



CONTRACT DOCUMENTS

FOR

**STELZER PARK RANGER STATION AND VISITOR CENTER**  
PROJECT NO. 1021904

REQUEST FOR BID NO. #10959

ONSITE PRE-BID CONFERENCE: 10:00AM August 6, 2021  
BID OPENING DATE: August 26, 2021

## SPECIAL NOTICES

**Disabled Veterans Business Enterprise (DVBE):** Attention is directed to pages 1-18 through 1-20 of the contract documents concerning DVBE participation. These pages contain specific requirements for either meeting an established participation requirement of 3% or a Good Faith Effort (GFE). As a general statement, GFE submittals must include required individual solicitations of DVBE firms and appropriate supporting documentation.

**Addenda and Interpretations:** The Owner will not be responsible for any oral interpretation of the meaning of the plans, specifications, or other pre-bid documents. Every request for such interpretation shall be in writing and forwarded via email to PCS [Anastasia.bulycheva@sdcounty.ca.gov](mailto:Anastasia.bulycheva@sdcounty.ca.gov) be given consideration must be received at least ten (10) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be posted on the County BuyNet website at <https://buynet.sdcounty.ca.gov>. It is the responsibility of all prospective bidders to check the County BuyNet website for any updates to contract documents. All addenda so issued shall become part of the Contract Documents.

**Plan Holders List:** All interested parties who would like to be placed on the plan holders list, please submit your information (company name, contact person, general or sub, address, phone and fax) in its entirety to PCS [Anastasia.bulycheva@sdcounty.ca.gov](mailto:Anastasia.bulycheva@sdcounty.ca.gov) on or before the due date for all RFIs. Plan holders list will be posted on BuyNet labeled "plan holders list" as a courtesy and is not a requirement of this solicitation. The County of San Diego makes no representation as to the accuracy or for the completeness of the plan holders list.



**COUNTY OF SAN DIEGO  
DEPARTMENT OF PARKS AND RECREATION  
5500 OVERLAND AVENUE, SUITE 410  
SAN DIEGO, CALIFORNIA 92123-1061**

**CONTRACT DOCUMENTS FOR CONSTRUCTION  
STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904  
REQUEST FOR BID NO. #10959**

**BID OPENING DATE: August 26, 2021**

Any questions relative to this project, prior to execution of the Contract, should be directed to:

Anastasia Bulycheva, Procurement Contracting Specialist  
Email: [Anastasia.bulycheva@sdcounty.ca.gov](mailto:Anastasia.bulycheva@sdcounty.ca.gov)

**RECOMMENDED BY:**

**Brian Albright** Digitally signed by Brian  
Albright  
Date: 2021.08.05  
16:41:48 -07'00'

**BRIAN ALBRIGHT, Director**  
Department of Parks and Recreation

**Date**

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**STELZER PARK RANGER STATION AND VISITOR CENTER**  
ORACLE PROJECT NO. 1021904

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## **PART I**

### **BIDDING INFORMATION**

## NOTICE TO CONTRACTORS INVITING BIDS

The County of San Diego, Owner, invites sealed bids for:

### **CONSTRUCTION OF STELZER PARK RANGER STATION AND VISITOR CENTER**

ORACLE PROJECT NO. 1021904  
REQUEST FOR BID NO. #10959

Submit to the County of San Diego, Department of Purchasing and Contracting, Front Desk (where it will be time stamped to indicate time of receipt), 5560 Overland Avenue, Suite 270, San Diego, CA 92123 in a sealed envelope or package clearly marked on the exterior with "**RFB #10959**" and the name and address of the offeror prior to **2:00 PM**, Local Time on **August 26, 2021**. Parking is limited, so be sure to deliver your bids early.

Late submission cannot be considered unless there was mishandling on the part of the County of San Diego purchasing staff. Submittals must be received at the Purchasing and Contracting front counter by the identified date and time. If utilizing a courier service or USPS, be advised that all courier service deliveries, including USPS, might be delivered to the County's central mail room, which may result in late submission and rejection of your bid.

A pre-bid meeting is scheduled for **Friday, August 6, 2021 from 10:00am to 11:00am**, 11470 Wildcat Canyon Rd, Lakeside, CA 92040, at proposed project site.

The Contractor shall possess, at the time of submitting the bid, a California contractor's license, Classification A, General Engineering Contractor.

In accordance with Board of Supervisors Policy "B-39a", a Disabled Veterans Business Enterprise (DVBE) participation of three percent (3%) is required for a public work project that is estimated (by the County) to exceed \$1 million. A good faith effort cannot be accepted in lieu of meeting the 3% requirement. Should the lowest prime contractor not meet the 3% requirement, the next lowest responsible and responsive bidder that complies with the DVBE requirement will be awarded the contract.

For a public work project that is estimated (by the County) to be between \$500,000 and \$1 million, all bidders are required to make a good faith effort to meet-or-exceed a 3% DVBE subcontractor participation. The Good Faith Effort shall be documented demonstrating all participation was obtained prior to bid submittal.

For a public work project estimated (by the County) to be less than \$500,000, DVBE participation is encouraged, but not required. DVBE participation may be documented on page 2-10 but is not required at this estimate level.

