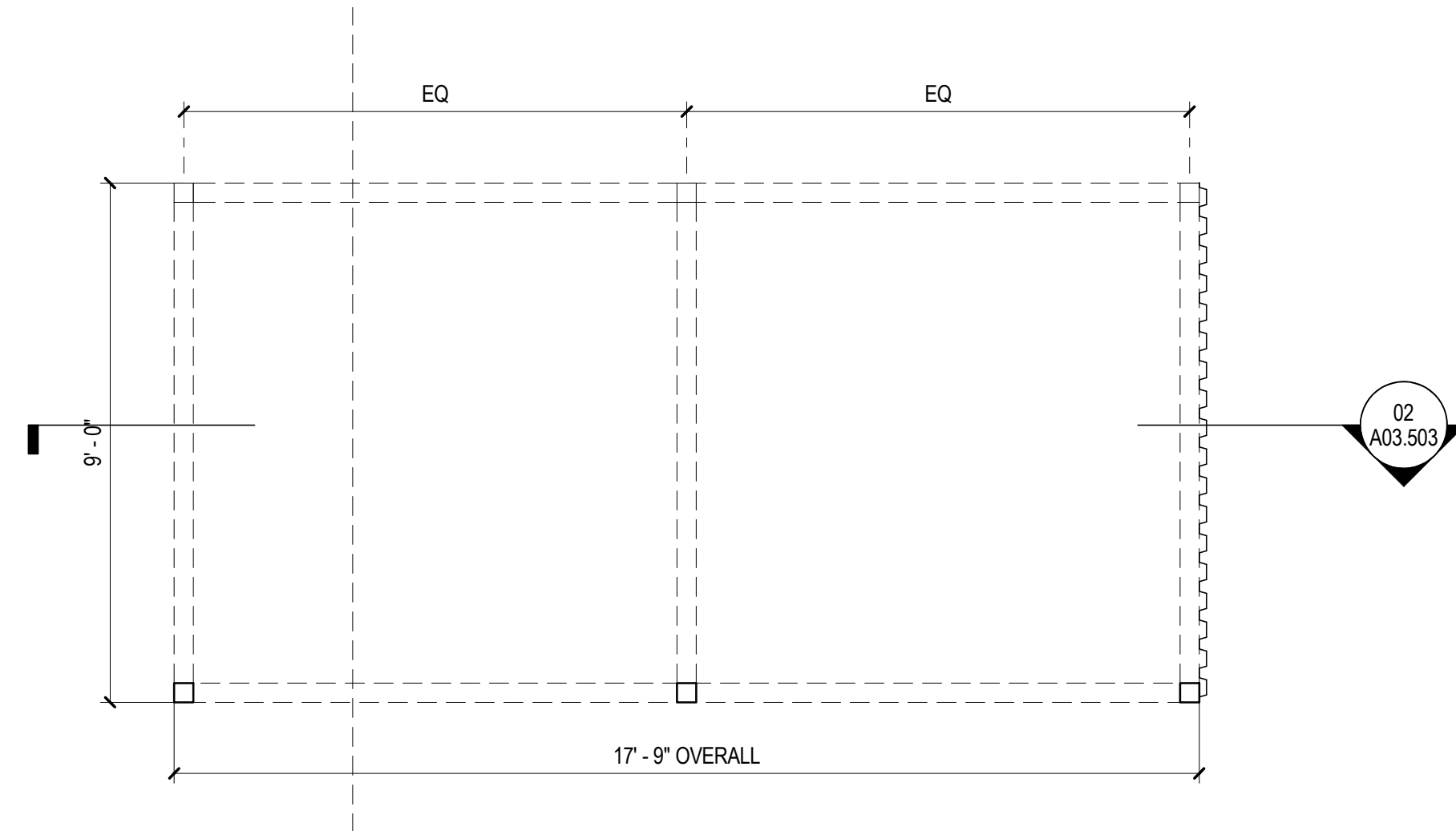
A03.500

UPDATED INTERIOR ELEVATIONS

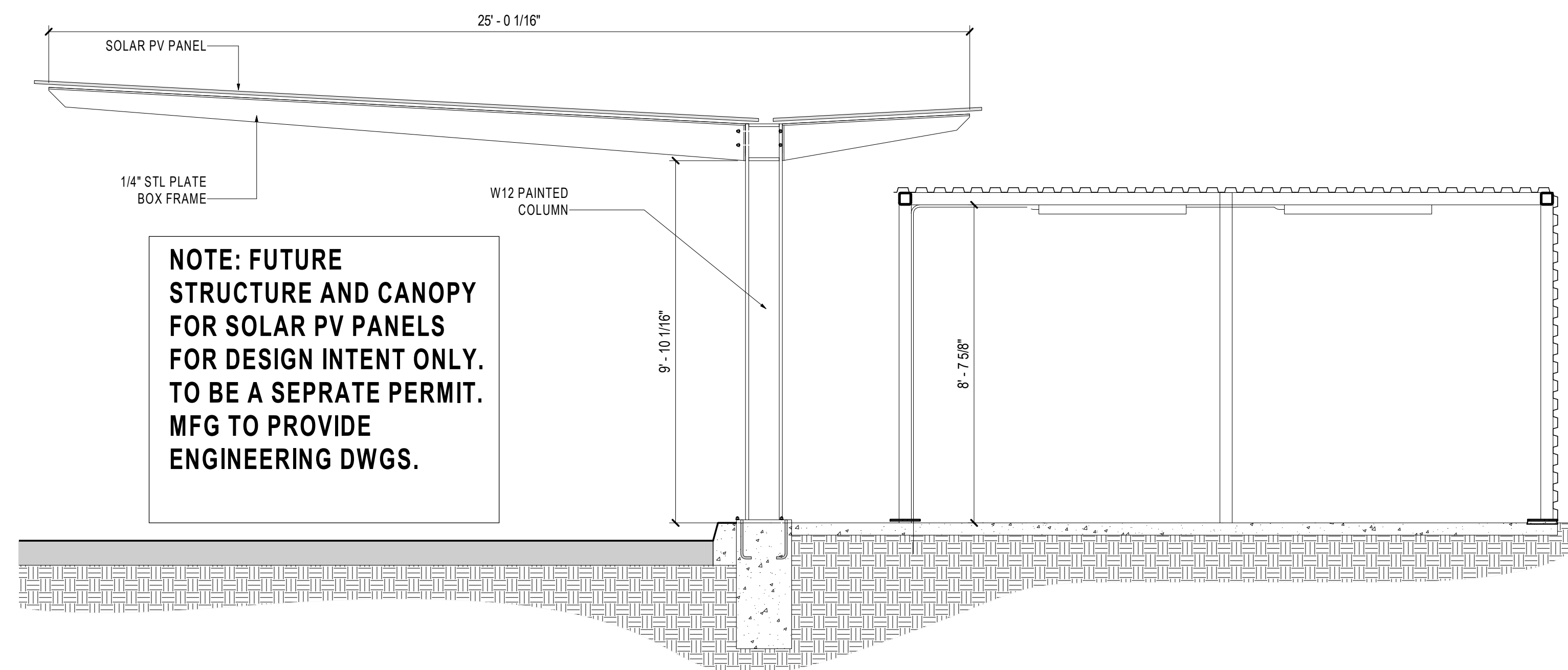
ADDENDUM A



**17 HANDRAIL DETAIL**  
SCALE: 1" = 1'-0"



**01 ENLARGED PLAN**  
SCALE: 3/8" = 1'-0"



**02 SECTION**  
SCALE: 3/8" = 1'-0"

Date	Description
------	-------------

**Gensler**  
225 Broadway  
Suite 100  
San Diego, CA 92101  
United States  
Tel: 619.557.2500  
Fax: 619.557.2520



Project Number

55.7291.015  
04.04.18

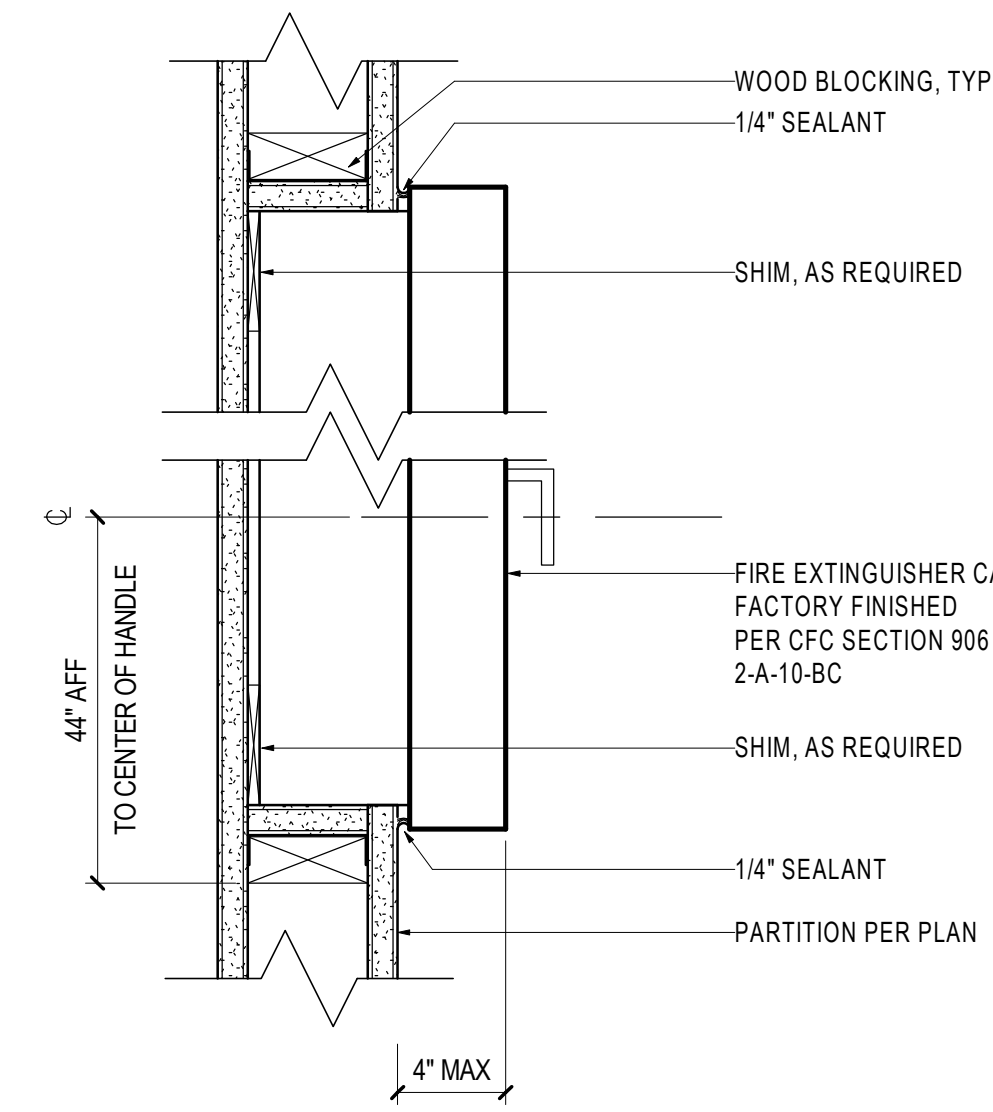
The City of  
**SAN DIEGO**  
Public Works

A03.503

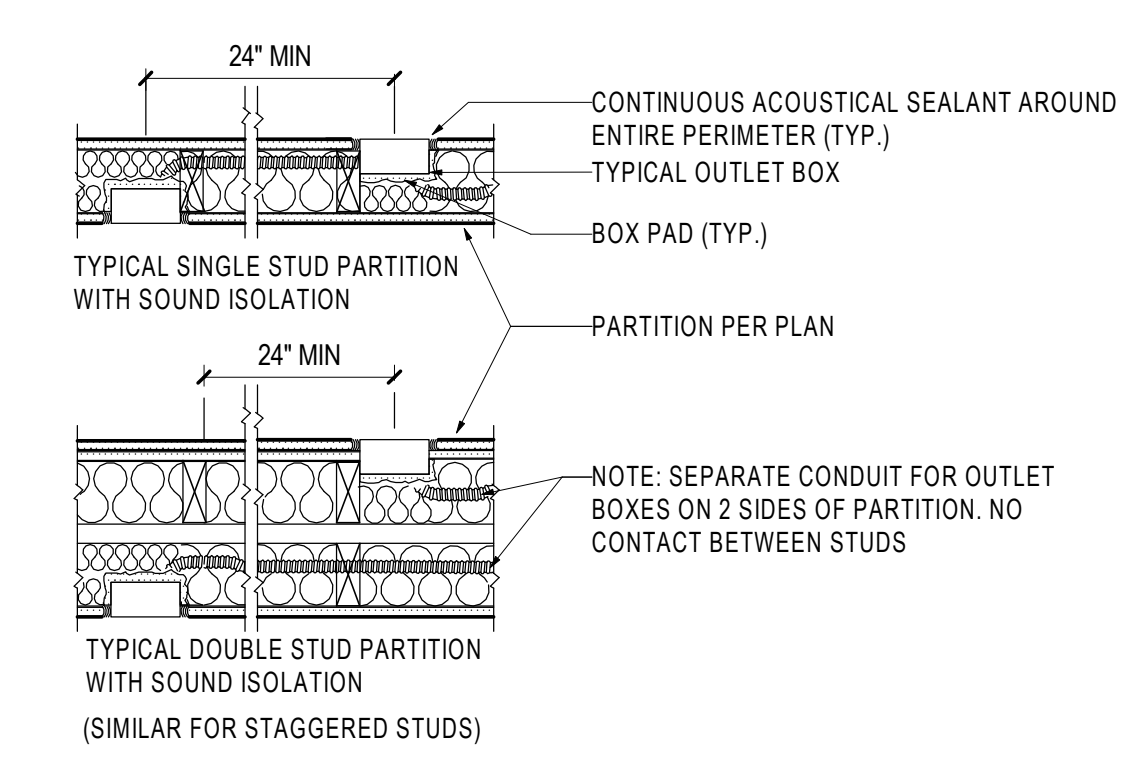
**PALM AVE TRANSITIONAL HOUSING**  
ENLARGED PLANS & SECTIONS - CANOPY 2

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 50 OF 122 SHEETS		WBS S-18003
APPROVED: FOR CITY ENGINEER JASON GRANI PRINT DCE NAME	DATE: 04.05.18 73308 RCE#	SUBMITTED BY: JASIAH NEFF PROJECT MANAGER CHECKED BY: PROJECT ENGINEER
DESCRIPTION: ADDENDUM A	BY: SHS	APPROVED: [Signature]
DATE STARTED: 5/1/2018	DATE FILMED:	PROJECT ENGINEER:
CONTRACTOR INSPECTOR:	DATE STARTED: DATE COMPLETED:	CCS27 COORDINATE
		CCS83 COORDINATE
		40498-50-D