The project site is located at 11470 Wildcat Canyon Rd, Lakeside, CA 92040

Work to be done includes, in general, furnish all labor, equipment and materials for the base bid and additive alternates as indicated below and in the construction documents.

#### Base Bid:

The project is the demolition of an existing 702 square-foot, single story ranger station and construction of a new 990 square-foot building in its place. Demolition will require limited asbestos removal and typical site clearing. The new building will include a lobby, small exhibit space, a small office space, storage, a restroom, and a small kitchen. No changes to access to the park or the



ranger station are included. Construction equipment and materials will be staged in the existing paved parking area.

Additive Alternate 1:

Construction of terrarium (see plans).

## BID SCHEDULE (Includes Materials & Installation):

| ITEM NO. | DESCRIPTION                                              | ESTIMATED QTY | UNIT OF MEASURE |
|----------|----------------------------------------------------------|---------------|-----------------|
| 1        | Mobilization                                             | LS            | LS              |
| 2        | Asbestos Removal                                         | LS            | LS              |
| 3        | Demolition                                               | LS            | LS              |
| 4        | Clearing and Grubbing                                    | 10,000        | SF              |
| 5        | Remedial Grading per Soils Report                        | 750           | CY              |
| 6        | Storm water Pollution Prevention Plan and Implementation | LS            | LS              |
| 7        | Surveying/Staking                                        | LS            | LS              |
| 8        | AC Paving Removal                                        | 114           | SY              |
| 9        | Water Line Trench Resurfacing                            | LS            | LS              |
| 10       | Paving, 4" AC Surface and AC Overlay (2" min)            | 61            | TN              |
| 11       | 6" Aggregate Base                                        | 19            | CY              |
| 12       | ADA Striping/Signage                                     | LS            | LS              |
| 13       | Concrete Removal                                         | 22            | SY              |
| 14       | 4" Site Concrete                                         | 4             | CY              |
| 15       | Stackable Block Wall                                     | 100           | SF              |
| 16       | Truncated Domes                                          | 250           | SF              |
| 17       | Relocate Existing Gas and Electric                       | LS            | LS              |
|          | WATER:                                                   |               |                 |
| 18       | 1" PVC (Water line relocation)                           | 65            | LF              |
| 19       | 2" PVC (Water line relocation)                           | 250           | LF              |
| 20       | 4" PVC (Water line relocation)                           | 70            | LF              |
| 21       | 6" PVC (Water line relocation)                           | 120           | LF              |
| 22       | Backflow Prevention Assembly                             | 2             | EA              |
| 23       | Water Line Fittings/Appurtenances/Thrust Blocks          | LS            | LS              |
|          | BUILDING:                                                |               |                 |
| 24       | Building Slab                                            | 1,290         | SF              |
| 25       | Stem Wall                                                | 45            | LF              |
| 26       | Stone Veneer                                             | 160           | SF              |
| 27       | Lumber/Carpentry                                         | 1,710         | SF              |
| 28       | Exterior Cladding                                        | 1,540         | SF              |
| 29       | Casework                                                 | LS            | LS              |
| 30       | Insulation                                               | LS            | LS              |
| 31       | Roofing                                                  | 1,710         | SF              |
| 32       | Doors, Frames & Hardware                                 | 7             | EA              |

|                                          |                              |                      |                        |
|------------------------------------------|------------------------------|----------------------|------------------------|
| 33                                       | Windows/Glazing              | 6                    | EA                     |
| 34                                       | Drywall                      | LS                   | LS                     |
| 35                                       | Porcelain Tile               | 385                  | SF                     |
| 36                                       | Resilient Flooring/Wall Base | 850                  | SF                     |
| 37                                       | Painting                     | 1,710                | SF                     |
| 38                                       | Restroom Accessories         | LS                   | LS                     |
| 39                                       | Signage                      | LS                   | LS                     |
| 40                                       | Blinds                       | 7                    | EA                     |
| 41                                       | Rain Barrels                 | 4                    | EA                     |
| 42                                       | Splash Block                 | 4                    | EA                     |
| 43                                       | Plumbing                     | LS                   | LS                     |
| 44                                       | HVAC                         | LS                   | LS                     |
| 45                                       | Electrical                   | LS                   | LS                     |
| 46                                       | Interior Lighting            | LS                   | LS                     |
| 47                                       | Exterior Lighting            | LS                   | LS                     |
| <b>ADDITIVE ALTERNATE 1 BID SCHEDULE</b> |                              |                      |                        |
| <b>ITEM NO.</b>                          | <b>DESCRIPTION</b>           | <b>ESTIMATED QTY</b> | <b>UNIT OF MEASURE</b> |
| 49                                       | Terrarium                    | LS                   | LS                     |

The Contractor is responsible to field verify all measurements prior to bid. No additional compensation will be provided. It is the intent of this bid schedule to include **ALL** Work in all divisions and sections of this specification. Specification references are provided as a courtesy and should not be fully relied on.

Contract Documents, including plans, specifications, materials report and bid forms are available to be downloaded, free of charge, from the Department of Purchasing and Contracting BuyNet website at: <https://buynet.sdcountry.ca.gov>.

Full-size plans for this project are not available for purchase.

Firms Associated with Project: The County of San Diego engaged the following Architect-Engineering firm with its subcontractors, or other firms to provide the Plans, Specifications, and other related supporting technical documents or services for this construction procurement.

MW Peltz & Associates  
143 South Cedros Avenue Suite B-104  
Solana Beach, CA 92075

The firms listed above have been associated with this project and are provided for informational purposes only. This list is not intended to be relied on for purposes of compliance with any conflict of interest rules or applicable laws or regulations affecting the project. The Contractor is solely responsible for due diligence in identifying and avoiding all potential conflicts of interest related to contracting for, and construction of, this project.

The Standard Specifications for this project are the Standard Specifications of the State of California, Department of Transportation, current edition, and Greenbook Standard Specifications for Public

Works Construction, current edition, and modifications to said Standard Specifications and said Amendments contained in Part VII of these Contract Documents.

The State Department of Transportation publication "Labor Surcharge and Equipment Rental Rates" in effect the date the work is accomplished, is incorporated by reference into these Contract Documents.

Disabled Veterans Business Enterprise (DVBE) Participation: The Owner, as a matter of policy, encourages the participation of disabled veteran owned businesses. County of San Diego, Board of Supervisor DVBE policy is found at:

<http://www.sdcounty.ca.gov/cob/docs/policy/B-39a.pdf>

General Information concerning the State of California DVBE program may be found at:

<http://www.pd.dgs.ca.gov/pd>

County DVBE policy requirements shall prevail over the State of California DVBE program requirements.

Bid Security in the form of cash, or a certified or cashier's check, or a Bidder's Bond for at least ten percent of the bid amount executed by a corporation duly authorized to issue bonds in the State of California shall accompany the bid.

Performance and Payment Bonds: The successful bidder will be required to furnish a Performance Bond for one hundred percent and a Payment Bond for one hundred percent of the Contract amount.

State Prevailing Wage Rates: This project is a "public work" in accordance with Labor Code § 1720, et seq. It is the sole responsibility of the Contractor to ensure that all workers employed in the execution of the contract are paid the correct prevailing wage rate of wages.

The Owner has obtained from the Director of the Department of Industrial Relations said Director's General Prevailing Wage Determinations for the locality in which the work is to be performed. Said determinations are on file and available for review at the Department of Purchasing and Contracting, 5560 Overland Avenue, Suite 270, San Diego, California 92123-1204 and are available from the Department of Industrial Relations at:

<http://www.dir.ca.gov/DLSR/PWD>

Not less than these rates shall be paid to all workers employed on the project.

Federal regulations and reporting requirements applicable to the proposed work must be complied with for this project.

AB 219 Notice: Ready-mix haulers and entities that deliver ready-mixed concrete to public works projects are considered subcontractors under Labor Code Section 1722.1 and must register as specified in Labor Code Section 1725.5.

SB 854 Notice: County public works projects are subject to compliance monitoring and enforcement by the Department of Industrial Relations (DIR) in accordance with Labor Code Section 1771.4(a)(1). As part of this program, Contractors and Subcontractors on Public Works Projects are required to be registered with DIR in accordance with Labor Code Section 1725.5. Unregistered contractors are not qualified to bid on, be listed in a bid proposal, listed as a Subcontractor, or engage in the performance of any Public Works Contract, all as more particularly described in Labor Code Section

1771.1(a). The prime Contractor shall be required to post the job site with all notices required by regulations per Labor Code Section 1771.4(a)(2), whether or not the County also posts.

Labor Code Compliance: Contractor shall comply with the provisions of the Labor Code requiring the payment of prevailing wages on public works, commencing with Section 1720. In accordance with Labor Code, Section 1775, the Contractor shall forfeit an amount, as determined by the Labor Commissioner, for each worker paid less than the applicable prevailing wage rate for the work or craft in which that worker is employed for any work done under Contract by Contractor or by any Subcontractor. Contractor agrees to pay the difference between the prevailing wage rate and amount paid to each worker in accordance with Labor Code, Section 1775 (a)(2)(E).

Pursuant to Labor Code, Section 1770, the Director of the Department of Industrial Relations has ascertained the general prevailing rate of per diem wages and a general prevailing rate for legal holiday and overtime work for each craft required for execution of the Contract. In accordance with Labor Code, Section 1773.2, copies of the prevailing rate of per diem wages are on file and can be viewed during normal business hours at the County Department of Purchasing and Contracting, located at 5560 Overland Avenue, Suite 270, San Diego, CA 92123-1294. Contractor shall post a copy of the applicable prevailing wage rates at the job site.

Wage rates set forth are the minimum that may be paid by the Contractor. Nothing herein shall be construed as preventing the Contractor from paying more than the minimum rates set. No extra compensation whatsoever will be allowed by the County due to the inability of the Contractor to hire labor at minimum rates, nor for necessity for payment by the Contractor of subsistence, travel time, overtime, or other added compensations, all of which possibilities are elements to be considered and ascertained to the Contractor's own satisfaction in preparing its Proposal.