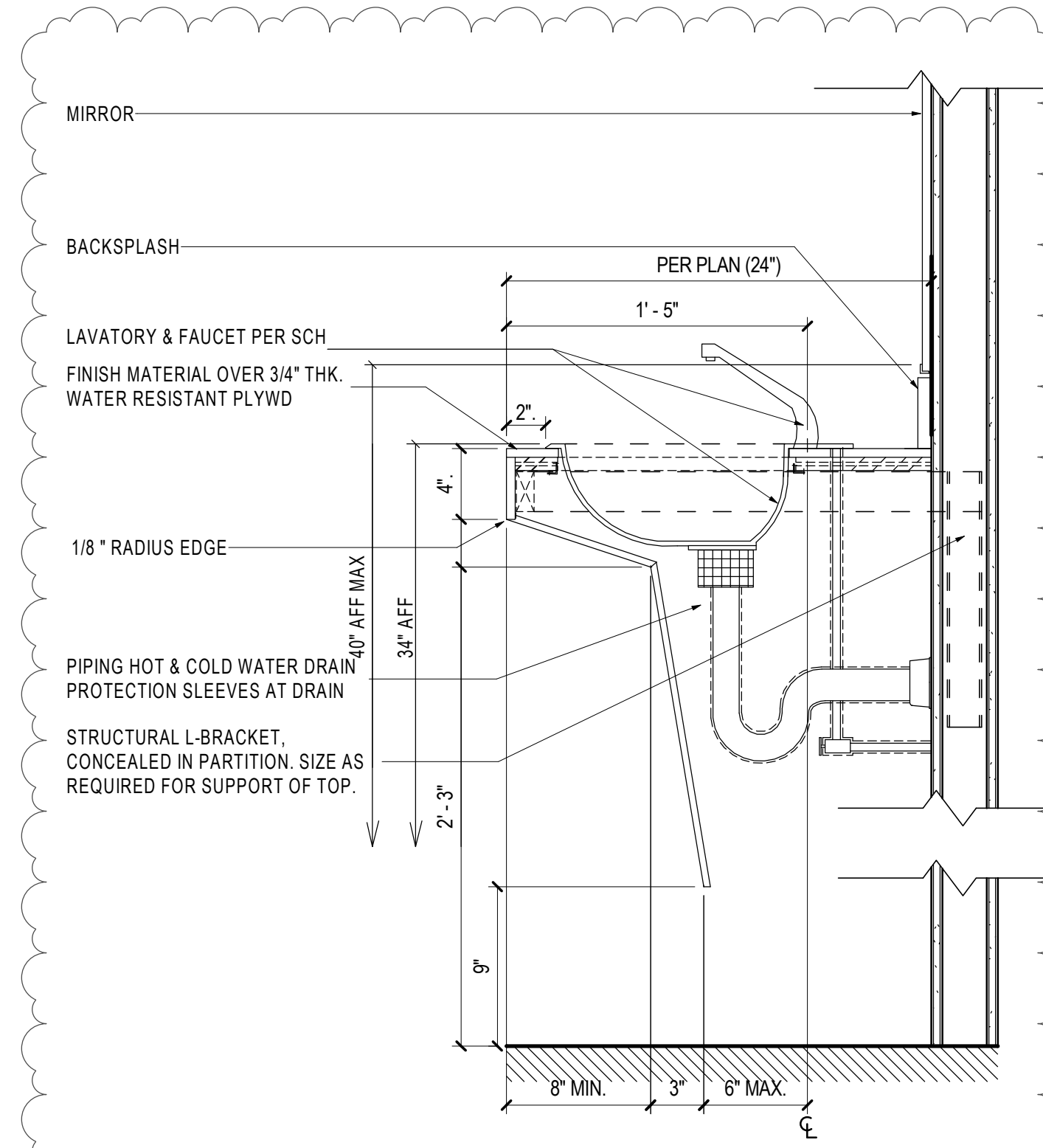


**05 FIRE EXTINGUISHER CABINET**  
SCALE: 3" = 1'-0"

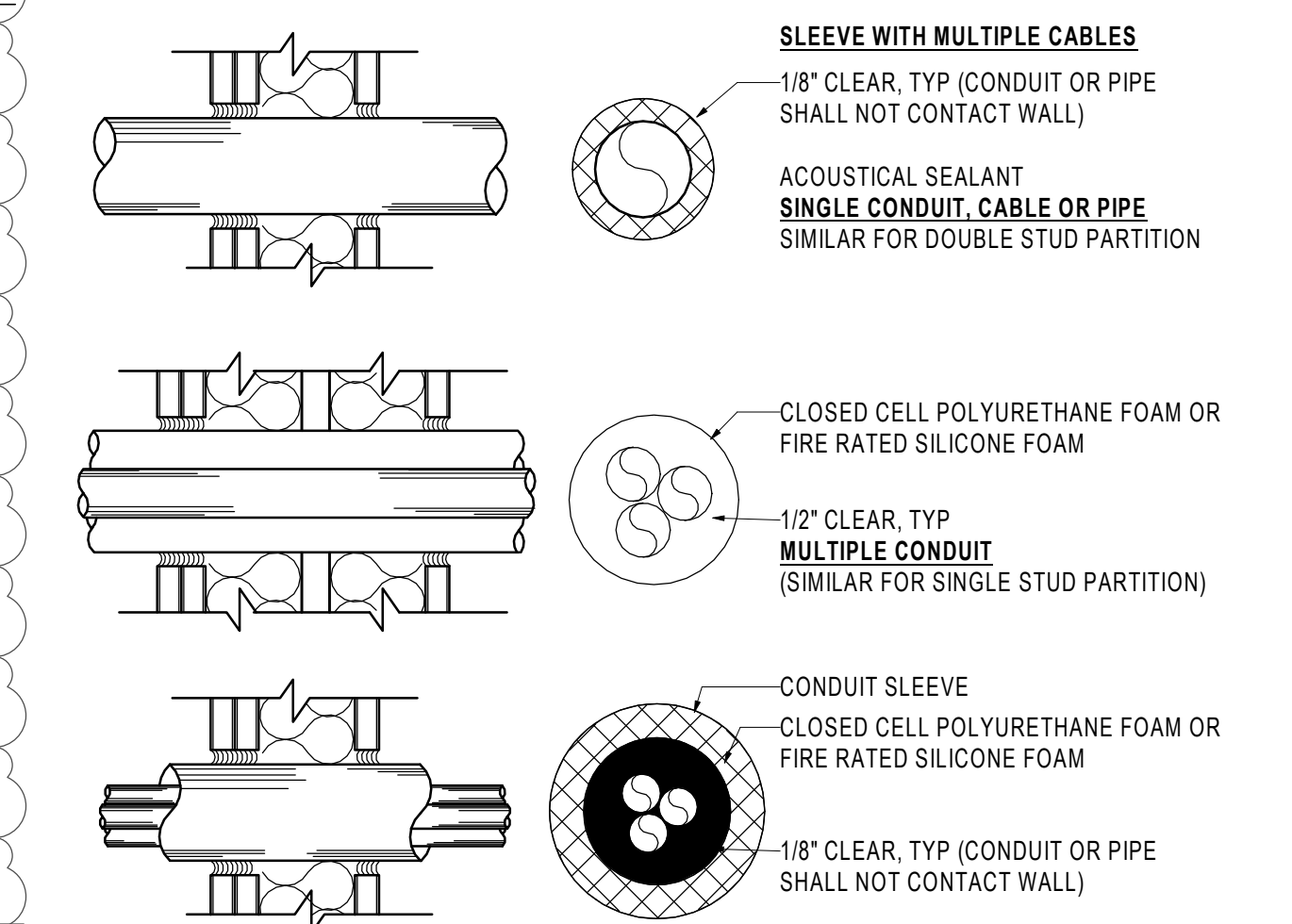


- NOTES:  
1. PLACE OUTLET BOXES IN SEPARATE STUD SPACES  
2. BACK-TO-BACK OUTLETS NOT PERMITTED  
3. PLUG ALL UNUSED KNOCK-OUTS IN OUTLET BOXES WITH KNOCK-OUT CAPS  
4. PROVIDE BACKING EQUIVALENT TO HILTI CP617 (CA FIRE MARSHALL LISTING 4485-1200-0123)  
5. DEPTH OF OUTLET BOX MUST BE COMPATIBLE WITH STUD SIZE IN ORDER TO ACCOMMODATE BOX PAD. 6. ACOUSTICAL BOX PAD REQUIREMENT APPLIES TO ALL PARTITIONS WITH ACOUSTICAL INSULATION. APPLIES TO POWER, PHONE, COMMUNICATIONS, ETC.

**01 OUTLET BOX DETAILS**  
SCALE: 3" = 1'-0"

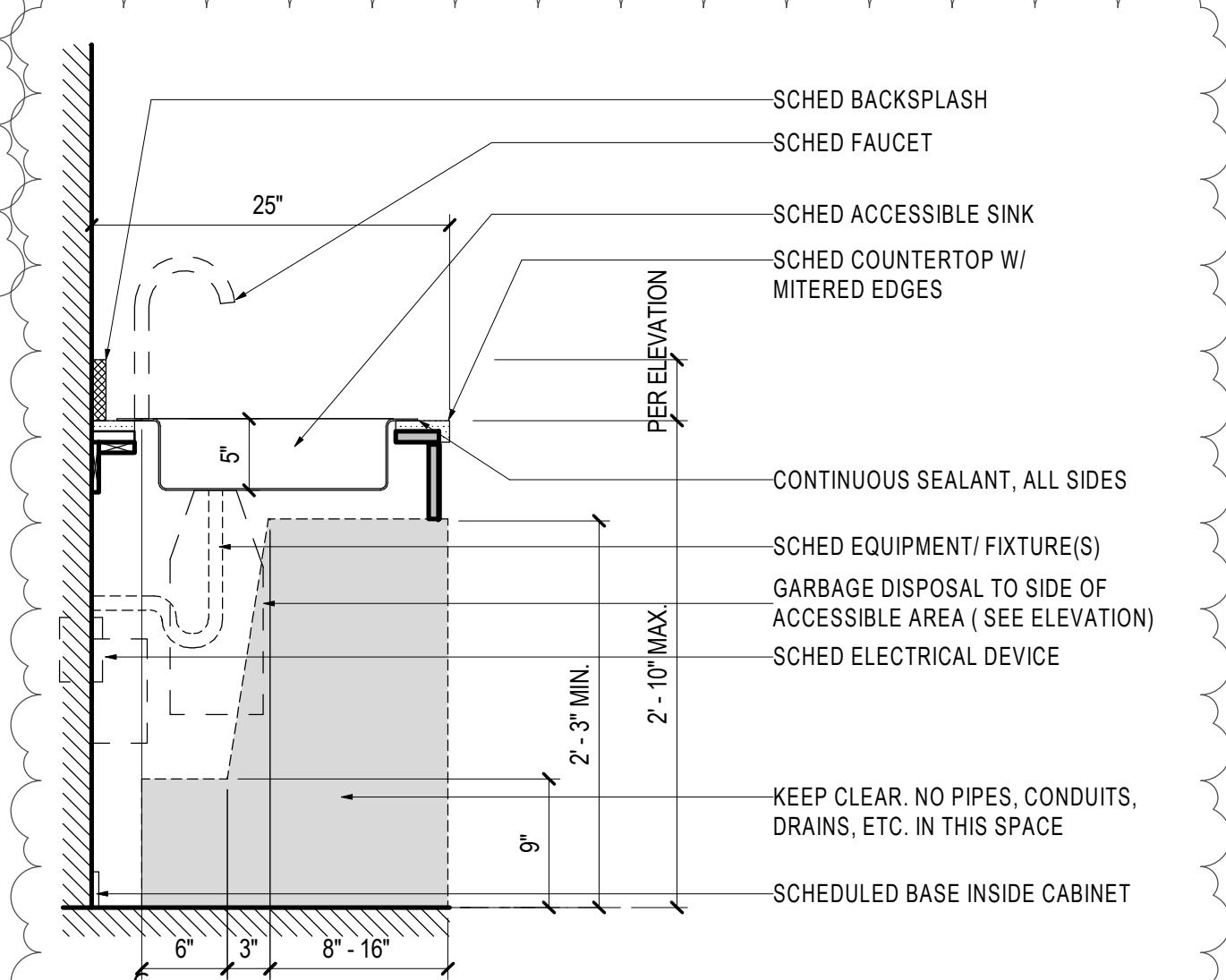


**06 LAVATORY DETAIL**  
SCALE: 1 1/2" = 1'-0"

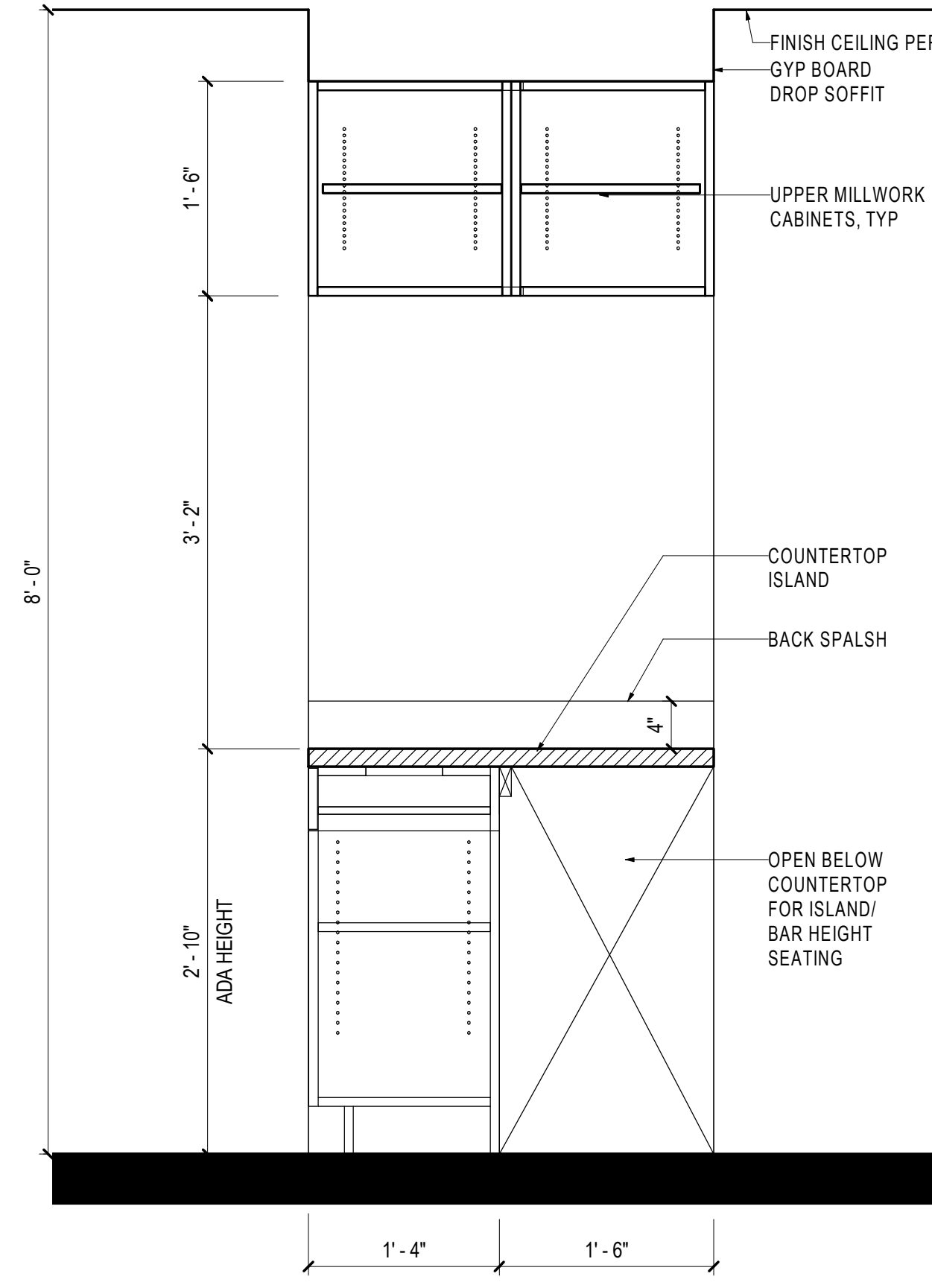


PENETRATIONS OF ACOUSTICAL PARTITIONS BY CONDUIT, CABLE, PIPES, ETC. SHALL BE ACOUSTICALLY SEALED AS SHOWN. GAPS LARGER THAN 1/2" SHALL BE COVERED W/ GYP BD. LAPPED A MINIMUM OF 2" AND SCREWED BEFORE USING ACOUSTICAL SEALANT. ALL PENETRATIONS SHALL BE INSTALLED/SEALED IN ACCORDANCE WITH ASTM E814 OR UL 1479 PER CBC 712.3.1.2

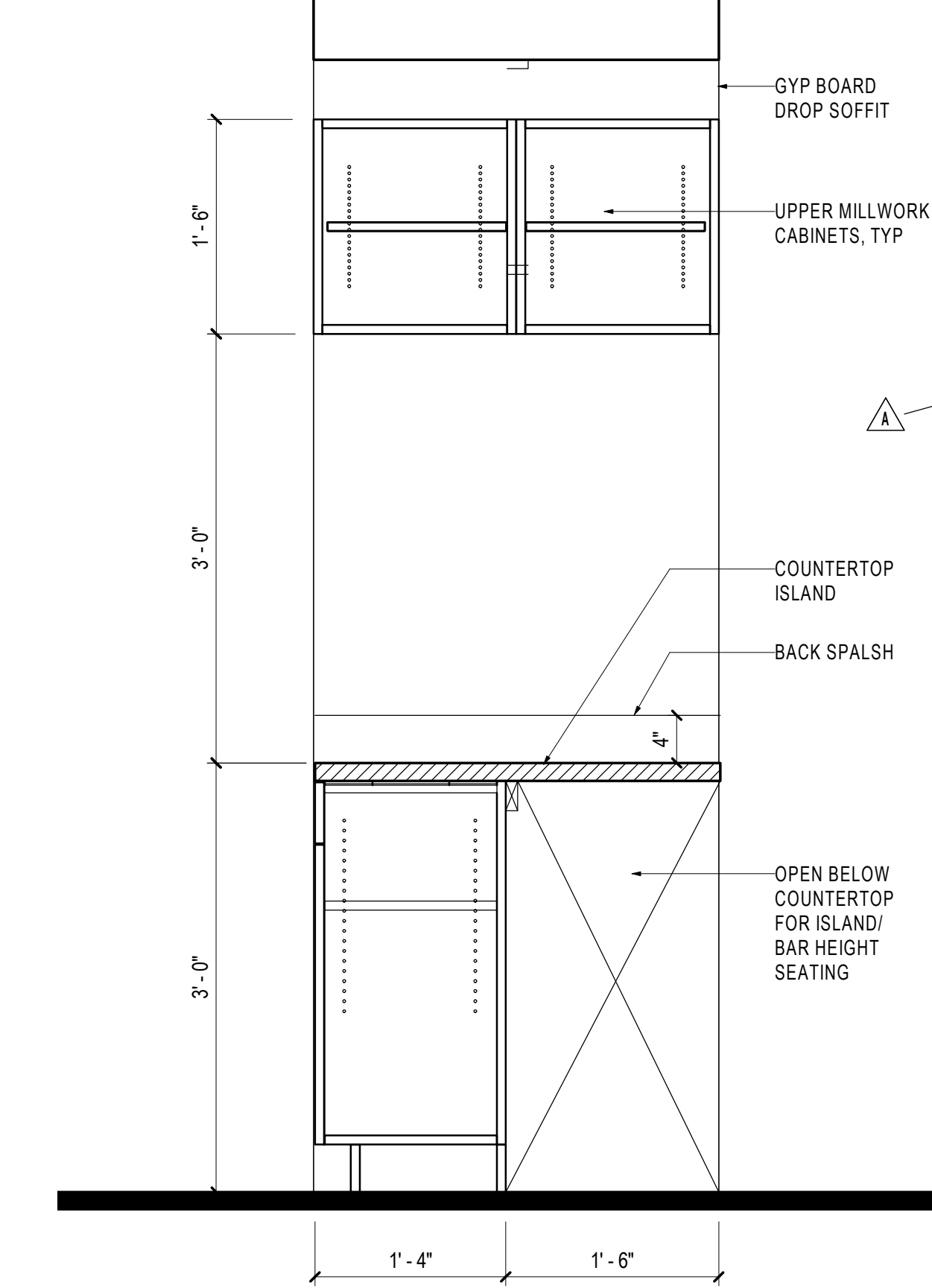
**02 DT-PTN/PENETRATION(S)**  
SCALE: 1 1/2" = 1'-0"



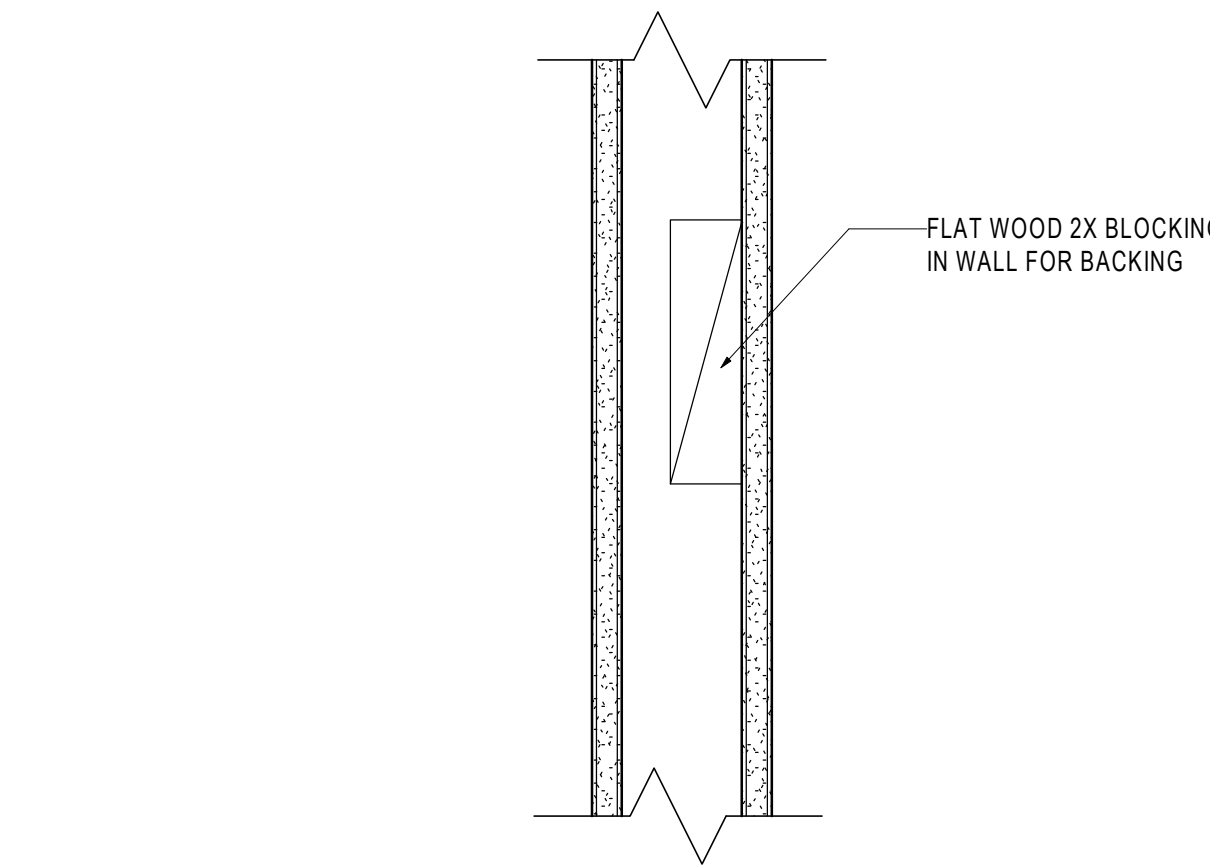
**03 BASE/ SINK (FOR ACCESSIBLE CLEARANCES ONLY)**  
SCALE: 1" = 1'-0"



**12 KITCHEN ISLAND COUNTER SECTION 01**  
SCALE: 1" = 1'-0"



**04 BLOCKING DETAIL**  
SCALE: 3" = 1'-0"



**08 KITCHEN ISLAND COUNTER SECTION 02**  
SCALE: 1" = 1'-0"

**04 BLOCKING DETAIL**  
SCALE: 3" = 1'-0"

UPDATED LAVATORY & SINK DETAIL

**PALM AVE TRANSITIONAL HOUSING**

DETAILS - MISCELLANEOUS

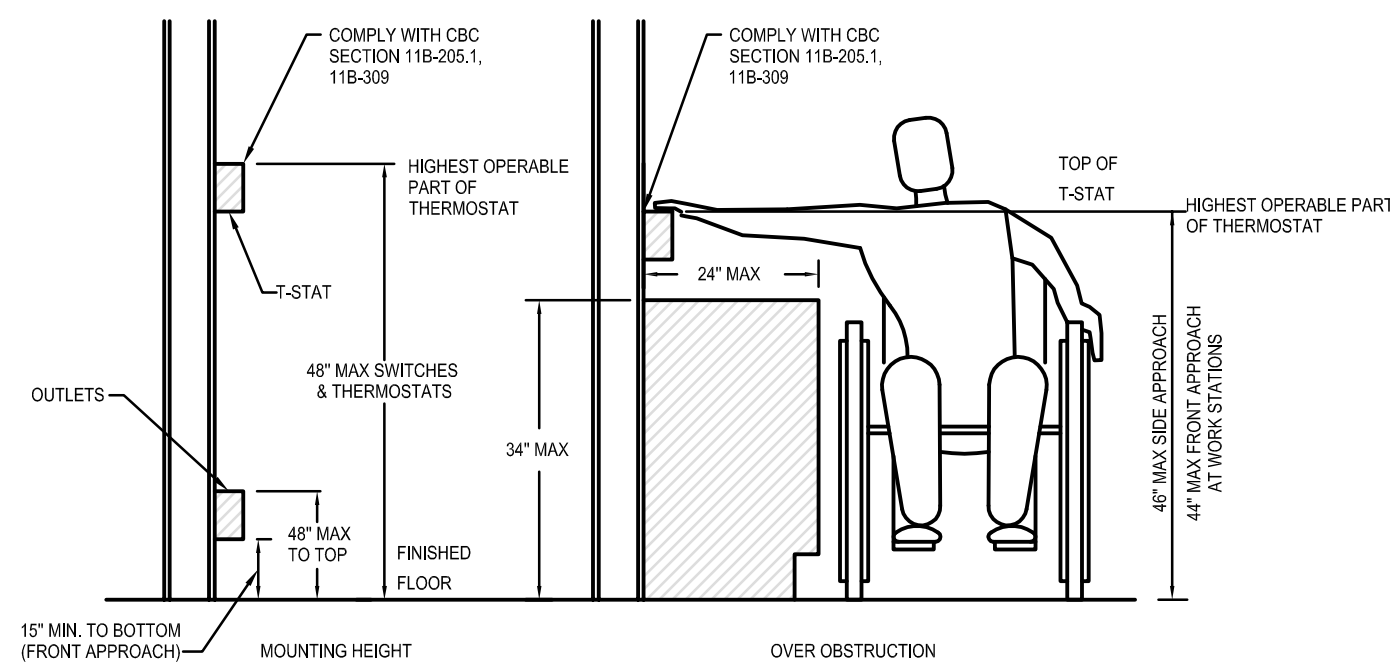
CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 58 OF 122 SHEETS		WBS S-18003
APPROVED: JASON GRANI FOR CITY ENGINEER PRINT DCE NAME	DATE: 7/30/18 RCE#	SUBMITTED BY: JASIAH NEFF PROJECT MANAGER CHECKED BY: PROJECT ENGINEER
DESCRIPTION: ADDENDUM A	BY: SHS	DATE FILMED: 5/1/2018
CONTRACTOR INSPECTOR		DATE STARTED: DATE COMPLETED
		CCS83 COORDINATE: 40498-58-D

**Gensler**  
225 Broadway  
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San Diego, CA 92101  
United States  
Tel 619.557.2500  
Fax 619.557.2520



Project Number: 55.7291.015  
04.04.18  
The City of **SAN DIEGO**  
Public Works  
A08.900





**MECHANICAL LEGEND**

SYMBOL	ABBREV.	DESCRIPTION	SYMBOL	ABBREV.	DESCRIPTION
		REMOVE EXISTING EQUIPMENT OR PIPING SHOWN HATCHED		DIA. Ø	DIAMETER
	POC	POINT OF CONNECTION		DN.	DOWN
	POD	POINT OF DISCONNECT		DWGS.	DRAWINGS
	CD	COORDINATE WITH ELECTRICAL		DB	DRY BULB
	CD	CONDENSATE DRAIN (A.C.)		DTR	DUCT THRU ROOF
	D	DRAIN		(E)	EXISTING
	D	DUCTWORK (1ST NUMBER INDICATES WIDTH SHOWN), NET INSIDE DIMENSION		EA	EXHAUST AIR
	TV	SQUARE ELBOW WITH TURNING VANES		ER	EXHAUST REGISTER
	MVD	RADIUS ELBOW WITH 3 SPLITTER VANES		EFF.	EFFICIENCY
	MOD	MANUAL VOLUME DAMPER		ELEV.	ELEVATION
	BDD	MOTOR OPERATED DAMPER		ENT.	ENTERING
	FD	BACKDRAFT DAMPER		EXH.	EXHAUST
	SD	FIRE DAMPER		EXIST.	EXISTING
	FLR	DUCT MOUNTED SMOKE DETECTOR		FF	FINISHED FLOOR
	SFD	AUTOMATIC SMOKE AND FIRE DAMPER		FIN.	FINISH
	FLEX	FLEXIBLE CONNECTION (DUCTWORK)		FLR	FLOOR
	FLEX	FLEXIBLE CONNECTION OR SEISMIC JOINT		GP	GALLONS PER MINUTE
	LD	LINED DUCTWORK (OR PLENUM)		IN.	INCH
	LD	DUCT RISE IN DIRECTION OF FLOW		HD.	HEAD
	LD	DUCT DROP IN DIRECTION OF FLOW		HOA	HAND-OFF-AUTOMATIC
	LWT	ROUND DUCT UP		HP	HORSEPOWER
	LWT	ROUND DUCT DOWN		LD	LINEAR DIFFUSER
	MAX.	SUPPLY DUCT UP		LVG.	LEAVING WATER TEMPERATURE
	MAX.	SUPPLY DUCT DOWN		MAX.	MAXIMUM
	RA/OA	RETURN AIR DUCT/OUTSIDE AIR DUCT UP		MECH.	MECHANICAL
	RA/OA	RETURN AIR DUCT/OUTSIDE AIR DUCT DOWN		MIN.	MINIMUM
	RA/OA	EXHAUST AIR DUCT UP		MTD.	MOUNTED
	RA/OA	EXHAUST AIR DUCT DOWN		MTG.	MOUNTING
	RA/OA	DUCT TRANSITION		NC	NORMALLY CLOSED
	CD	CEILING DIFFUSER		NO	NORMALLY OPEN
	RR	RETURN REGISTER		OBD	OPPOSED BLADE DAMPER
	ER	EXHAUST REGISTER		OA	OUTSIDE AIR
	TSTAT	THERMOSTAT OR TEMPERATURE SENSOR (NUMBER INDICATES EQUIPMENT ZONE SERVED)		PD	PRESSURE DROP
	HSTAT	HUMIDISTAT		PSIG	POUNDS PER SQUARE INCH GAUGE
	RA	CARBON DIOXIDE SENSOR		PTAC	PACKAGE TERMINAL AIR CONDITIONER
	RA	CARBON MONOXIDE SENSOR		RA	RETURN AIR
	CFM	CUBIC FEET PER MINUTE		REG.	REGISTER
	AD/AP	ACCESS DOOR / ACCESS PANEL		RR	RETURN REGISTER
	AFF	ABOVE FINISHED FLOOR		SA	SUPPLY AIR
	BDD	BACK DRAFT DAMPER		SF	SQUARE FEET
	BOD	BOTTOM OF DUCT		TYP.	TYPICAL
	BOP	BOTTOM OF PIPE (ABOVE FIN. FLR.)		UNO	UNLESS NOTED OTHERWISE
	CD	CEILING DIFFUSER		UOS	UNLESS OTHERWISE SPECIFIED
	CLG.	CEILING		UVR	UP THRU ROOF
	CFM	CUBIC FEET PER MINUTE		VAV	VARIABLE AIR VOLUME
	CONC.	CONCRETE		VFD	VARIABLE FREQUENCY DRIVE
	CONT.	CONTINUATION		VTR	VENT THRU ROOF
	°F	DEGREES FAHRENHEIT		WG	WATER GAUGE
				WB	WET BULB
				W	WITH

**PLAN CHECK NOTES:**

- CERTIFICATE OF ACCEPTANCE (MECH-2A AND ENV-2A) AND ALL RELATED ACCEPTANCE DOCUMENTS SHALL BE SUBMITTED TO THE FIELD INSPECTOR DURING CONSTRUCTION. CERTIFICATE OF OCCUPANCY WILL NOT BE ISSUED UNTIL THESE FORMS ARE REVIEWED AND APPROVED.
- PROVIDE SMOKE DETECTORS IN MAIN SUPPLY AIR DUCTS OF AIR MOVING SYSTEMS EXCEEDING 2000 CFM PER SECTION 608.0 CMC.
- EXHAUST DUCTS SHALL BE EQUIPPED WITH BACK-DRAFT DAMPERS PER SEC. 504.1.1.1 CMC.
- A WATERTIGHT PAN OF CORROSION RESISTANT MATERIAL SHALL BE PROVIDED BENEATH HVAC UNITS PER SECTION 309.2 CMC.
- ROOF ACCESS LADDER SHALL COMPLY WITH SECTION 304 CMC.
- DRYER VENTS SHALL BE EQUIPPED WITH BACK-DRAFT DAMPERS PER SECTION 504.1.1.1 CMC.
- SCREENS SHALL NOT BE INSTALLED AT DRYER VENT TERMINATIONS PER SEC. 504.4 CMC.
- FLEXIBLE CLOTHES DRYER TRANSITION DUCTS SHALL NOT BE CONCEALED WITHIN CONSTRUCTION (REF. SECTION 504.4.2 CMC).
- EXHAUST DUCTS FOR TYPE II DRYERS SHALL COMPLY WITH SECTION 504.4.3 CMC.
- MULTIPLE INSTALLATION OF TYPE 2 CLOTHES DRYERS SHALL BE MADE IN A MANNER TO PREVENT ADVERSE OPERATION DUE TO BACK PRESSURES THAT ARE CAPABLE OF BEING CREATED IN THE EXHAUST SYSTEMS PER SECTION 504.4.3.1 (b) CMC.
- TYPE 2 CLOTHES DRYERS SHALL BE EQUIPPED OR INSTALLED WITH LINT CONTROLLING MEANS.

**TITLE 24 NOTES:**

- HVAC SYSTEMS SHALL MEET THE LATEST CONTROL REQUIREMENTS OF SECTIONS 110.2 & 120.2 ENERGY EFFICIENCY STANDARDS.
- DOORS AND WINDOWS SHALL MEET MINIMUM INFILTRATION REQUIREMENTS OF SECTION 110.8 & 110.7 ENERGY EFFICIENCY STANDARDS.
- INSULATION AND FLEXIBLE DUCT SHALL COMPLY WITH STATE FIRE MARSHAL CRITERIA AND SHALL NOT EXCEED FLAME SPREAD OF 25 AND SMOKE DEVELOPED OF 50 PER ASTM-84, NFPA-225, AND UL 723.
- ALL WORK SHALL BE IN ACCORDANCE WITH CITY CODES, CALIFORNIA ENERGY CONSERVATION STANDARDS, TITLE 24, AND ALL OTHER APPLICABLE CODES.
- ALL PIPING AND DUCT WORK SHALL BE INSULATED CONSISTENT WITH THE REQUIREMENTS OF SECTIONS 120.3, 120.4, & 120.7 TITLE 24 ENERGY STANDARDS AND CHAPTER 6 OF CALIFORNIA MECHANICAL CODE.
- CERTIFICATE OF ACCEPTANCE (MECH-2A AND ENV-2A) AND ALL RELATED ACCEPTANCE DOCUMENTS SHALL BE SUBMITTED TO THE FIELD INSPECTOR DURING CONSTRUCTION. CERTIFICATE OF OCCUPANCY WILL NOT BE ISSUED UNTIL THESE FORMS ARE REVIEWED AND APPROVED.
- ALL HVAC EQUIPMENT AND APPLIANCES SHALL MEET THE REQUIREMENTS PER SECTION 110.1 - 110.3, 110.5, 120.1 - 120.4 TITLE 24 ENERGY STANDARDS.
- PROVIDE SMOKE DETECTORS IN MAIN SUPPLY AIR DUCTS OF AIR MOVING SYSTEMS EXCEEDING 2000 CFM PER SECTION 609.0 CMC.
- INSULATION MATERIAL SHALL MEET THE CALIFORNIA QUALITY STANDARD PER SECTION 110.8 ENERGY EFFICIENCY STANDARDS.