If it becomes necessary to employ crafts other than those listed in the General Prevailing Wage Rate, the Contractor shall obtain a wage rate determination. The rates thus determined shall be applicable as minimum from the time of initial employment. Contractor shall be responsible for paying the applicable rate.

The Contractor and each Subcontractor shall keep and make available accurate payroll record in accordance with Labor Code, Section 1771.4(a)(3) and Section 1776. The record shall contain the names, addresses, social security numbers, work classifications, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by the Contractor and/or Subcontractor in connection with the Work. Payroll records shall be certified and shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as those forms. A copy of all payrolls shall be submitted weekly to the Engineer in accordance with Section 7-1.01A (3) "Payroll Records" of the Standard Specifications. The Contractor's and Subcontractor's certified payroll records shall be available for inspection at the principal office of the Contractor, or at the job site should the principal office be located outside of San Diego County.

Apprentices: The Contractor and each Subcontractor shall comply with the requirements of Labor Code, Section 1777.5, and any related regulations regarding the employment of registered apprentices. Properly registered apprentices shall be employed in the execution of the Work at the ratios required, but in no case shall the ratio be less than one hour of apprentice work for every five hours of journeyman work. Every apprentice shall be paid the standard wage paid to apprentices under the regulations of the craft or trade at which the apprentice is employed and shall be employed only at the work of the craft or trade to which the apprentice is registered. The Contractor shall be responsible for compliance to Labor Code, Section 1777.5 for all apprenticeable occupations. More information available at:

<http://www.dir.ca.gov/DAS/DASApprenticesOnPublicWorksSummaryOfRequirements.htm>

Contractors Licensing Laws: Attention is directed to the Contractor's License Law, Section 7000 and following of the Business and Professions Code concerning the licensing of contractors. Any bidder or contractor not properly licensed may be subject to the penalties provided and will not be considered for award of this Contract. Contractors are required by law to be licensed and are regulated by the Contractors State License Board. Any questions concerning a contractor may be referred to the Registrar, Contractors State License Board, 9821 Business Park Drive, Sacramento, CA, 95827. Contractors are required to be properly licensed in California on the date bids are submitted (Bus. & Prof. Code, § 7028.15), unless federal funds are involved. If federal funds are involved, the bidder shall be properly licensed in California at the time the contract is awarded (Pub. Contract Code, § 20103.5). In this case, failure of the bidder to obtain proper and adequate licensing for an award of this Contract shall constitute a failure to execute the Contract and shall result in the forfeiture of the security of the bidder.

Bid Submittal Envelope - Each Bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, bidder's address, the name of the project for which the bid is submitted, and the appropriate State Contractor's License designation held by the bidder. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed to:

**County of San Diego, Department of Purchasing and Contracting  
RFB #10959 – STELZER PARK RANGER STATION AND VISITOR CENTER |  
5560 Overland Avenue, Suite 270  
San Diego, CA 92123-1204**

It is the responsibility of the bidder to ensure the bid is submitted in proper time.

The Board reserves the right to reject any or all bids and to waive any informality or irregularity in the bids or bidding.

Withdrawal of bids shall not be permitted for a period of seventy-five (75) days after the date set for the opening thereof.

Monies withheld by the Owner to ensure performance under the Contract may be released in accordance with Public Contract Code Section 22300 and these Contract Documents.

Electrician Certification and Labor Compliance: It is the sole responsibility of the contractor, if applicable, to ensure compliance with CA Labor Code 3099-3099.5 regarding electrician certification requirements. All General Electricians and Fire/Life Safety Technicians in the employ of C-10 contractors must be certified in order to perform electrical work in CA. Information on the electrician certification program may be obtained at the Division of Apprenticeship Standards (DAS) at <http://www.dir.ca.gov/DAS/ElectricalTrade.htm>.

Preliminary Notices and Stop Notices: Preliminary (Public Work) Notices and Stop Notices shall be filed, if applicable, in accordance with California Civil Code Sections 3098, 3111, 3158, 3181, 3183, 3184, 3241 and 3252. For the Department of Parks & Recreation construction contracts notices shall be delivered to:

County of San Diego Operations Center  
Department of Parks and Recreation  
Attn.: Nick Ferracone, Park Project Manager  
5500 Overland Avenue, Suite 410  
San Diego, CA 92123-1248

Air Pollution Compliance: The Contractor shall be in compliance with all federal, state, and local

laws and regulations applicable to the Contractor.

## **INFORMATION FOR BIDDERS**

The bidder's attention is directed to Section 2, "Bid Requirements and Conditions," of the Standard Specifications and the modifications to said Section 2 contained in Part VII of these Contract Documents.

The prospective bidder shall prepare the Proposal and Bond as provided therein, and failure to do so may be cause for rejection.

### **PREPARATION OF BID FORMS**

Preparation: The Owner invites bids, on the forms posted on the Department of Purchasing and Contracting's BuyNet website under "Documents to be Executed by Bidder," to be submitted on or before the time and place set for the opening of bids in the published "Notice to Contractors Inviting Bids." Bids not presented on forms so furnished will be disregarded. All downloaded and printed forms must be consistent and conform to the P&C official posted documents.

These Contract Documents on the Department of Purchasing and Contracting BuyNet website contain the Bid forms (Part II), together with the Notice to Contractors, Contract and Special Provisions. Part II of these Contract Documents shall be returned in a sealed envelope bearing on the outside the name of the bidder, bidder's address, the name of the project for which the bid is submitted, and the appropriate State Contractor's License designation held by the bidder.

The Bid must be executed in accordance with the instructions contained on the forms provided. If the bidder is an individual or a partner, the signature on the Bid and the Bidder's Bond must be the same as the name of the bidder shown on other parts of these forms, (showing the name as "J. E. Doe" and the signature as "John E. Doe" may be considered as an irregularity).

Modifications on the Submitted Bid: Modifications, changes or additions to the Bid may be considered an irregularity. Erasures or corrections in preparing the bids must be initialed by the person(s) signing the Bid. Alternate bids will not be considered unless called for.

Competency of Bidders: No award will be made to a Contractor who, in accordance with Chapter 9, Division 3, Business and Professions Code, is not properly licensed to do the described work.

Prospective bidders may be required to file with the Owner answers to questions contained in a questionnaire and a financial statement including a complete statement of their financial ability and experience in performing previous public works of a similar nature.

### **DOCUMENTS SUPPLEMENTING THE BID**

Bid Security: Each bid shall be accompanied by cash, a certified or cashier's check, or a bidder's bond executed by a corporation duly authorized to issue bonds in the State of California. Cash check or bond shall be in the amount of not less than ten (10) percent of the maximum amount of the bid. Check or bond shall be made payable to the order of the Owner designated in the Notice to Contractors Inviting Bids.

Said cash, check or bond shall be given as a guarantee that the bidder will, within the period specified after being requested to do so by the Owner, enter into a contract and provide the required bonds if awarded the work; if the bidder to whom the work has been awarded and to whom the request has been made refuses or fails to enter into said contract and provide the required bonds within the specified time, the cash or check shall be forfeited to the Owner or the principal and surety on the bond shall be liable to the Owner for the principal amount thereof in accordance with its terms.

If the lowest responsible bid is not accepted by the Owner within the period specified following the date set for the opening of bids, or for such further period of time as may be agreed upon in writing

between the Owner and the bidder concerned, or if the bidder to whom the contract is awarded executes and delivers to the Owner the required Contract Documents, the amount of the cash or certified or cashier's check will be returned to the bidder. Attention is directed to the requirement noted on the contract bonds that the Attorney-in-Fact shall attach a certified copy of the Power of Attorney.

Designation of Subcontractor: The Business Name and Address, the Portion of Work, and License Number that will be done by each subcontractor (including DVBE subcontractors) for all portions of the work, including any additive alternates, are required at the time of bid submittal. An inadvertent error in listing the California contractor license number must be corrected by the prime contractor within 24 hours after bid opening by email to the Procurement Contracting Officer listed as contact for this RFB, provided the corrected contractor's license number corresponds to the submitted name and location for that subcontractor, or else the bid may be determined non-responsive. The remainder of the information shall be submitted by all bidders within two business days of bid opening by e-mail to said Procurement Contracting Officer. If no subcontractors are to be designated, enter the word "NONE."

#### AMENDMENTS AND INTERPRETATION OF CONTRACT UNIT

Addenda and Interpretations: The Owner will not be responsible for any oral interpretation of the meaning of the plans, specifications, or other pre-bid documents. Every request for such interpretation shall be in writing forwarded via email to [Anastasia.bulycheva@sdcounty.ca.gov](mailto:Anastasia.bulycheva@sdcounty.ca.gov) and must be received at least ten (10) days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be posted on the County BuyNet website at <http://buynet.sdcounty.ca.gov>. It is the responsibility of all prospective bidders to check the County BuyNet website for any updates to contract documents. All addenda so issued shall become part of the Contract Documents.

Interpretation of Estimated Quantities: An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the Bid, Special Provisions, or shown on the construction plans. It is given only as a basis for comparison of bids and the award of the contract. The Owner does not expressly or by implication guarantee that the actual quantities involved will correspond exactly therewith. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications.

#### Rejection of Bids:

The Owner reserves the right to reject any or all bids and the right to waive technicalities if such waiver is in its best interest and conforms to local laws and ordinances pertaining to the letting of construction contracts. Bids in which the prices are obviously unbalanced, or the submittal is incomplete, may be rejected.

#### AWARD AND EXECUTION OF THE CONTRACT

The bidder's attention is directed to Section 3, "Award and Execution of Contract," of the Standard Specifications, the modifications to said Section 3 contained in Part VII of these Contract Documents and to Part III of these Contract Documents which contains all the documents the successful bidder shall execute.

Notice of Intent: For purposes of clarification regarding Board of Supervisors Policy A-97, "Protest Procedures for Award of Contracts" the posting of the bid abstract is equivalent to the posting of the Notice of Intent (NOI).

**Award of the Contract:** The bids will be compared on the basis of the base bid, including those bid items listed in additive alternate bid items, if any, in combinations as stipulated in the Bid, which may be selected by the Owner.