**CA GREEN BUILDING NOTES:**

- IN MECHANICALLY VENTILATED BUILDINGS, PROVIDE OCCUPIED AREAS OF BUILDING WITH AIR FILTRATION MEDIA FOR OUTSIDE AND RETURN AIR PRIOR TO OCCUPANCY THAT PROVIDES AT LEAST MERV OF 8 (REF. SECTION 5.504.5.3).
- PROVIDE TESTING AND ADJUSTING OF HVAC SYSTEMS AND CONTROLS PER 5.713.10.4.
- IF THE HVAC SYSTEM IS USED DURING CONSTRUCTION, RETURN AIR FILTERS WITH A MERV 8 RATING SHALL BE USED PER 5.714.1.
- INSTALLED HVAC EQUIPMENT SHALL NOT CONTAIN CFCOS OR HALONS PER 5.714.8.1.
- THE PERMANENT HVAC SYSTEM SHALL ONLY BE USED DURING CONSTRUCTION IF NECESSARY TO CONDITION THE BUILDING OR AREAS OF ADDITION OR ALTERATION WITHIN THE REQUIRED TEMPERATURE RANGE FOR MATERIAL AND EQUIPMENT INSTALLATION. IF THE HVAC SYSTEM IS USED DURING CONSTRUCTION, RETURN AIR FILTERS WITH A MINIMUM EFFICIENCY REPORTING VALUE (MERV) OF 8, BASED ON ASHRAE 52.2-1999, OR AN AVERAGE EFFICIENCY OF 30% BASED ON ASHRAE 52.2-1992 SHALL BE USED. ALL FILTERS SHALL BE REPLACED IMMEDIATELY PRIOR TO OCCUPANCY OR AT THE CONCLUSION OF CONSTRUCTION (CAL GREEN SECTION 5.504.1.3).
- AT THE TIME OF ROUGH INSTALLATION AND DURING STORAGE ON THE CONSTRUCTION SITE UNTIL FINAL STARTUP OF THE HEATING, COOLING AND VENTILATING EQUIPMENT, ALL DUCT AND OTHER RELATED AIR DISTRIBUTION COMPONENT OPENINGS SHALL BE COVERED WITH TAPE, PLASTIC, SHEET METAL OR OTHER METHODS ACCEPTABLE TO THE ENFORCING AGENCY TO REDUCE THE AMOUNT OF DUST, WATER AND DEBRIS WHICH MAY ENTER THE SYSTEM. (CAL GREEN SECTION 5.504.3)
- IN MECHANICALLY VENTILATED BUILDINGS, REGULARLY OCCUPIED AREAS OF THE BUILDING SHALL BE PROVIDED WITH AIR FILTRATION MEDIA FOR OUTSIDE AND RETURN AIR THAT PROVIDES AT LEAST A MINIMUM EFFICIENCY REPORTING VALUE (MERV) OF 8. MERV 8 FILTERS SHALL BE INSTALLED PRIOR TO OCCUPANCY, AND RECOMMENDATIONS FOR MAINTENANCE WITH FILTERS OF THE SAME VALUE SHALL BE INCLUDED IN THE OPERATION AND MAINTENANCE MANUAL. (CAL GREEN SECTION 5.504.5.3)
- EXCEPTION TO CAL GREEN SECTION 5.504.3: AN ASHRAE 10% TO 15% EFFICIENCY FILTER SHALL BE PERMITTED FOR AN HVAC UNIT MEETING THE 2016 CALIFORNIA ENERGY CODE HAVING 6000 BTUH OR LESS CAPACITY PER FAN COIL, IF THE ENERGY USE OF THE AIR DELIVERY SYSTEM IS 0.4 WCFM OR LESS AT DESIGN AIRFLOW.
- WHERE OUTDOOR AREAS ARE PROVIDED FOR SMOKING, PROHIBIT SMOKING WITHIN THE BUILDING AS ALREADY PROHIBITED BY OTHER LAWS OR REGULATIONS, OR AS ENFORCED BY ORDINANCES, REGULATIONS, OR POLICES OF ANY CITY, COUNTY, CITY AND COUNTY, CALIFORNIA COMMUNITY COLLEGE, CAMPUS OF THE CALIFORNIA STATE UNIVERSITY, OR CAMPUS OF THE UNIVERSITY OF CALIFORNIA, WHOEVER ARE MORE STRINGENT. WHEN ORDINANCES, REGULATIONS, OR POLICES ARE NOT IN PLACE, SIGNAGE SHALL BE POSTED TO INFORM BUILDING OCCUPANTS OF THE PROHIBITIONS.
- MECHANICALLY OR NATURALLY VENTILATED SPACES IN BUILDINGS SHALL MEET THE MINIMUM REQUIREMENTS OF SECTION 120.1 (REQUIREMENTS FOR VENTILATION) OF THE 2016 CALIFORNIA ENERGY CODE, OR THE APPLICABLE LOCAL CODE, WHICHEVER IS MORE STRINGENT, AND DIVISION 1, CHAPTER 4 OF CCR, TITLE 8, (CAL GREEN SECTION 5.506.1)
- FOR BUILDINGS OR ADDITIONS EQUIPPED WITH DEMAND CONTROL VENTILATION, CO2 SENSORS AND VENTILATION CONTROLS SHALL BE SPECIFIED AND INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF 2016 CALIFORNIA ENERGY CODE, SECTION 120.1(C)(3). (CAL GREEN SECTION 5.506.1)
- BUILDING ASSEMBLIES AND COMPONENTS WITH STC VALUES DETERMINED IN ACCORDANCE WITH ASTM E90 AND ASTM E413 SHALL BE EMPLOYED.
- WALL AND ROOF-CEILING ASSEMBLIES EXPOSED TO THE NOISE SOURCE MAKING UP THE BUILDING OR ADDITION ENVELOPE OR ALTERED ENVELOPE SHALL MEET A COMPOSITE STC RATING OF AT LEAST 50 OR A COMPOSITE OITC RATING OF NO LESS THAN 40, WITH EXTERIOR WINDOWS OF A MINIMUM STC OF 40 OR OITC OF 30 FT. LOCATED WITHIN THE 65 ONE NOISE INDUSTRIAL SOURCE OR FIXED-GUIDEWAY SOURCE AS DETERMINED BY THE NOISE ELEMENT OF THE GENERAL PLAN. (SECTION 5.507.4.1 (C)(8)(S) SEE EXCEPTIONS 1&2 ON SEC. 5.507.4.1.
- INSTALLATIONS OF HVAC, REFRIGERATION AND FIRE SUPPRESSION EQUIPMENT SHALL COMPLY WITH SECTIONS 5.508.1.1 AND 5.508.1.2. HVAC, REFRIGERATION AND FIRE SUPPRESSION EQUIPMENT SHALL NOT CONTAIN (FCOs) AND SHALL NOT CONTAIN HALONS (SECTION 5.506.1)
- IN ADDITION TO TESTING AND ADJUSTING, BEFORE A NEW SPACE-CONDITIONING SYSTEM SERVING A BUILDING OR SPACE IS OPERATED FOR NORMAL USE, BALANCE THE SYSTEM IN ACCORDANCE WITH THE PROCEDURES DEFINED BY THE TESTING ADJUSTING AND BALANCING BUREAU NATIONAL STANDARDS, THE NEBB PROCEDURAL STANDARDS, OR AABC NATIONAL STANDARDS.
- PROVIDE THE BUILDING OWNER OR REPRESENTATIVE WITH DETAILED OPERATING AND MAINTENANCE INSTRUCTIONS AND COPIES OF GUARANTEES/WARRANTIES FOR EACH SYSTEM. O&M INSTRUCTIONS SHALL BE CONSISTENT WITH OSHA REQUIREMENTS IN CCR, TITLE 8, SECTION 5142, AND OTHER RELATED REGULATIONS.

**GENERAL NOTES:**

- THESE DRAWINGS ARE A GENERAL GRAPHIC PRESENTATION OF THE WORK. DUCTWORK, PIPING, AND EQUIPMENT, AS SHOWN, ARE SCHEMATIC. FABRICATE AND INSTALL BASED ON ACTUAL FIELD MEASUREMENT, COORDINATE WITH OTHER TRADES. PROVIDE A COMPLETE SET OF SHOP DRAWINGS REFLECTING ACTUAL DIMENSIONS, ACCESS REQUIREMENTS, AND DETAILS BASED UPON THE ACTUAL EQUIPMENT PROCURED. MAINTAIN AN UP TO DATE SET OF AS-BUILT DRAWINGS AT THE JOB SITE.
- COMPLY WITH CALIFORNIA MECHANICAL CODE (CMC), CALIFORNIA PLUMBING CODE (CPC), AND NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) AND GOVERNING CODES. THERE SHALL BE NO EXCEPTION. REPORT DEFICIENCIES WITHIN THIRTY (30) DAYS UPON AUTHORIZATION TO PROCEED.
- REVIEW ALL DRAWINGS AND SPECIFICATIONS INCLUDING ARCHITECTURAL, STRUCTURAL, CIVIL, MECHANICAL, PLUMBING, AND ELECTRICAL. ANY QUESTIONS SHALL BE BROUGHT UP, IN WRITING, TO THE ATTENTION OF THE ENGINEER BEFORE THE START OF CONSTRUCTION.
- PROVIDE ACCESS AND CLEARANCE FOR MAINTENANCE FOR MECHANICAL EQUIPMENT AND COMPONENTS AS RECOMMENDED BY EQUIPMENT MANUFACTURER AND APPLICABLE CODES.
- HANDLE, STORE AND INSTALL EQUIPMENT PER MANUFACTURER'S INSTRUCTIONS.
- INSTALL VALVES WITH UNIONS OR FLANGES AT EACH PIECE OF EQUIPMENT ARRANGED TO ALLOW SERVICE MAINTENANCE, AND EQUIPMENT REMOVAL WITHOUT SYSTEM SHUT-DOWN.
- BRACE AND SUPPORT PIPES, CONDUIT, AND DUCTWORK IN ACCORDANCE WITH SMACNA GUIDELINES FOR SEISMIC RESTRAINTS OF MECHANICAL AND PLUMBING PIPING SYSTEM.
- REFER TO ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF DIFFUSERS, REGISTERS, GRILLES, AND ACCESS PANELS.
- ALL DUCT DIMENSIONS, AS SHOWN ON MECHANICAL DRAWINGS ARE CLEAR INSIDE DIMENSIONS.
- INSULATION AND FLEXIBLE DUCT SHALL COMPLY WITH STATE FIRE MARSHAL CRITERIA AND SHALL NOT EXCEED FLAME SPREAD OF 25 AND SMOKE DEVELOPED OF 50 PER ASTM-84, NFPA-223 AND UL 723.
- INSULATE PIPING AND DUCTWORK IN ACCORDANCE WITH THE GOVERNING CODES.
- COMMISSION AND START-UP THE MECHANICAL SYSTEMS TO ASSURE A COMPLETE AND OPERATIONAL HVAC SYSTEM IN ACCORDANCE WITH ASHRAE AND NEBB.
- ALL SQUARE ELBOWS IN DUCTWORK SHALL HAVE DOUBLE THICKNESS TURNING VANES. ALL RADIUS ELBOWS IN DUCTWORK SHALL BE MINIMUM 1.5W (1.5X WIDTH) AND HAVE 5 SPLITTER VANES. PROVIDE MANUAL VOLUME DAMPER AT EACH BRANCH DUCT TAKE-OFF SERVING EACH AIR TERMINAL DEVICE. PROVIDE BALANCING DAMPERS FOR EACH MAIN DUCT TAKE-OFF IN ACCORDANCE WITH SMACNA IN ORDER TO ASSURE A COMPLETELY BALANCED SYSTEM.
- FIRE DAMPER ASSEMBLIES, INCLUDING LOGGING, SLEEVES, AND INSTALLATION PROCEDURES SHALL BE APPROVED BY THE BUILDING INSPECTOR PRIOR TO PROCUREMENT AND INSTALLATION. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATION OF FIRE RATED WALLS AND SEPARATIONS.
- COORDINATE WITH ELECTRICAL AND CONTROL CONTRACTORS FOR ALL POWER REQUIREMENTS PRIOR TO BID.
- COORDINATE WITH ELECTRICAL AND CONTROL CONTRACTORS FOR ALL POWER REQUIREMENTS PRIOR TO ORDERING ANY EQUIPMENT.
- UPON INSTALLATION OF ALL EQUIPMENT, DEVICES, VIBRATION ISOLATION, ETC., PROVIDE WRITTEN CONFIRMATION BY EQUIPMENT MANUFACTURER'S REPRESENTATIVES TO ENSURE COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS.
- PROVIDE DETAILS AND SEISMIC CALCULATIONS FOR ALL EQUIPMENT ON VIBRATION ISOLATION. ALL DETAILS SHALL BE STAMPED BY A STRUCTURE ENGINEER FROM VIBRATION ISOLATION MANUFACTURER.
- THE CONTRACTOR SHALL SELECT ALL CIRCUIT SETTERS/BALANCING VALVES FOR ACTUAL FLOW THROUGH THE PIPE AND THE PROPER PRESSURE DROP TO ENSURE PROPER OPERATION AND NOT BASED ON PIPE SIZES.

**PROJECT NOTES:**

- CONTRACTOR SHALL COORDINATE ARCHITECTURAL REFLECTED CEILING PLANS WITH ALL DISCIPLINES TO VERIFY CLEARANCES BETWEEN HVAC DUCTS, HVAC PIPING, LIGHT FIXTURES, ELECTRICAL DATA CONDUITS, PLUMBING LINES, FIRE PROTECTION LINES, STRUCTURAL MEMBERS, ETC. SPECIAL ATTENTION IS REQUIRED ALONG THE LENGTH OF MAIN MECHANICAL SUPPLY AND RETURN AIR DUCTS WHERE THERE IS LIMITED CLEARANCE FOR PASSAGE OR ROUTING OF UTILITIES.
- THE SPACE FOR DUCT WORK & MECHANICAL EQUIPMENT FOR THIS PROJECT IS LIMITED. COORDINATION WITH OTHER TRADES IS CRITICAL. PROCEED WITH PREPARATION OF SHOP DRAWINGS IMMEDIATELY UPON RECEIVING AN AUTHORIZATION TO PROCEED FOR THE PROJECT. COMPLETE SHOP DRAWINGS PRIOR TO MATERIAL FABRICATION AND INSTALLATION. SHOP DRAWINGS SHALL BE REVIEWED BY COMMISSIONING AGENT PRIOR TO SUBMITTAL.
- PROVIDE ORIGINAL PREPARED CONTRACTOR'S SHOP DRAWINGS IN ELECTRONIC FORMAT IN ADDITION TO THE REQUIREMENTS SPECIFIED ELSEWHERE. THE SHOP DRAWINGS SHALL INCLUDE THE FOLLOWING:
  - DUCT, PIPE AND PLUMBING ELEVATIONS.
  - DOUBLE LINE DUCTWORK AND PIPING (6" AND LARGER).
  - ACTUAL SIZE OF PURCHASED EQUIPMENT, PER APPROVED CONTRACTORS SHOP DRAWINGS.
  - ACCESS PANELS INCLUDING CEILING PANELS.
  - ACCESS CLEARANCES FOR EQUIPMENT.
  - ACTUAL LOCATIONS OF CEILING DIFFUSERS, REGISTERS, AND RETURN REGISTERS.
  - LOCATIONS OF STRUCTURAL MEMBERS SUCH AS BEAMS.
  - ACTUAL LOCATIONS OF CONTROL PANELS AND POWER CONNECTIONS TO EQUIPMENT.
  - COLOR CODED DUCT AND PIPING BASED ON MATERIAL USED.
  - MINIMUM 1/4"=10" SCALE DRAWINGS.
  - LABEL AND TAG SCHEDULE FOR EQUIPMENT.
  - DUCT TRANSITIONS TO CLEAR BEAMS OR TIGHT AREAS.
  - ROOM TEMPERATURE SENSOR LOCATIONS.
  - POINT OF CONNECTION TO UTILITIES OUTSIDE THE BUILDING.
  - SECTIONS OR 3-D DRAWINGS OF CONGESTED AREAS.
  - GRID LINES.
  - UTILITY PROFILES FOR UNDERGROUND PIPING.
- DO NOT COMMENCE WITH ANY INSTALLATION, DEMOLITION OR ORDERING OF ANY EQUIPMENT OR MATERIAL FABRICATION WITHOUT AN APPROVED SHOP DRAWING SUBMITTAL.
- FOR EACH SUBMITTAL, THE CONTRACTOR SHALL PROVIDE A LETTER (ON COMPANY LETTERHEAD) AND SIGNED BY THE PROJECT MANAGER INDICATING THE SUBMITTAL HAS BEEN FULLY IN HOUSE REVIEWED TO ENSURE FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS AND COORDINATION WITH OTHER TRADES. ANY EXCEPTIONS TO THE CONTRACT DOCUMENTS SHALL BE CLEARLY INDICATED ON THIS LETTER. ANY DISCREPANCIES/EXCEPTIONS NOT IDENTIFIED IN WRITING SHALL BE CORRECTED AT THE SOLE EXPENSE OF THE CONTRACTOR AND AT NO EXPENSE TO THE OWNER AND ENGINEER.

Date	Description
A 04.30.18	ADDENDUM A MA

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Project Number  
**55.7291.015**  
04.16.18

The City of  
**SAN DIEGO**  
Public Works

**M00.001**

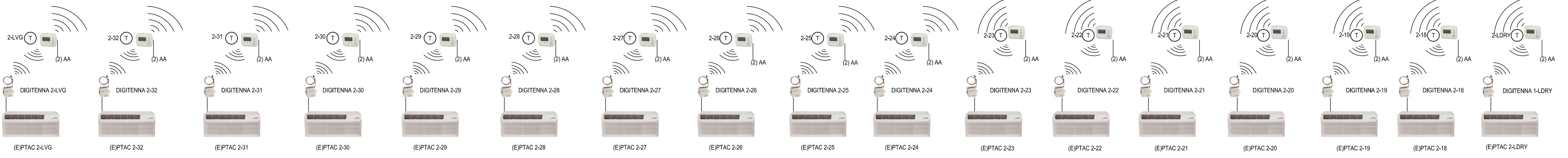
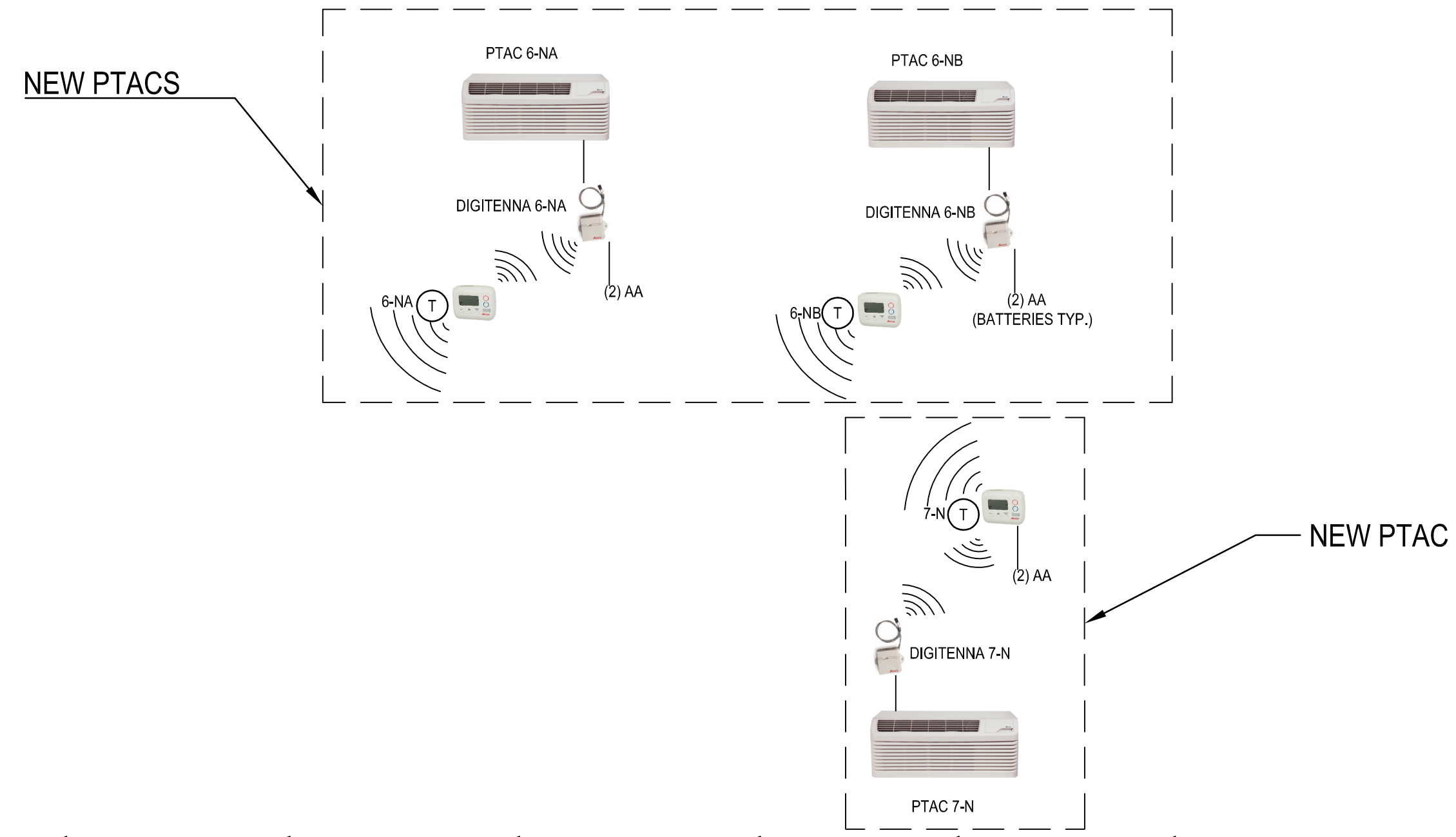
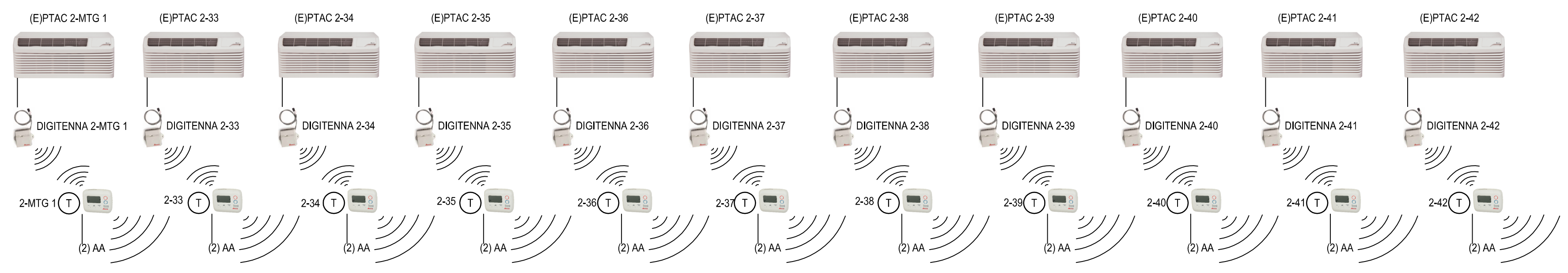
**PALM AVE TRANSITIONAL HOUSING**  
MECHANICAL LEGEND AND GENERAL NOTES