Cancellation of Award: The Owner reserves the right to cancel the award without liability to the bidder, except return of bid guaranty, at any time before a Contract has been fully executed by all parties and is approved by the Owner.

#### PROTEST PROCEDURES

Protest of contract award must be made in writing and shall be filed with the Contracting Officer identified in the Contract Document. Protests must be filed within five (5) business days after a Notice of Intent to award the contract has been posted in a public place in the County's Contracting Office or County Internet website. Protests must conform to the requirements of Board of Supervisors Policy "A-97 Protest Procedures for Award of Contracts". The policy is available for review at <http://www.sdcounty.ca.gov/cob/docs/policy/A-97.pdf>

For purposes of clarification regarding Board of Supervisors Policy "A-97, Protest Procedures for Award of Contracts" the posting of the bid abstract on BuyNet (<http://buynet.sdcounty.ca.gov>) is equivalent to the posting of the Notice of Intent (NOI) to award.

#### TAX INFORMATION

In compliance with California Revenue and Taxation code section 18662, if you are a non-resident of California (out-of-state invoices) who receives California source income, the County will pay California Use Tax directly to the State of California per permit no. SR FH 25-632384. Fifteen (15) business days prior to the first payment, new suppliers or suppliers with expired forms or forms with incorrect information, must submit new forms to the County (forms are available from the Franchise Tax Board websites listed in the next page).

Under certain circumstances you may be eligible for reduced or waived non-resident withholding. If you have already received a waiver or a reduced withholding response from the State of California and the response is still valid, submit the response to the County in lieu of the forms. Failure to submit the required forms will result in withholding of payments.

Refer to the Franchise Tax Board websites (listed below) for tax forms and information on non-resident withholding, including waivers or reductions. The County will not give you any tax advice. It is recommended you speak with your tax adviser and/or the State of California for guidance.

#### Franchise Tax Board Websites:

<http://www.ftb.ca.gov>

[http://www.ftb.ca.gov/individuals/Withholding\\_Definitions.shtml](http://www.ftb.ca.gov/individuals/Withholding_Definitions.shtml)

[http://www.ftb.ca.gov/individuals/wsc/Processing\\_Changes\\_for\\_2010.shtml](http://www.ftb.ca.gov/individuals/wsc/Processing_Changes_for_2010.shtml)

[http://www.ftb.ca.gov/individuals/wsc/forms\\_and\\_publications.shtml](http://www.ftb.ca.gov/individuals/wsc/forms_and_publications.shtml)

[http://www.ftb.ca.gov/individuals/wsc/decision\\_chart.shtml](http://www.ftb.ca.gov/individuals/wsc/decision_chart.shtml)

Submit forms to the Auditor & Controller via fax at (858) 694-2060 or mail originals to: County of San Diego, 5530 Overland Ave., Suite 410, San Diego, CA 92123. The P.O. Number or Contract Number (if available) and "California Revenue and Taxation Code Section 18662" must appear on fax cover sheet and/or the outside of the mailing envelope.



GENERAL INFORMATION REGARDING COMPLIANCE WITH  
DISABLED VETERANS BUSINESS ENTERPRISE (DVBE) PROGRAM

1. Disabled Veterans Business Enterprises will be afforded full opportunity to submit bids in response to this invitation. DVBE firms bidding as prime contractors will automatically meet the stated Disabled Veterans Business Enterprise (DVBE) participation.
2. Certified DVBE Information is available at the California State Department of General Services (DGS), Procurement Division (PD), Office of Small Business and DVBE Services (OSDS) website:

Information can be viewed or downloaded from:

<http://www.dgs.ca.gov/pd/Programs/OSDS.aspx>

**COUNTY DISABLED VETERANS BUSINESS ENTERPRISE PROGRAM**

1. Board of Supervisors Policy B-39a  
Board of Supervisors Policy B-39a states that Disabled Veterans Business Enterprises (DVBEs) will be afforded maximum opportunity to compete for all County contracts; The policy can be downloaded at <http://www.sdcounty.ca.gov/cob/docs/policy/B-39a.pdf>.
2. Objectives  
The following DVBE participation is imposed to recognize the service of disabled veterans to our country.
3. DVBE Participation for the Project  
DVBE participation of three percent (3%) of Bid amount is required for a public work project estimated (by the County) to exceed \$1million. A good faith effort cannot be accepted in lieu of meeting the 3% requirement. A bidder who fails to meet this requirement shall be declared non-responsive and the next lowest responsible and responsive bidder that complies with this requirement will be awarded the contract.

For a public work project that is estimated (by the County) to be between \$500,000 and \$1million, the prime contractor shall make a good faith effort to meet-or-exceed 3% DVBE subcontractor participation, and the Good Faith Effort shall be documented in accordance with this bid document demonstrating all participation was obtained prior to bid submittal or the bidder may be deemed non-responsive.

For a public work project estimated (by the County) to be less than \$500,000, DVBE participation is encouraged, but not required. DVBE participation may be documented on page 2-15 but is not required at this estimate level.