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET <b>76</b> OF 122 SHEETS		WBS <b>S-18003</b>
APPROVED:	FOR CITY ENGINEER DATE 04.05.18 772008	SUBMITTED BY: PROJECT MANAGER JASIN NEFF
PRINT DCE NAME: JASON GRANI	DATE: 5/1/2018	CHECKED BY: PROJECT ENGINEER
DESCRIPTION: <b>ADDENDUM A</b>	BY: JF	PROJECT ENGINEER
APPROVED:	DATE: 5/1/2018	FILED:
CONTRACTOR INSPECTOR	DATE STARTED	DATE COMPLETED
		<b>40498-76D</b>

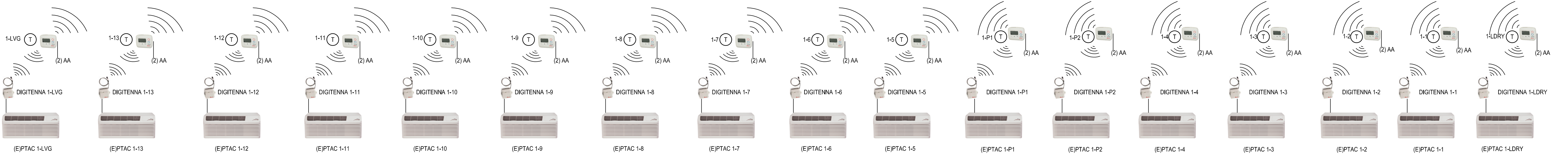
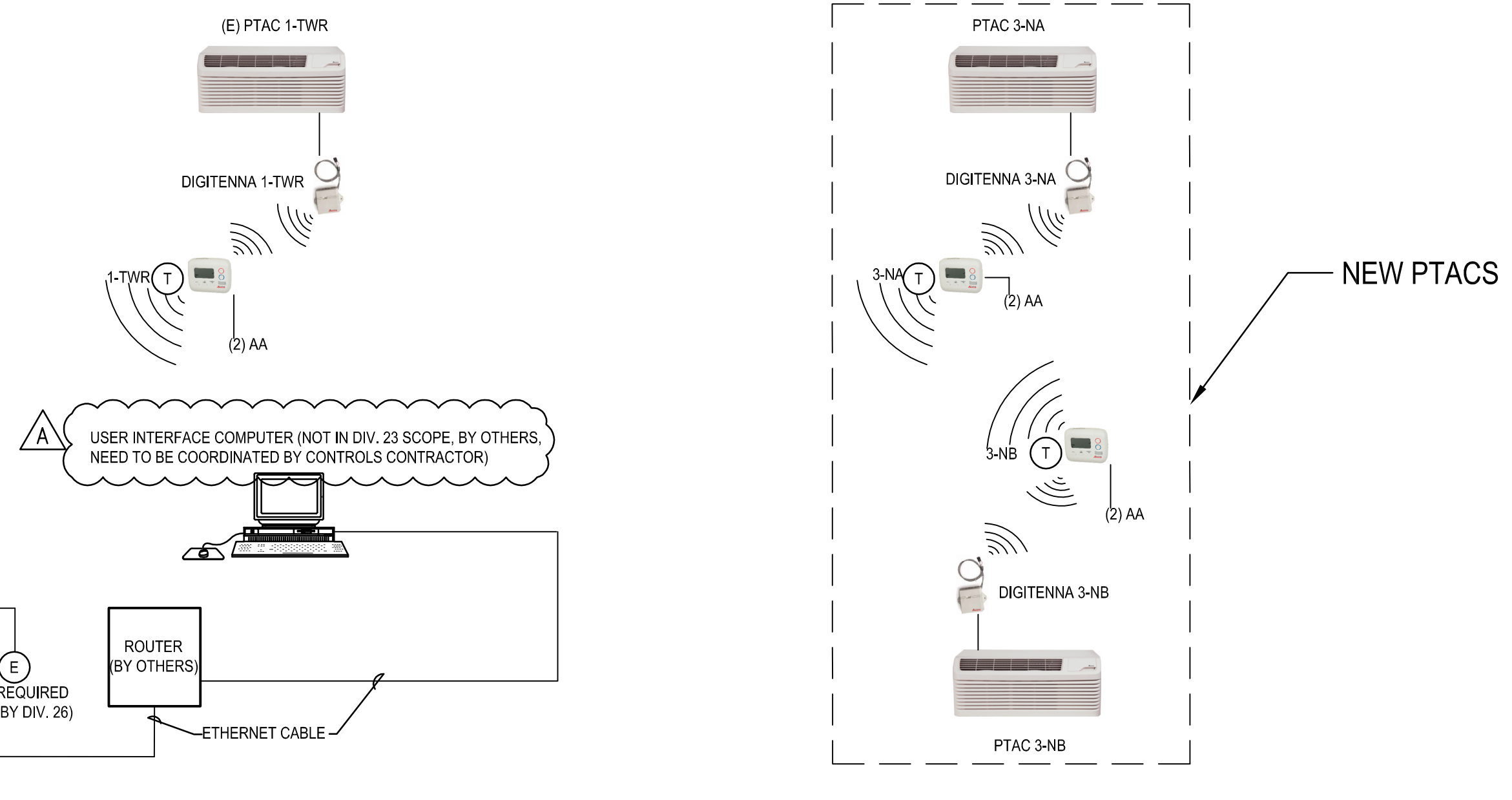
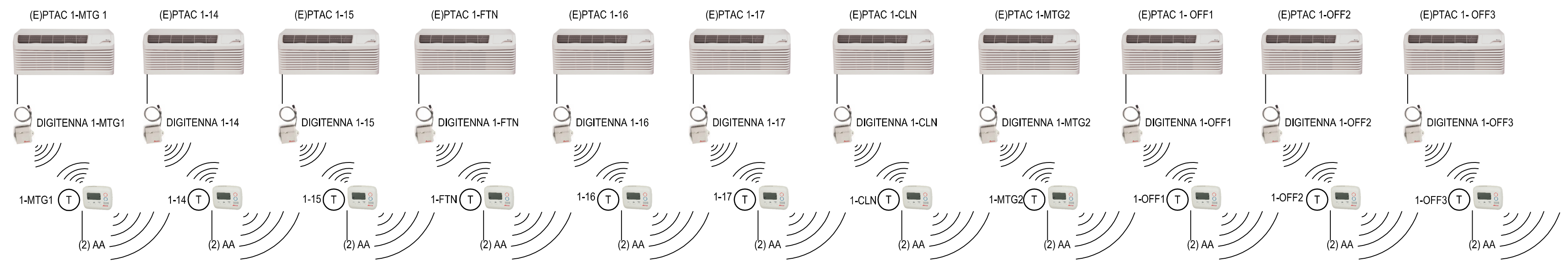
UPDATED MECHANICAL LEGEND

**ADDENDUM A**





**MECHANICAL CONTROLS - LEVEL 02**



**MECHANICAL CONTROLS - LEVEL 01**

**GENERAL NOTES**

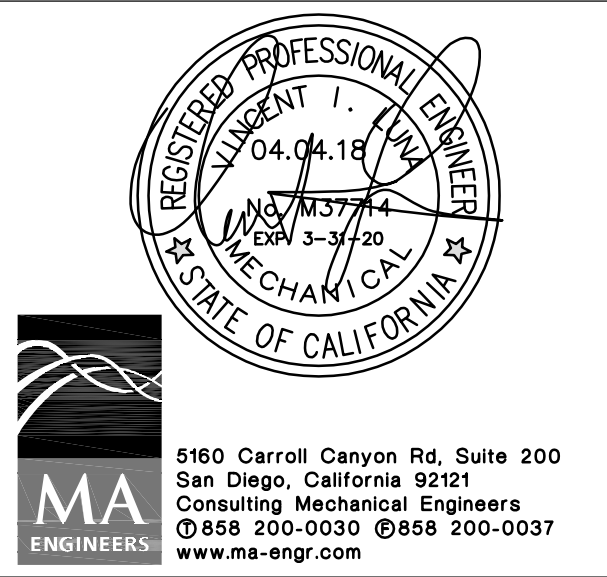
- A. DIGITENNA MOUNTS INSIDE THE AMANA PTAC, HIDDEN FROM SIGHT.
- B. CONTRACTOR SHALL FIELD VERIFY EXACT LOCATION OF DIGISMART CONTROLLER, SUCH THAT IT FUNCTIONS 100% CAPABLE OF CONTROLLING ALL PTACS IN THE BUILDING THROUGH THE WIRELESS (WEB BASED) SYSTEM. THIS LOCATION SHALL BE SUBMITTED TO WIRELESS CONTROL MANUFACTURE FOR APPROVAL, PRIOR TO INSTALLATION.
- C. ALL WIRELESS THERMOSTATS ARE NEW AND DIGITENNAS ARE NEW.
- D. ALL PTACS ARE EXISTING UNLESS NOTED OTHERWISE.
- E. DIGISMART CONTROLLER SHALL NOT BE MOUNTED IN A METAL ENCLOSURE AND IS TO BE MOUNTED A MINIMUM OF 5 FEET ABOVE THE FLOOR.

**PALM AVE TRANSITIONAL HOUSING**

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 99 OF 122 SHEETS				
APPROVED:	FOR CITY ENGINEER	DATE	04.05.18	SUBMITTED BY:
	JASON GRANI	7/23/08		JASIN NEFF
	PRINT DCE NAME	RCE#		PROJECT MANAGER
				CHECKED BY:
				PROJECT ENGINEER
				CCS27 COORDINATE
				CCS83 COORDINATE
CONTRACTOR INSPECTOR	DATE STARTED	DATE COMPLETED		40498-93-D

Date	Description
A 04.30.18	ADDENDUM A MA

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Project Number  
55.7291.015  
04.16.18

The City of  
**SAN DIEGO**  
Public Works

M06.001

**ADDENDUM A**

UPDATED MECHANICAL CONTROLS LEVEL 01



### ANCHORAGE NOTES

#### MEP COMPONENT ANCHORAGE NOTE

ALL MECHANICAL, PLUMBING, AND ELECTRICAL COMPONENTS SHALL BE ANCHORED AND INSTALLED PER THE DETAILS ON THE DSA APPROVED CONSTRUCTION DOCUMENTS. WHERE NO DETAIL IS INDICATED THE FOLLOWING COMPONENTS SHALL BE ANCHORED OR BRACED SECTIONS 1616A.1.18 THROUGH 1616A.1.26 AND ASCE 7-10 CHAPTER 13, 26 AND 30.

- ALL PERMANENT EQUIPMENT AND COMPONENTS.
- TEMPORARY OR MOVABLE EQUIPMENT THAT IS PERMANENTLY ATTACHED (E.G.: HARD-WIRED) TO BUILDING UTILITY SERVICES SUCH AS ELECTRICITY, GAS, OR WATER.
- MOVABLE EQUIPMENT THAT IS STATIONED IN ONE PLACE FOR MORE THAN 8 HOURS AND HEAVIER THAN 400 POUNDS IS REQUIRED TO BE ANCHORED WITH TEMPORARY ATTACHMENTS.

THE FOLLOWING MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE POSITIVELY ATTACHED TO THE STRUCTURE, BUT THE ATTACHMENT NEED NOT BE DETAILED ON THESE COMPONENTS SHALL HAVE FLEXIBLE CONNECTIONS PROVIDED BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING, AND CONDUIT.

- COMPONENTS WEIGHING LESS THAN 400 POUNDS AND HAVING A CENTER OF MASS LOCATED 4 FEET OR LESS ABOVE THE ADJACENT FLOOR OR ROOF LEVEL THAT DIRECTLY SUPPORT THE COMPONENT.
- COMPONENTS WEIGHING LESS THAN 20 POUNDS, OR IN THE CASE OF DISTRIBUTED SYSTEMS LESS THAN 5 POUNDS PER FOOT WHICH ARE SUSPENDED FROM A ROOF OR FLOOR OR HUNG FROM A WALL.

FOR THOSE ELEMENTS THAT DO NOT REQUIRE DETAILS ON THE APPROVED DRAWINGS, THE INSTALLATION SHALL BE SUBJECT TO THE APPROVAL OF THE STRUCTURAL ENGINEER OF AND THE DISTRICT DSA STRUCTURAL ENGINEER. THE PROJECT INSPECTOR WILL VERIFY THAT ALL COMPONENTS AND EQUIPMENT HAVE BEEN ANCHORED IN ACCORDANCE WITH THE ABOVE REQUIREMENTS.

#### PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEM BRACING NOTE

PIPING, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS SHALL BE BRACED TO COMPLY WITH THE FORCES AND DISPLACEMENTS PRESCRIBED IN ASCE 7-10 SECTION 13.3 AS DEFINED IN ASCE 7-10 SECTION 13.6.8, 13.6.7, 13.6.5.6, AND 2013 CBC 1616A.1.23, 1616A.1.24, 1616A.1.25 AND 1615A.1.26.

THE BRACING AND ATTACHMENTS TO THE STRUCTURE SHALL BE DETAILED ON THE APPROVED DRAWINGS OR THEY SHALL COMPLY WITH ONE OF THE OSHPD PRE-APPROVALS.

COPIES OF THE BRACING SYSTEM INSTALLATION GUIDE OR MANUAL SHALL BE AVAILABLE ON THE JOBSITE PRIOR TO THE START OF HANGING AND BRACING OF THE PIPE, DUCTWORK, AND ELECTRICAL DISTRIBUTION SYSTEMS.

THE STRUCTURAL ENGINEER OF RECORD SHALL VERIFY THE ADEQUACY OF THE STRUCTURE TO SUPPORT THE HANGER AND BRACE LOADS.

### TESTING AND INSPECTIONS

- SOIL/WASTE AND VENT PIPING: A WATER TEST SHALL BE APPLIED TO THE DRAINAGE SYSTEM EITHER IN ITS ENTIRETY OR IN SECTIONS. IF APPLIED TO THE ENTIRE SYSTEM, ALL OPENINGS IN THE PIPING SHALL BE TIGHTLY CLOSED, EXCEPT THE HIGHEST OPENING, AND THE SYSTEM SHALL BE FILLED WITH WATER TO THE POINT OF OVERFLOW. IF THE SYSTEM IS TESTED IN SECTIONS, EACH OPENING SHALL BE TIGHTLY PLUGGED EXCEPT THE HIGHEST OPENINGS OF THE SECTION UNDER TEST, AND EACH SECTION SHALL BE FILLED WITH WATER, BUT NO SECTION SHALL BE TESTED WITH LESS THAN A 10-FOOT HEAD OF WATER.
- WATER PIPING: UPON COMPLETION OF A SECTION OF OR THE ENTIRE WATER SUPPLY SYSTEM, THE SYSTEM, OR PORTION COMPLETED SHALL BE TESTED AND PROVED TIGHT UNDER A WATER PRESSURE NOT LESS THAN THE WORKING PRESSURE OF THE SYSTEM; OR, FOR PIPING SYSTEMS OTHER THAN PLASTIC, BY AN AIR TEST OF NOT LESS THAN 50 PSI. THIS PRESSURE SHALL BE HELD FOR AT LEAST MINUTES.
- ALL TESTING SHALL BE PERFORMED IN ACCORDANCE WITH CURRENT EDITION OF THE CALIFORNIA PLUMBING CODE (CPC).

### PLAN CHECK NOTES

- LABEL MEDIUM PRESSURE GAS EVERY FIVE FEET.
- EACH KITCHEN FAUCET SHALL NOT EXCEED A WATER FLOW OF 1.8 GPM.
- WHEN A SHOWER IS SERVED BY MORE THAN ONE SHOWERHEAD, THE COMBINED FLOW RATE OF ALL THE SHOWERHEADS AND/OR OTHER SHOWER OUTLETS CONTROLLED BY A SINGLE VALVE SHALL NOT EXCEED 2.0 GALLONS PER MINUTE AT 80 PSI OR THE SHOWER SHALL BE DESIGNED TO ALLOW ONLY ONE SHOWER OUTLET TO BE IN OPERATION AT A TIME. (CAL GREEN SECTION: 5.303.3.3.2).
- TOILETS SHALL BE 1.28 G.P.F. MAX.
- EACH SHOWERHEAD SHALL NOT EXCEED A WATER FLOW OF 2.0 GPM.
- EACH SELF CLOSING LAVATORY FAUCET SHALL NOT EXCEED A WATER FLOW OF 2.0 GPM.
- WATER HEATER SHALL BE ANCHORED OR STRAPPED TO RESIST HORIZONTAL DISPLACEMENT DUE TO EARTHQUAKE MOTION PER SECTION 507.2 CPC.