4. DVBE Subcontractor Documentation  
The bidder shall designate all licensed subcontractors in accordance with the instructions on the form titled DESIGNATION OF SUBCONTRACTORS contained in Part II of these Contract Documents. Designation of Subcontractors is due at the time of bid. In addition, the bidder shall designate at the time of bid the DVBE prime contractors, subcontractors, and vendors (material suppliers and service providers) on the BIDDER DVBE INFORMATION form (page 2-16). The remaining information on the BIDDER DVBE INFORMATION form and copies of the DVBE bids are due within 2 business days of the Bid opening. "Good Faith Effort Documentation" shall be submitted in accordance with Item 7 below.

5. Credit Toward Participation for DVBE Prime Contractors, Subcontractors and Vendors

A DVBE prime contractor automatically meets a DVBE participation for a project. If the Prime is not a DVBE, compliance with 3% DVBE participation shall be calculated by taking the aggregate value of all DVBE subcontracts to be used on the project as a percentage of the total bid, which shall include all additive alternates, if any. Participation amounts to a DVBE must be for a commercially useful function, as that term is defined in California Military and Veterans Code § 999(b)(5)(B). In addition, for a DVBE to perform a commercially useful function, the amount the firm is to be paid under the contract shall be commensurate with the bid amount for the work it is actually performing and the DVBE credit claimed for its performance of the work.

6. Good Faith Effort Defined

a. A bidder who fails to meet the stated DVBE participation requirement for this project shall have made a good faith effort to meet participation prior to the time bids are submitted.

b. In evaluating the good faith effort of a bidder, the Owner shall consider the following criteria:

- 1) The bidder solicited certified DVBEs to perform work or provide supplies or services for the project. Good faith effort shall include solicitation of individual certified DVBEs. Record of firms solicited shall be included in the Documentation of Good Faith Effort submittal.

Solicitations conducted must be documented in the Documentation of Good Faith Effort. DVBE subcontractors solicited must be licensed for appropriate work on this project and must be physically located within the County of San Diego, or have indicated they would consider work in San Diego Service Region 11.

Good Faith Efforts not adequately documented shall be considered non-responsive.

- 2) Where DVBE bids were rejected, the bidder provided the reasons for the rejections. If no bids received from DVBEs, the bidder shall so indicate in the Documentation of Good Faith Effort submittal.
- 3) Contact with local DVBE organizations to identify DVBE firms is encouraged but is not a requirement for the Documentation of Good Faith Effort submitted to the Owner.
- 4) Due to relatively short project solicitation periods, the Owner does not require advertising in trade and focus publications as a condition of satisfying the good faith effort for the DVBE participation. Advertising alone without direct solicitation of DVBE firms as required in paragraph 1) above does not satisfy the Good Faith Effort.

7. Good Faith Effort Documentation

For public work projects estimated (by the County) to be between \$500,000 and \$1 million where a DVBE requirement has not been established, all bidders, are required to submit the Documentation of Good Faith Effort (pages 2-16 through 2-18; and supporting documentation), in addition to the BIDDER DVBE INFORMATION form (page 2-14), within 2 business days of the Bid opening.

When the stated DVBE participation requirement is met, only the BIDDER DVBE INFORMATION form (page 2-14), contained in these Contract Documents, is required within 2 business days of Bid opening.

Bidders are cautioned that even if their BIDDER DVBE INFORMATION form (page 2-14) indicates the stated DVBE participation is met, all bidders should still consider submitting Documentation of Good Faith Effort. Submittal of satisfactory Documentation of Good Faith Effort will protect eligibility for award for those public work projects estimated (by the County) between \$500,000 and \$1 million in the event the County, in its review, finds that the stated DVBE participation has not been met.

The DVBE Good Faith Effort, if required, must be submitted on the DOCUMENTATION OF GOOD FAITH EFFORT forms (pages 2-17 through 2-19) contained in these Contract Documents and shall include sufficient and timely supporting documentation to validate the solicitations conducted.

8. Protest Procedure for DVBE

A bidder who does not attain the stated project DVBE participation or has not made a "good faith effort" in accordance with these bid document instructions may be declared non-responsive. A bidder so declared may file a protest in writing with the Director, Department of Purchasing and Contracting within five (5) business days of the notification of the declaration, in accordance with Board of Supervisor Policy A-97 "Protest Procedures for Award of Contract" located at:

<http://www.sdcountry.ca.gov/cob/docs/policy/A-97.pdf>.

9. DVBE Certification

Eligible contractors, subcontractors and vendors wishing to participate as DVBEs on this project must be certified by the California State Department of General Services (DGS), Procurement Division (PD), Office of Small Business and DVBE Services (OSDS), and have a current certification on the date bids are opened.

Information regarding certification and certified DVBEs can be obtained by visiting the Department of General Services site at:

<http://www.pd.dgs.ca.gov/pd>

**PART II**

**DOCUMENTS TO BE EXECUTED BY BIDDER**

STATE OF CALIFORNIA  
COUNTY OF SAN DIEGO  
PROPOSAL TO THE BOARD  
FOR  
STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904

REQUEST FOR BID NO.: 10959

Name of Bidder \_\_\_\_\_

Business Address \_\_\_\_\_

Place of Residence \_\_\_\_\_

LOCATION

The work to be performed under this contract is located at 11470 Wildcat Canyon Rd, Lakeside, CA 92040.