### PLUMBING LEGEND AND ABBREVIATIONS

SYMBOL	ABBREV.	DESCRIPTION	SYMBOL	ABBREV.	DESCRIPTION
	POC	POINT OF CONNECTION		ABV	ABOVE
	W	WASTE OR SEWER BELOW SLAB		A/C	ABOVE CEILING
	W	WASTE OR SEWER ABOVE SLAB		A.F.F.	ABOVE FINISH FLOOR
	V	SANITARY VENT		A.F.G.	ABOVE FINISH GRADE
	CW	COLD WATER		A/G	ABOVE GRADE
	HW	HOT WATER		A.P.	ACCESS PANEL
	SOV	SHUT OFF VALVE		B/F	BELOW FLOOR
	BLV	BALANCING VALVE		B/G	BELOW GRADE
	PRV	PRESSURE REDUCING VALVE		CFH	CUBIC FEET PER HOUR
	FS	FLOOR SINK		DWGS.	DRAWINGS
	FD	FLOOR/AREA DRAIN		EA.	EACH
	FCO	FLOOR CLEAN-OUT		EXIST.	EXISTING
	WCO	WALL CLEAN-OUT		(E)	EXISTING
	GCO	GRADE CLEAN-OUT		FT.	FEET OR FOOT
	DN	DOWN OR DROP		FDC	FIRE DEPARTMENT CONNECTION
	UP	RISE OR RISER		F	FIRE RISER
	HB	HOSE BIBB		FLR.	FLOOR
		VALVE ON RISE OR DROP		G.P.F.	GALLONS PER FLUSH
	U	UNION		G.P.H.	GALLONS PER HOUR
	RV	TEMPERATURE & PRESSURE RELIEF VALVE		G.P.M.	GALLONS PER MINUTE
	F	FIRE SPRINKLER PIPING		I.E.	INVERT ELEVATION
	CD	CONDENSATE DRAIN PIPING		NTS	NOT TO SCALE
	FDC	FIRE DEPARTMENT CONNECTION		ORD	OVERFLOW ROOF DRAIN
	CP	CIRCULATING PUMP		LB	POUNDS
	CV	CHECK VALVE		PSI	POUNDS PER SQUARE INCH
	TP	TRAP PRIMER		RD	ROOF DRAIN
	WHA	WATER HAMMER ARRESTOR		SA	SET ASSEMBLY
	REG	GAS REGULATOR W/SHUT-OFF VALVE		SF	SQUARE FEET
				T.D.H.	TOTAL DEVELOPED HEAD
				V.T.R.	VENT THROUGH ROOF
				W.C.	WATER COLUMN
				WHA	WATER HAMMER ARRESTOR

### PLUMBING FIXTURE SCHEDULE

SYMBOL	FIXTURE	ROUGH-IN					REMARKS
		HW	CW	W	TRAP	V	
	LAVATORY W / FAUCET	1/2"	1/2"	2"	2"	1 1/2"	COUNTERTOP MOUNT. 1.0 GPM. LAVATORY SHALL BE AMERICAN STANDARD AQUALYN MODEL # 0475.047 OR EQUAL. PROVIDE AMERICAN STANDARD FAUCET MODEL # 7075.100, OR EQUAL.
	KITCHEN SINK W / FAUCET - ADA COMPLIANT	1/2"	1/2"	2"	2"	2"	FOR RESIDENT UNIT PROVIDE SINGLE BOWL, COUNTER MOUNT, 0.5 GPM. WITH 3/4 HP GARBAGE DISPOSAL, SINK SHALL BE JUST MODEL # SL-ADA-2125-A-GR 5" DEPTH, DRAIN CENTER REAR OR EQUAL. PROVIDE CHICAGO FAUCET 1100-G2AE35-317VAB, OR EQUAL.
	KITCHEN SINK W / FAUCET - ADA COMPLIANT	1/2"	1/2"	2"	2"	2"	FOR COMMUNITY KITCHENS PROVIDE DOUBLE BOWL COUNTER MOUNT, 0.5 GPM. WITH 3/4 GARBAGE DISPOSAL, SINK SHALL BE JUST MODEL # DL-ADA-2133-A-GR 5" DEPTH REAR RIGHT OR EQUAL. PROVIDE CHICAGO FAUCET 1100-G2AE35-317VAB, OR EQUAL.
	WATER CLOSET - ADA COMPLIANT	--	1"	4"	INT.	2"	FLOOR MOUNTED. 1.28 GPF. FLUSH VALVE. WATER CLOSET SHALL BE AMERICAN STANDARD MADERA FLOWISE OR EQUAL.
	FAUCET	1/2"	1/2"	--	--	--	SENSOR BATTERY OPERATED, 0.5 GPM. FAUCET SHALL BE ZURN MODEL # 26915-XL, OR EQUAL.
	SUPPLY BOX	1/2"	1/2"	--	--	--	PROVIDE WATER AND FILTER FOR ICE MACHINE. FIRE RATED. SUPPLY BOX SHALL BE GUY GRAY MODEL # FRIB12DSAB, OR EQUAL.
	SHOWER - ADA COMPLIANT	3/4"	1/2"	2"	2"	1 1/2"	SHOWER SHALL BE, BEST BATH SLES26331A75B - SHOWER UNIT, OR EQUAL.
	CLOTHES WASHER BOX	3/4"	3/4"	2"	--	2"	--
	CONDENSATE PUMP	--	--	--	--	--	MAXI BLUE X87 - 110V / 1/60, 0.7A, 23" FT. HD OR EQUAL.
	FLOOR DRAIN	--	--	2"	2"	1 1/2"	BRONZE GRATE. PROVIDE AUTOMATIC TRAP PRIMER, FLOOR DRAIN SHALL BE JAY R. SMITH MODEL # 2050, OR EQUAL.
	PRESSURE RELIEF VALVE	--	--	--	--	--	GAS PRESSURE RELIEF VALVE.
	TRAP PRIMER	--	1/2"	--	--	--	FLOOR SINKS/DRAINS.
	GARBAGE DISPOSAL	--	--	--	--	--	3/4 HP, GARBAGE DISPOSAL SHALL BE BADGER EXP.

### HW PIPING SIZING CHART 3 psi / 100 ft

SIZE	GPM	FIXTURE UNITS		VELOCITY (FPS)
		FLUSH TANK	FLUSH VALVE	
1/2"	1.8	--	--	2.4
3/4"	4.7	4	--	3.0
1"	9	12	--	3.6
1 1/4"	17	24	--	4.3
1 1/2"	27	46	--	4.9
2"	46	111	--	5
2 1/2"	72	236	--	5
3"	113	440	--	5

### CW PIPING SIZING CHART 3 psi / 100 ft

SIZE	GPM	FIXTURE UNITS		VELOCITY (FPS)
		FLUSH TANK	FLUSH VALVE	
1/2"	1.8	--	--	2.4
3/4"	4.7	4	--	3.0
1"	9	12	--	3.6
1 1/4"	17	24	--	4.3
1 1/2"	27	46	10	4.9
2"	56	155	63	5.7
2 1/2"	100	380	245	7.2
3"	175	778	739	8

### GENERAL NOTES

- THESE DRAWINGS ARE A GENERAL GRAPHIC PRESENTATION OF THE WORK. DUCTWORK, PIPING, AND EQUIPMENT, AS SHOWN, ARE SCHEMATIC. FABRICATE AND INSTALL BASED ON ACTUAL FIELD MEASUREMENT. COORDINATE WITH OTHER TRADES. PROVIDE A COMPLETE SET OF SHOP DRAWINGS REFLECTING ACTUAL DIMENSIONS, ACCESS REQUIREMENTS, AND DETAILS BASED UPON THE ACTUAL EQUIPMENT PROCURED. MAINTAIN AN UP TO DATE SET OF AS-BUILT DRAWINGS AT THE JOB SITE.
- NO PLUMBING SHALL BE INSTALLED UNTIL ALL REQUIRED PLUMBING PLAN CHECK PERMITS AND APPROVALS HAVE BEEN OBTAINED FROM ALL REQUIRED AGENCIES.
- COORDINATE WITH THE ARCHITECTURAL DRAWINGS FOR EXACT LOCATION OF PLUMBING FIXTURES AND DRAINS.
- COORDINATE AND VERIFY SIZES, LOCATIONS, DEPTHS AND PRESSURIZED PIPING PRESSURES OF ALL BUILDING UTILITIES WITH CIVIL.
- COORDINATE AND SCHEDULE TIMING FOR UTILITY SERVICE CONNECTION.
- ALL LINES BELOW SLAB ON GRADE TO BE LOCATED AWAY FROM ALL LOAD BEARING FOOTINGS.
- ALL LINES RUNNING BELOW GRADE BEAMS OR PENETRATING, SEE STRUCTURAL DRAWINGS FOR CONSTRUCTION.
- ALL VENTS THRU ROOF SHALL BE MINIMUM OF 18 INCHES VERTICAL AND TEN FEET HORIZONTAL AWAY FROM ALL AIR CONDITIONING FRESH AIR INTAKES AND PROVIDED WITH VANDAL PROOF HOODS.
- CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING OF WALLS, ROOFS, FOOTINGS, FLOORS, INCLUDING ALL SAW CUTTING AND CORE DRILLING. COORDINATE ALL SAW CUTTING AND CORE DRILLING WITH STRUCTURAL DRAWINGS. ANY CUTTING AND DRILLING REQUIRED OF STRUCTURAL ELEMENTS THAT IS NOT SPECIFICALLY SHOWN ON THE PLANS SHALL BE BROUGHT TO THE ARCHITECTS ATTENTION PRIOR TO CUTTING AND DRILLING. CONTRACTOR SHALL SUBMIT PROPOSED LOCATION AND SIZES OF SUCH CUTTING AND DRILLING FOR THE ARCHITECTS AND STRUCTURAL ENGINEERS APPROVAL.
- COORDINATE ALL EQUIPMENT LOCATIONS, PIPE PENETRATIONS AND EQUIPMENT PAD LOCATIONS WITH STRUCTURAL DRAWINGS PRIOR TO WORK.
- COORDINATE INSTALLATION OF ALL EQUIPMENT AND PIPING WITH OTHER TRADES PRIOR TO INSTALLATION. ENSURE THAT ALL CONTROL DEVICES, SHUT-OFF VALVES, ETC. ARE ACCESSIBLE FOR MAINTENANCE. WHERE ACCESS PANELS IN FINISHED SPACES, OTHER THAN THAT SHOWN, CONTRACTOR SHALL PROVIDE AND COORDINATE EXACT LOCATION OF PANELS WITH ARCHITECT PRIOR TO INSTALLATION.
- INSTALL VALVES WITH UNIONS OR FLANGES AT EACH PIECE OF EQUIPMENT ARRANGED TO ALLOW SERVICE, MAINTENANCE, AND EQUIPMENT REMOVAL WITHOUT SYSTEM SHUT-DOWN.
- CROSS CONNECTION PROTECTION SHALL BE PROVIDED AT ALL POTABLE WATER SUPPLIED APPLIANCES AND EQUIPMENT (OTHER THAN THOSE LISTED IN INFORMATION BULLETIN 103).
- UPON INSTALLATION OF ALL EQUIPMENT, DEVICES, VIBRATION ISOLATION, ETC., PROVIDE WRITTEN CONFIRMATION BY EQUIPMENT MANUFACTURER'S REPRESENTATIVES TO ENSURE COMPLIANCE WITH MANUFACTURER'S REQUIREMENTS.
- FOR EACH SUBMITTAL, THE CONTRACTOR SHALL PROVIDE A LETTER (ON COMPANY LETTERHEAD) AND SIGNED BY THE PROJECT MANAGER INDICATING THE SUBMITTAL HAS BEEN FULLY IN HOUSE REVIEWED TO ENSURE FULL COMPLIANCE WITH THE CONTRACT DOCUMENTS AND COORDINATION WITH OTHER TRADES. ANY EXCEPTIONS TO THE CONTRACT DOCUMENTS SHALL BE CLEARLY INDICATED ON THIS LETTER. ANY DISCREPANCIES/EXCEPTIONS NOT IDENTIFIED IN WRITING SHALL BE CORRECTED AT THE SOLE EXPENSE OF THE CONTRACTOR AND AT NO EXPENSE TO THE OWNER AND ENGINEER.
- THE CONTRACTOR SHALL SELECT ALL CIRCUIT SETTERS/BALANCING VALVES FOR ACTUAL FLOW THROUGH THE PIPE AND THE PROPER PRESSURE DROP TO ENSURE PROPER OPERATION AND NOT BASED ON PIPE SIZES.

### PIPE MATERIAL

- WATER ABOVE GRADE: COPPER TYPE "L" HARD DRAWN WITH WROUGHT COPPER SOLDER JOINT FITTINGS.
- WATER BELOW GRADE: COPPER TYPE "K" WITH CAST SOLDER JOINT FITTINGS. ROUGH SOLDER JOINT FITTINGS, OR FLARED JOINT FITTINGS.
- SOIL/WASTE AND VENT ABOVE GRADE: POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS PER ASTM D2865.
- SOIL/WASTE AND VENT BELOW GRADE: SOLID CORE, SCHEDULE 40 PVC WITH SOLVENT WELDED FITTINGS.
- NATURAL GAS ABOVE GRADE: BLACK STEEL, SCHEDULE 40 WITH MALLEABLE IRON-THREADED FITTINGS.
- NATURAL GAS BELOW GRADE: POLYETHYLENE (PE) ASTM 2513, SDR 11, SOCKET-FUSION TYPE ASTM D 2683 OR BUTT-FUSION ASTM D3261 PE FITTINGS.
- STORM DRAIN BELOW GRADE: SOLID CORE, SCHEDULE 40 PVC WITH SOLVENT WELDED FITTINGS.
- CONDENSATE: COPPER TYPE "L".

### SLOPE OF PIPING SYSTEMS

- SANITARY SEWER, WASTE & VENT PIPING: 2% UNLESS NOTED OTHERWISE.
- CONDENSATE PIPING: 1% UNLESS NOTED OTHERWISE.

Date	Description
04.30.18	ADDENDUM A MA

## Gensler

225 Broadway  
Suite 100  
San Diego, CA 92101  
United States

Tel 619.557.2900  
Fax 619.557.2520



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San Diego, California 92121  
Consulting Mechanical Engineers  
619.557.2500-250030 ©1988-2007-0037  
www.ma-engr.com

Project Number

55.7291.015  
04.16.18

The City of  
**SAN DIEGO**  
Public Works

P00.001

## PALM AVE TRANSITIONAL HOUSING

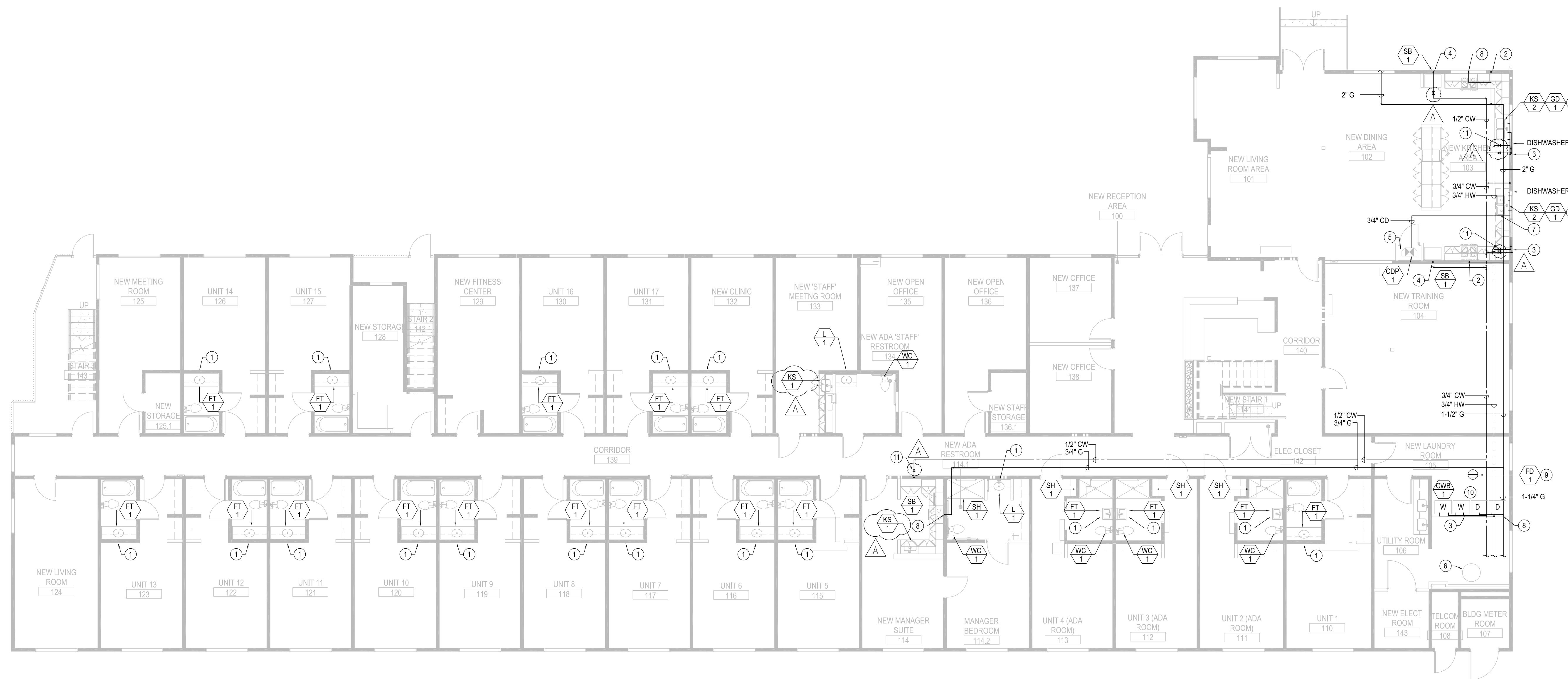
### PLUMBING LEGEND AND GENERAL NOTES

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 94 OF 122 SHEETS				WBS_S-18003
APPROVED:	JASON GRANI FOR CITY ENGINEER PRINT DCE NAME	04.05.18 DATE 77308 RCE#	SUBMITTED BY: JASIAH NEFF PROJECT MANAGER	CHECKED BY:
DESCRIPTION	BY	APPROVED	DATE	FILMED
A ADDENDUM A	JF	[Signature]	5/1/2018	
CONTRACTOR INSPECTOR				DATE STARTED DATE COMPLETED
				40498-a+D



**SHEET NOTES**

- 1 CONNECT TO EXISTING UTILITIES. RECONDITION PIPING AS NEEDED TO MEET CURRENT CPC AND ACCOMMODATE NEW PLUMBING FIXTURE.
- 2 3/4" G UP.
- 3 3/4" CW & HW UP.
- 4 1/2" CW UP.
- 5 MECHANICAL EQUIPMENT SHOWN FOR REFERENCE ONLY. SEE MECHANICAL DRAWINGS (TYP).
- 6 EXISTING WATER HEATER TO REMAIN.
- 7 ROUTE 3/4" CD TO HOUSE SIDE OF LAVATORY/SINK TAILPIECE. SEE DETAIL 1P05.001.
- 8 3/4" G DOWN.
- 9 EXISTING FLOOR DRAIN TO REMAIN.
- 10 PER LAW-UFAS WASHING AND DRYER MACHINES SHALL BE FRONT-LOADING MACHINES.
- 11 PROVIDE SHUT-OFF VALVES WITH ACCESS PANEL.



**PLUMBING FLOOR PLAN - LEVEL 01**

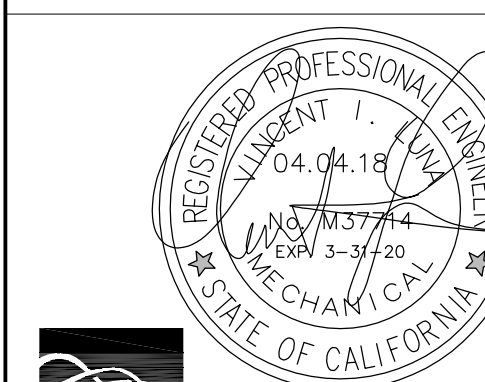
SCALE: 1/8" = 1'-0"

Date	Description
04.30.18	ADDENDUM A MA

**Gensler**

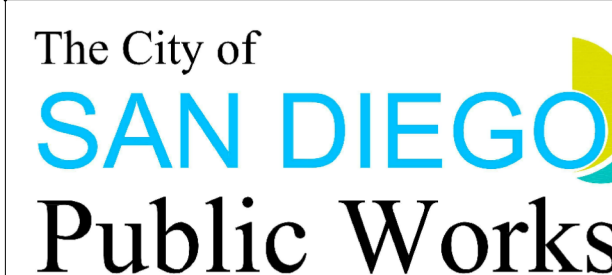
225 Broadway  
Suite 100  
San Diego, CA 92101  
United States

Tel 619.557.2500  
Fax 619.557.2520



Project Number

55.7291.015  
04.16.18



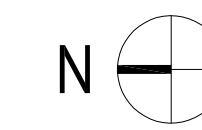
P02.01

**GENERAL NOTES**

- A. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO START OF ANY DEMOLITION.
- B. ALL EXISTING WASTE PIPING THAT IS FOUND TO BE UNUSABLE OR IN NEED OF REPAIR SHALL BE REVIEWED AND BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER, AND REPLACED OR REPAIRED TO PROVIDE A FUNCTIONAL SYSTEM AS REQUIRED.

**PALM AVE TRANSITIONAL HOUSING**  
PLUMBING FLOOR PLAN - LEVEL 01

CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 97 OF 122 SHEETS		WBS S-18003
APPROVED: <i>JG</i>	DATE: 04.05.18	SUBMITTED BY: JASIAH NEFF
FOR CITY ENGINEER: JASON GRANI	DATE: 7/3/2018	PROJECT MANAGER
PRINT DCE NAME: JG	RCE#	PROJECT ENGINEER
DESCRIPTION: ADDENDUM A	BY: JF	APPROVED: <i>JG</i>
		DATE: 5/1/2018
		FILMED
		CCS27 COORDINATE
		CCS83 COORDINATE
CONTRACTOR INSPECTOR	DATE STARTED	DATE COMPLETED
		40498-07-D

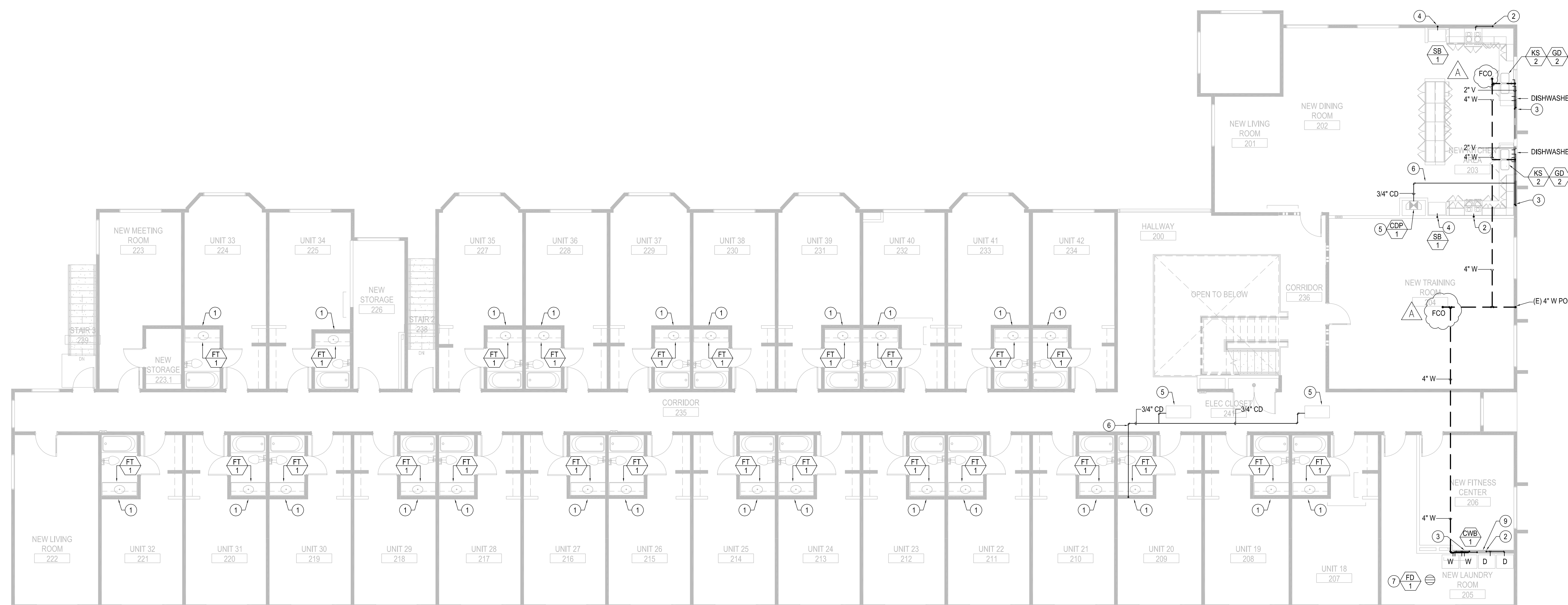


UPDATED KITCHEN NOTES

**ADDENDUM A**

**SHEET NOTES**

- 1 CONNECT TO EXISTING UTILITIES. RECONDITION PIPING AS NEEDED TO MEET CURRENT CPD AND ACCOMMODATE NEW PLUMBING FIXTURE.
- 2 3/4" GAS DOWN.
- 3 3/4" CW & HW DOWN.
- 4 1/2" CW DOWN.
- 5 MECHANICAL EQUIPMENT SHOWN FOR REFERENCE ONLY. SEE MECHANICAL DRAWINGS (TYP).
- 6 ROUTE 3/4" CD TO HOUSE SIDE OF LAVATORY/SINK TAILPIECE. SEE DETAIL 1105.001.
- 7 EXISTING FLOOR DRAIN TO REMAIN.
- 8 4" WASTE DOWN.
- 9 PER LAW-UFAS WASHING AND DRYER MACHINES SHALL BE FRONT-LOADING MACHINES.



**PLUMBING FLOOR PLAN - LEVEL 02**

SCALE: 1/8" = 1'-0"

Date	Description
04.30.18	ADDENDUM A MA

**Gensler**  
 225 Broadway  
 Suite 100  
 San Diego, CA 92101  
 United States  
 Tel 619.557.2500  
 Fax 619.557.2520



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 San Diego, California 92121  
 Consulting Mechanical Engineers  
 (619) 557-2500 © 1998-2018 www.ma-engr.com

Project Number  
 55.7291.015  
 04.16.18

The City of  
**SAN DIEGO**  
 Public Works

P02.202

**GENERAL NOTES**

- A. THE CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS PRIOR TO START OF ANY DEMOLITION.
- B. ALL EXISTING WASTE PIPING THAT IS FOUND TO BE UNUSABLE OR IN NEED OF REPAIR SHALL BE REVIEWED AND BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER, AND REPLACED OR REPAIRED TO PROVIDE A FUNCTIONAL SYSTEM AS REQUIRED.

**PALM AVE TRANSITIONAL HOUSING**  
 PLUMBING FLOOR PLAN - LEVEL 02

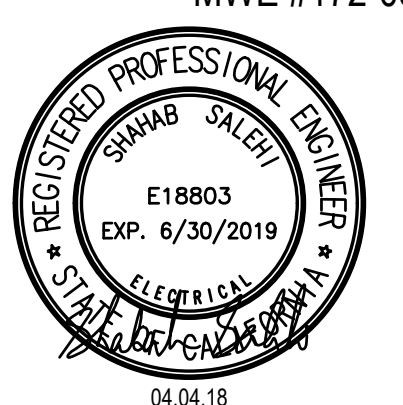
CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 98 OF 122 SHEETS		WBS S-18003
APPROVED: <i>JG</i>	DATE: 04.05.18	SUBMITTED BY: JASIAH NEFF
FOR CITY ENGINEER: JASON GRAN	DATE: 7/30/18	PROJECT MANAGER
PRINT DCE NAME: JG	DATE: 5/1/2018	CHECKED BY:
DESCRIPTION: ADDENDUM A	BY: JF	PROJECT ENGINEER
APPROVED: <i>JF</i>	DATE: 5/1/2018	CCS27 COORDINATE
INSPECTOR: _____	DATE COMPLETED: _____	CCS83 COORDINATE
		40498-08-D



△ ADDED CLEAN-OUTS

**ADDENDUM A**





- KEY NOTES:**
- MECHANICAL CONDENSING UNITS. REFER TO SHEET E02.201 FOR CIRCUITING INFORMATION.
  - PV STRING INVERTER TO BE INSTALLED UNDERNEATH THE CARPORT STRUCTURE.
  - PROVIDE (1) 1" C.O. TO RECEPTION DESK. VERIFY POWER REQUIREMENTS WITH EQUIPMENT MANUFACTURER, AND PROVIDE AN ADDITIONAL 1" CONDUIT TO RECEPTION DESK FOR SIGNAL WIRING.
  - PROVIDE WP J-BOX WITH 1-1/4" C.O TO ELECTRICAL CLOSET ON FIRST LEVEL.
  - ROUTE (1) 4" C.O. FROM ROOF LEVEL TO AC COMBINER BOX LOCATED IN ELECTRICAL ROOM 143.
  - COORDINATE ROUTING WITH ARCHITECT AND STRUCTURAL EOR. INSTALL PULLBOXES AS NEEDED, PER NEC REQUIREMENTS.
  - COORDINATE NEW INCOMING ELECTRICAL SERVICE REQUIREMENTS WITH SDGE PLANNER, AND WITH NEW SDGE ENGINEERED UTILITY PLANS. REFER TO DET 1/E03.003 FOR ADDITIONAL REQUIREMENTS AT EXISTING CONCRETE SLAB.
  - PROVIDE WEATHERPROOF J-BOX WITH 120VAC CIRCUIT FOR IRRIGATION CONTROLLER. COORDINATE FINAL LOCATION WITH ARCHITECT. VERIFY FINAL TERMINATIONS WITH MANUFACTURER.
  - SEE LEVEL 02 POWER AND SIGNAL PLAN ON SHEET E02.202 FOR ADDITIONAL SECURITY CAMERA LOCATIONS.
  - SEE LEVEL 01 POWER AND SIGNAL PLAN ON SHEET E02.202 FOR ADDITIONAL SECURITY CAMERA LOCATIONS.
  - SEE ENLARGED LEVEL 01 COMMON AREA ON SHEET 1/E03.001 FOR ADDITIONAL SECURITY CAMERA LOCATIONS.
  - PROVIDE (1) 1" CONCEALED C.O. FROM CAMERA MOUNTING LOCATION TO TELECOM ROOM 108.
  - DEDUCT ALTERNATE #01: PHOTOVOLTAICS.
  - COORDINATE CONDUIT, CABLING, AND DEVICE REQUIREMENTS WITH ARCHITECT. SEE SHEET G0.002 FOR MORE DETAILS.
  - PROVIDE (1) 1-1/4" CONDUIT PATHWAY BACK TO PANEL 'P4' FOR EV CHARGING STATION.
  - FOR EV CHARGING STATION BACK TO NEW ELECTRICAL ROOM 143. COORDINATE STUB-UP LOCATION FOR EV CHARGING STATION WITH CIVIL AND ARCHITECT.
  - PROVIDE (1) 1-1/4" CONDUIT PATHWAY FOR INTERCOM BACK TO RECEPTION DESK. COORDINATE STUB-UP LOCATION WITH CIVIL AND ARCHITECT.

- GENERAL NOTES:**
- PROVIDE MINIMUM SIZED #10AWG CONDUCTORS FOR ALL SITE POWER U.O.N.
  - ALL PVC WILL BE BURIED BELOW GRADE LEVEL AND NEVER BE INSTALLED WITHIN A CONCRETE SLAB OR FLOOR.
  - ALL STUBUPS IN PVC WILL BE CHANGED TO EMT IN INTERIOR WALLS. EXTERIOR BLOCK WALLS MAY BE PVC. NO FLEXIBLE CONDUIT WILL BE USED AT GRADE TRANSITIONS.
  - ALL CONDUITS EXPOSED BELOW 4' OF FINISH GRADE SHALL BE RIGID GRC CONDUIT.
  - ANY EXPOSED WIRING DEVICE OR LIGHT FIXTURE JUNCTION BOXES WILL BE CAST IRON. NO CAST ALUMINUM.
  - ALL OUTDOOR OUTLETS WILL BE INSTALLED IN A RECESSED STAINLESS STEEL BOX WITH A FLUSH, LOCKABLE COVER WITH A 20A GFCI RECEPTACLE ON A DEDICATED CIRCUIT.
  - ROOFTOP CONDUITS WILL BE INSTALLED IN RIGID CONDUIT, NEATLY GROUPED AND INSTALLED PARALLEL TO THE BUILDING LINES. SUPPORT FOR CONDUITS SHALL BE RUBBER SLEEPERS WITH INSET UNISTRUT.
- UTILITY SERVICE NOTES:**
- U1 (1)-5"C.O. FOR PRIMARY SERVICE PER POWER UTILITY COMPANY REQUIREMENTS. PROVIDE 3" CONCRETE COVER UNLESS OTHERWISE NOTED.
  - U2 POWER UTILITY PAD (SDGE 3425) WITH NEW TRANSFORMER. VERIFY SECONDARY/ PRIMARY HANDHOLE REQUIREMENTS. PROVIDE GROUNDING, CLEARANCES, AND BOLLARDS PER UTILITY COMPANY REQUIREMENTS.
  - U3 POWER UTILITY SECONDARY CONDUITS. PROVIDE (1)-5"C.O. PER EACH 400A OF SERVICE CAPACITY UNLESS NOTED OTHERWISE. REVIEW SDGE SERVICE ORDER AND DESIGN DRAWINGS FOR SPECIFIC REQUIREMENTS.
- UTILITY SERVICE GENERAL NOTES:**
- ALL UTILITY SERVICES SHALL BE INSTALLED PER THE UTILITY COMPANY REQUIREMENTS. VERIFY FINAL CONSTRUCTION REQUIREMENTS WITH UTILITY COMPANY SERVICE PLANNERS.
  - CONTACT THE FOLLOWING SERVICE PLANNERS FOR FURTHER INFORMATION:

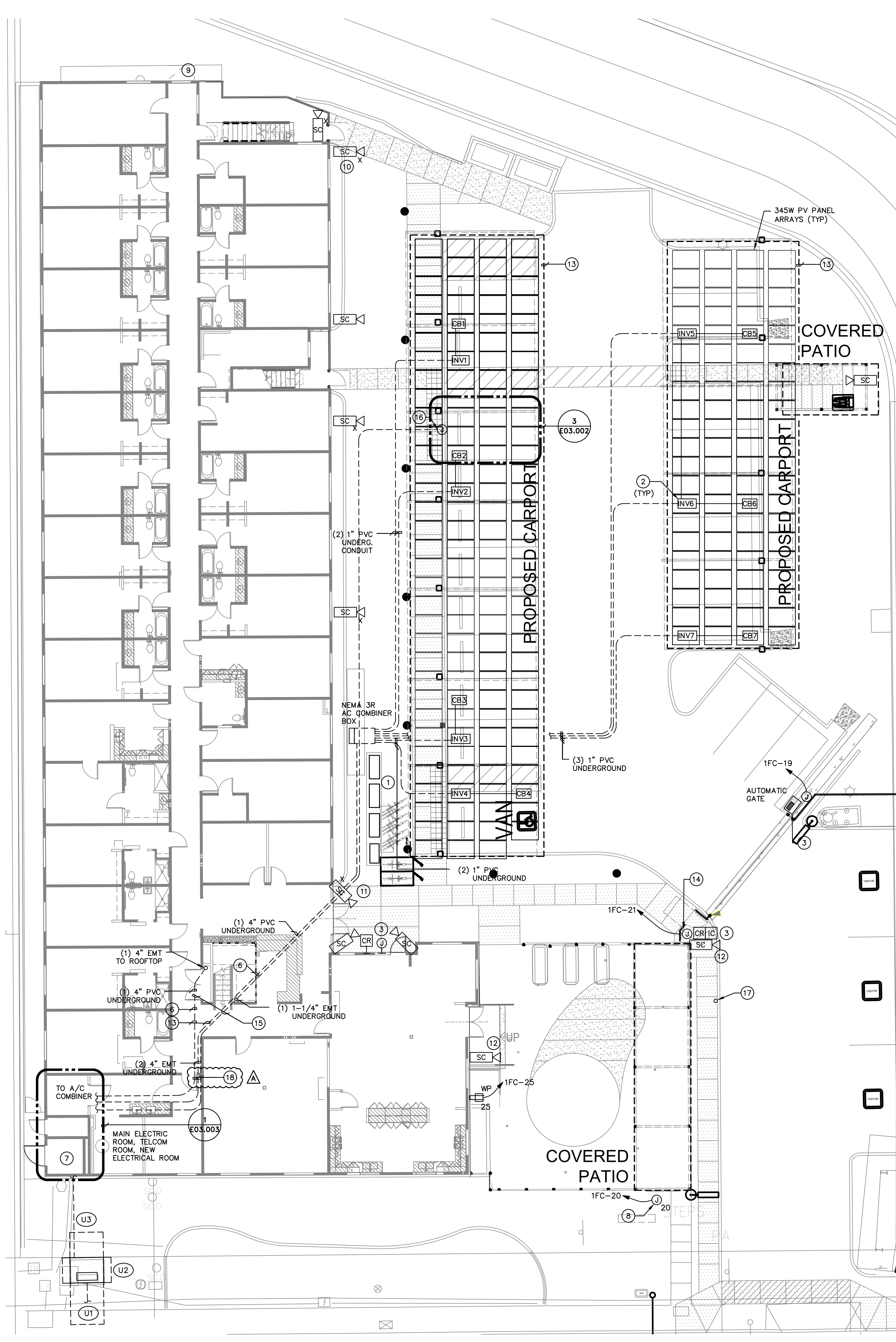
- POWER: JEFF HARRIS  
 SAN DIEGO GAS & ELECTRIC  
 PH: 858.636.5705  
 EMAIL: JHARRIS@SEMPTRAUTILIES.COM
- THE CONTRACTOR SHALL INSPECT AND VERIFY ALL FIELD CONDITIONS PRIOR TO INSTALLATION OF UTILITY SERVICES.
  - COORDINATE TRENCH ROUTING AND EQUIPMENT LOCATIONS WITH EXISTING CONDITIONS AND NEW WORK.
  - UTILITY SERVICE INFORMATION SHOWN IS FOR BIDDING PURPOSES ONLY. ACTUAL CONSTRUCTION DOCUMENTS SHALL BE OBTAINED FROM THE APPROPRIATE UTILITY COMPANY REPRESENTATIVE.
  - THE CONTRACTOR SHALL CONTACT THE UTILITY COMPANY REPRESENTATIVE TO ESTABLISH PRE-CONSTRUCTION COORDINATION, OBTAIN ALL NECESSARY METERS AND/OR APPROVALS, AND SCHEDULE UTILITY WORK TO COORDINATE WITH THE CONSTRUCTION SCHEDULE.
  - THE CONTRACTOR SHALL VERIFY ALL EXISTING UNDERGROUND UTILITIES, SUBSTRUCTURES, EASEMENTS, RIGHTS-OF-WAY, ETC. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.
  - THE CONTRACTOR SHALL VERIFY ALL EQUIPMENT AND DEVICE LOCATIONS WITH THE ARCHITECT, CIVIL ENGINEER, AND LANDSCAPE ARCHITECT PRIOR TO INSTALLATION.
  - THE CONTRACTOR SHALL IDENTIFY ALL EASEMENTS AND GAIN EXCAVATION RIGHTS AS REQUIRED BEFORE COMMENCEMENT OF CONSTRUCTION.
  - ALL CONDUIT STUBS SHALL BE CAPPED, MARKED, LOCATED, AND LABELED.
  - PROVIDE CODE-SIZED PULL BOXES OR HANDHOLES WHERE REQUIRED.

**Gensler**  
 225 Broadway  
 Suite 100  
 San Diego, CA 92101  
 United States  
 Tel 619.557.2500  
 Fax 619.557.2520

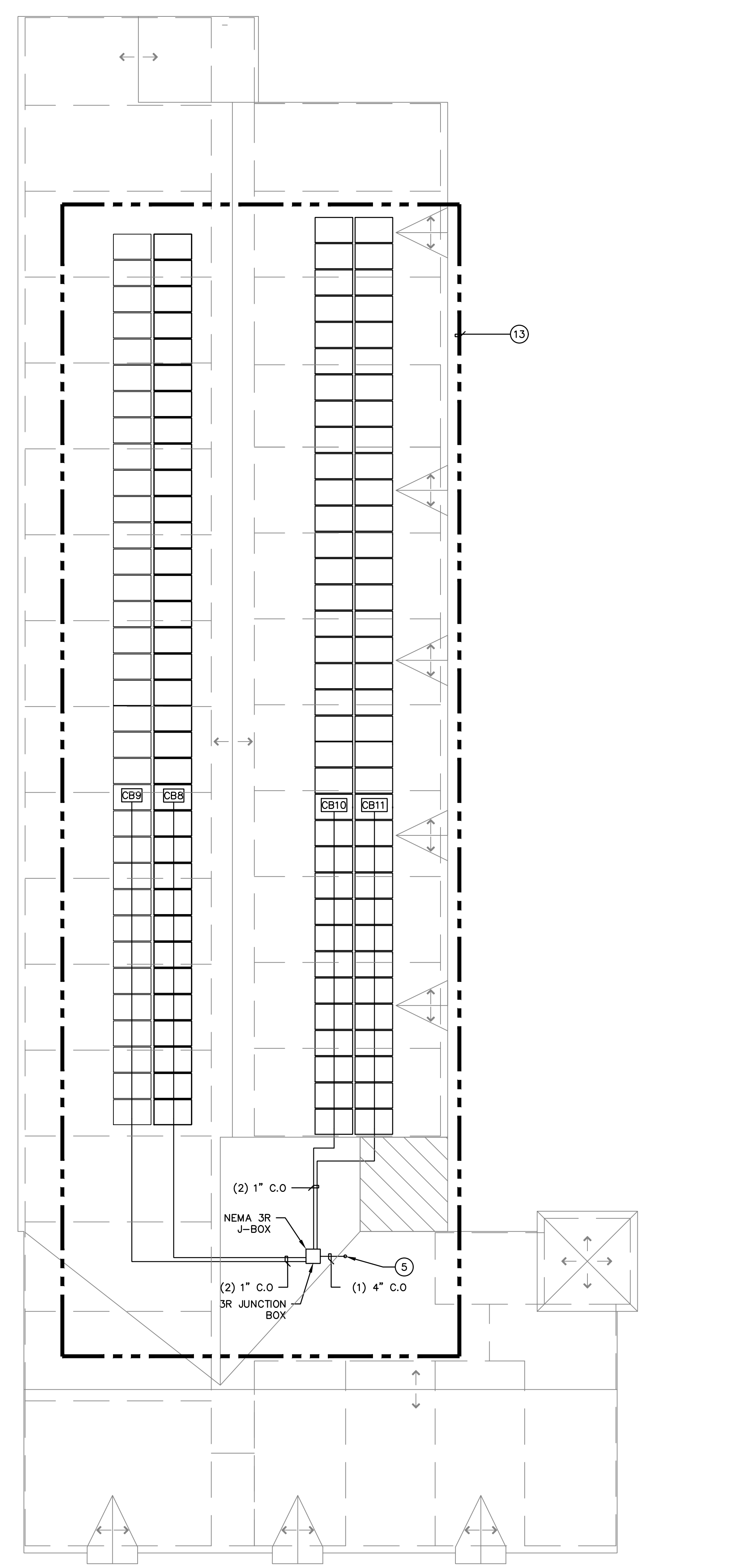
Project Number  
 55.7291.015  
 04.04.18  
 The City of  
**SAN DIEGO**  
 Public Works  
 E00.302

**PALM AVE TRANSITIONAL HOUSING**  
 NEW POWER AND SIGNAL PLAN - SITE

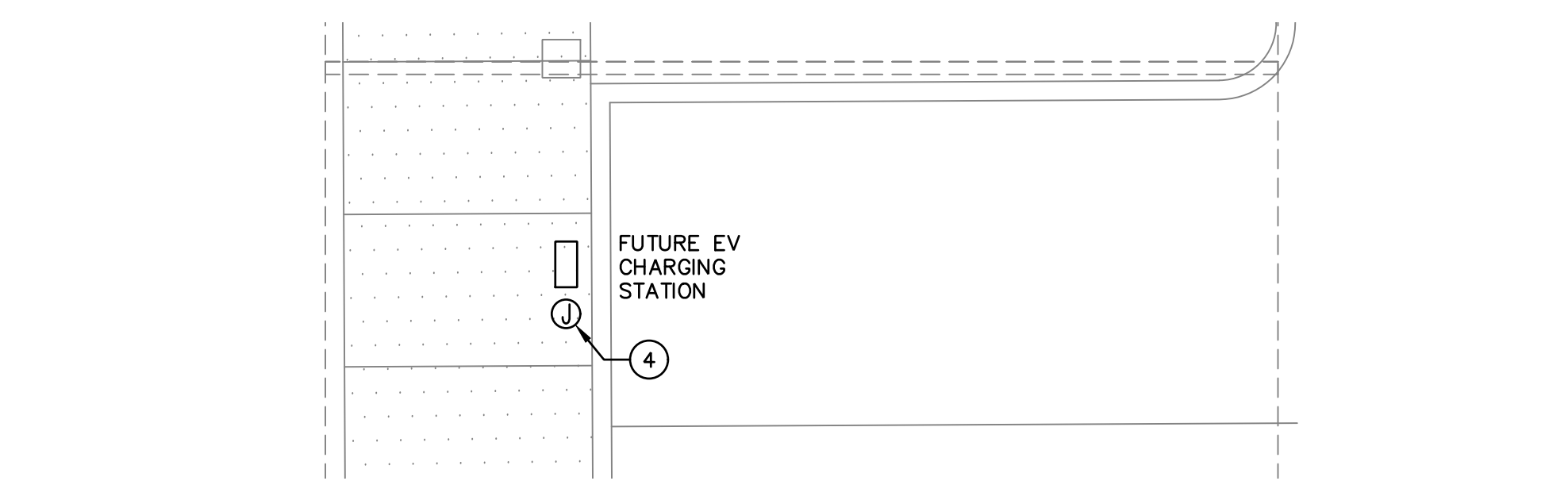
CITY OF SAN DIEGO, CALIFORNIA PUBLIC WORKS DEPARTMENT SHEET 106 OF 122 SHEETS		WBS_S-18003
APPROVED: [Signature]	DATE: 04.05.18	SUBMITTED BY: JASIAH NEFF
FOR CITY ENGINEER	DATE: 7/23/2018	PROJECT MANAGER
JASON GRANT	DATE: [Blank]	PROJECT ENGINEER
PRINT DGE NAME	DATE: [Blank]	PROJECT ENGINEER
DESCRIPTION	BY	APPROVED
ADDENDUM A	MVE	[Signature]
		DATE
		5/1/2018
		FILMED
CONTRACTOR	DATE STARTED	40498-00-D
INSPECTOR	DATE COMPLETED	



**1 NEW POWER AND SIGNAL PLAN - SITE**  
 SCALE: 1" = 10'-0"



**2 NEW ROOF PV SYSTEM PLAN**  
 SCALE: 1" = 10'-0"



**3 ENLARGED EV CHARGING STATION**  
 SCALE: 1" = 10'-0"



**Bid Results**

**Bidder Details**

**Vendor Name** West Coast General Corporation  
**Address** 13700 Stowe dr  
 ste. 100  
 Poway, CA 92064  
 United States  
**Respondee** David Davey  
**Respondee Title** President  
**Phone** 619-561-4200 Ext. 118  
**Email** nwalters@wgcgcorp.com  
**Vendor Type** PQUAL,CADIR,Local  
**License #** 479019  
**CADIR** 1000002666

**Bid Detail**

**Bid Format** Electronic  
**Submitted** May 16, 2018 1:51:16 PM (Pacific)  
**Delivery Method**  
**Bid Responsive**  
**Bid Status** Submitted  
**Confirmation #** 141896  
**Ranking** 0

**Respondee Comment**

**Buyer Comment**

**Attachments**

File Title	File Name	File Type
pending action cert	Contractors Certification of Pending Actions.pdf	CONTRACTOR'S CERTIFICATION OF PENDING ACTIONS
lobby prohibition	Lobby Prohibition, Certification and Disclosure.pdf	Lobby Prohibition, Certification and Disclosure
lobbying disclosure	Disclosure of Lobbying Activities.pdf	Disclosure of Lobbying Activities
additive alternate listings	Additive Alternate Listings.pdf	Subcontractor Additive/Deductive Alternate Form
mand discl	Mandatory Disclosure of Business Interests Form.pdf	Mandatory Disclosure of Business Interests Form
Bid Bond	Bid Bond.pdf	Bid Bond

**Line Items**

Type	Item Code	UOM	Qty	Unit Price	Line Total	Comment
	<b>Main Bid</b>					
1	Bonds (Payment and Performance)					
	524126	LS	1	\$37,800.00	\$37,800.00	
2	Building Permits (EOC Type I)					
	236220	AL	1	\$175,000.00	\$175,000.00	

**Bid Results**

Type	Item Code	UOM	Qty	Unit Price	Line Total	Comment
3	WPCP Development					
	541330	LS	1	\$672.00	\$672.00	
4	WPCP Implementation					
	238990	LS	1	\$15,534.00	\$15,534.00	
5	Rehabilitation of Existing Hotel Building for the Operation of Transitional Housing Facility					
	236220	LS	1	\$4,028,258.00	\$4,028,258.00	
6	Fire Protection					
	238220	LS	1	\$125,216.00	\$125,216.00	
7	Fire Alarm					
	238210	LS	1	\$49,258.00	\$49,258.00	
8	19/32 inch, 4 feet by 8 feet, Structural 1 Plywood (40/20) Roof Sheet					
	238160	EA	133	\$242.00	\$32,186.00	
9	New Interconnecting Staircase					
	236220	LS	1	\$18,590.00	\$18,590.00	
10	Field Orders (EOC Type II)					
		AL	1	\$350,000.00	\$350,000.00	
<b>Subtotal</b>					<b>\$4,832,514.00</b>	
<b>Alternate Items</b>						
11	Photo Voltaic Panels for Parking Lot Trellis and Roof					
	238210	LS	1	\$564,559.00	\$564,559.00	
<b>Subtotal</b>					<b>\$564,559.00</b>	
<b>Total</b>					<b>\$5,397,073.00</b>	

**Subcontractors**

Name & Address	Description	License Num	CADIR	Amount	Type
<b>Kyne Construction, Inc.</b> 971 Industrial Place el cajon, CA 92020 United States	portion of wet underground CONSTRUCTOR SBE, WoSB	814510	1000000233	\$30,625.00	CAU,FEM,PQUAL,C ADIR,WOSB
<b>Astro Mechanical Contractors, Inc.</b> 603 S. Marshall Avenue El Cajon, CA 92020 United States	portion of plumbing CONSTRUCTOR SBE	267392	1000006333	\$162,369.00	PQUAL
<b>McGrath Consulting</b> PO BOX 2488 El Cajon, CA 92021 United States	portion of WPCP Development CONSULTANT SDB	n/a	1000037165	\$600.00	ELBE,SDB
<b>Earth Forms Inc</b> 475 E Mission Rd San Marcos, CA 92069 United States	portion of landscaping CONSTRUCTOR SBE	768401	1000002592	\$178,412.00	CAU,MALE
<b>Bradshaw Engineering Corporation</b> 8645 Argent Street, Ste.B Santee, CA 92071 United States	portion of fire sprinkler CONSTRUCTOR	383330	1000006261	\$108,600.00	CAU,MALE,CADIR



**Bid Results**

<b>Name &amp; Address</b>	<b>Description</b>	<b>License Num</b>	<b>CADIR</b>	<b>Amount</b>	<b>Type</b>
<b>Long Glazing &amp; Doors Inc.</b> 12344 Topa Hill Circle Lakeside, CA 92040 United States	portion of storefront and glazing CONSTRUCTOR	1013077	1000038012	\$79,411.00	CAU,MALE,CADIR
<b>SealRight Paving, Inc.</b> 9053 Olive Dr. Spring Valley, CA 91977 United States	portion of Asphalt Paving CONSTRUCTOR DBE, SBE	364113	1000003903	\$24,029.06	NAT,MALE,PQUAL, MBE,CADIR
<b>Red Hawk Fire &amp; Security</b> 1640 N Batavia Ave Orange, CA 92867 United States	portion of fire alarm CONSTRUCTOR	713099	1000006967	\$43,980.00	
<b>San Diego Steel Solutions</b> 579 Enterprise St Escondido, CA 92029 United States	portion of site concrete and structural concrete CONSTRUCTOR DBE, SBE	932783	1000009468	\$120,883.94	CADIR,DBE,FEM,LA T,MBE,SDB,SLBE,W BE
<b>ACCI Roofing Services</b> 11325 Santa Maria Avenue Lakeside, CA 92040 United States	portion of roofing CONSTRUCTOR WoSB, MBE	840297	1000002422	\$44,240.00	LAT,FEM,CADIR
<b>Bradford Signs</b> 2546 Helix St. Spring Valley, CA 91977 United States	portion of building signage CONSTRUCTOR SBE	1034012	1000054455	\$8,943.00	CADIR
<b>Briven Construction Inc</b> 1227 Clarence Drive Vista, CA 92084 United States	portion of framing CONSTRUCTOR SBE	849487	1000042390	\$212,000.00	CAU,MALE,CADIR
<b>BRISTOL OMEGA, INC</b> 9441 OPAL AVE MENTONE, CA 92359 United States	portion of millwork CONSTRUCTOR SBE	667339	1000012779	\$75,000.00	CAU,MALE
<b>Knight Maintenance Inc dba Air Metrx</b> 20619 Evant Dr. Walnut, CA 91789 United States	portion of HVAC CONSTRUCTOR SBE	746204	1000020232	\$170,199.31	
<b>Service Electrical Systems</b> 157 Palm Avenue Imperial Beach, CA 91932 United States	portion of Electrical CONSTRUCTOR DVBE, SBE, SDVOSB	917219	1000006809	\$402,215.00	ELBE,PQUAL,DVBE, CADIR,SDVSB
<b>In-Line Fence &amp; Railing</b> P.O. Box 2637 Ramona, CA 92065 United States	portion of railing and fencing CONSTRUCTOR DBE, SBE	769516	1000002605	\$245,450.00	CADIR,DBE,LAT,MA LE,MBE,SDB,SLBE
<b>Standard Drywall, Inc.</b> 9902 Channel Road Lakeside, CA 92040 United States	portion of gypsum board CONSTRUCTOR	444328	1000000269	\$142,000.00	CADIR,PQUAL
<b>Vasquez Construction Company</b> 3009 G Street San Diego, CA 92102 United States	portion of painting CONSTRUCTOR SBE	560999	1000002710	\$97,197.00	
<b>M Bar C Construction</b> 674 Rancheros Dr San Marcos, CA 92069 United States	portion of steel trellis for patio CONSTRUCTOR	869960	1000001297	\$49,337.00	
<b>Workplace Services, Inc.</b> 610 Alpine Way Escondido, CA 92029 United States	portion of flooring CONSTRUCTOR	793563	1000006879	\$78,822.98	
<b>McIntyre Metal Decking</b> 2817 E. Cedar St Ontario, CA 91761 United States	portion of metal decking CONSTRUCTOR	590332	1000005985	\$33,600.00	