Said work is to be performed in accordance with the Contract and the Special Provisions annexed hereto and including Addenda Nos. \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_, and also in accordance with Parts 1 through 9 of the Standard Specifications of the State of California, Department of Transportation, current edition, and Greenbook Standard Specifications for Public Works Construction, current edition, and the modifications to said Standard Specifications and said Amendments contained in Part VII of these Contract Documents.

The work to be done is shown on "Bid Schedule" and Project Plans in Part IX of these Contract Documents.

By signing this proposal on the signature portion hereof, the undersigned, as bidder, under penalty of perjury deposes and says: that the only persons or parties interested in this Proposal as Principals are those named herein; that the bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with said proposal; that the undersigned has carefully examined the location of the proposed work, the annexed proposed form of Contract, and the Plans, Special Provisions and Specifications therein referred to; and the undersigned proposes, and agrees if this Proposal is accepted, that the undersigned will furnish the required Bonds and Contract with the Owner, in the form and copy of the Contract annexed hereto, to provide all necessary machinery, tools, apparatus and other means of construction, and to do all the work and furnish all the materials specified in the Contract, in the manner and time therein set forth, and that the undersigned will take in full payment therefore the following unit and lump sum prices, to wit:

**BID SCHEDULE**

| ITEM NO. | DESCRIPTION                                              | ESTIMATED QTY | UNIT OF MEASURE | UNIT COST | TOTAL |
|----------|----------------------------------------------------------|---------------|-----------------|-----------|-------|
| 1        | Mobilization                                             | LS            | LS              |           |       |
| 2        | Asbestos Removal                                         | LS            | LS              |           |       |
| 3        | Demolition                                               | LS            | LS              |           |       |
| 4        | Clearing and Grubbing                                    | 10,000        | SF              |           |       |
| 5        | Remedial Grading per Soils Report                        | 750           | CY              |           |       |
| 6        | Storm water Pollution Prevention Plan and Implementation | LS            | LS              |           |       |
| 7        | Surveying/Staking                                        | LS            | LS              |           |       |
| 8        | AC Paving Removal                                        | 114           | SY              |           |       |
| 9        | Water Line Trench Resurfacing                            | LS            | LS              |           |       |
| 10       | Paving, 4" AC Surface and AC Overlay (2" min)            | 61            | TN              |           |       |
| 11       | 6" Aggregate Base                                        | 19            | CY              |           |       |
| 12       | ADA Striping/Signage                                     | LS            | LS              |           |       |
| 13       | Concrete Removal                                         | 22            | SY              |           |       |
| 14       | 4" Site Concrete                                         | 4             | CY              |           |       |
| 15       | Stackable Block Wall                                     | 100           | SF              |           |       |
| 16       | Truncated Domes                                          | 250           | SF              |           |       |
| 17       | Relocate Existing Gas and Electric                       | LS            | LS              |           |       |
|          | WATER:                                                   |               |                 |           |       |
| 18       | 1" PVC (Water line relocation)                           | 65            | LF              |           |       |
| 19       | 2" PVC (Water line relocation)                           | 250           | LF              |           |       |
| 20       | 4" PVC (Water line relocation)                           | 70            | LF              |           |       |
| 21       | 6" PVC (Water line relocation)                           | 120           | LF              |           |       |
| 22       | Backflow Prevention Assembly                             | 2             | EA              |           |       |
| 23       | Water Line Fittings/Appurtenances/Thrust Blocks          | LS            | LS              |           |       |
|          | BUILDING:                                                |               |                 |           |       |
| 24       | Building Slab                                            | 1,290         | SF              |           |       |
| 25       | Stem Wall                                                | 45            | LF              |           |       |
| 26       | Stone Veneer                                             | 160           | SF              |           |       |
| 27       | Lumber/Carpentry                                         | 1,710         | SF              |           |       |
| 28       | Exterior Cladding                                        | 1,540         | SF              |           |       |
| 29       | Casework                                                 | LS            | LS              |           |       |
| 30       | Insulation                                               | LS            | LS              |           |       |
| 31       | Roofing                                                  | 1,710         | SF              |           |       |
| 32       | Doors, Frames & Hardware                                 | 7             | EA              |           |       |
| 33       | Windows/Glazing                                          | 6             | EA              |           |       |
| 34       | Drywall                                                  | LS            | LS              |           |       |
| 35       | Porcelain Tile                                           | 385           | SF              |           |       |
| 36       | Resilient Flooring/Wall Base                             | 850           | SF              |           |       |

**COUNTY OF SAN DIEGO  
BIDDER/OFFER DVBE INFORMATION**

**ATTACHMENT B**

|                                          |                      |                      |                        |                  |              |
|------------------------------------------|----------------------|----------------------|------------------------|------------------|--------------|
| 37                                       | Painting             | 1,710                | SF                     |                  |              |
| 38                                       | Restroom Accessories | LS                   | LS                     |                  |              |
| 39                                       | Signage              | LS                   | LS                     |                  |              |
| 40                                       | Blinds               | 7                    | EA                     |                  |              |
| 41                                       | Rain Barrels         | 4                    | EA                     |                  |              |
| 42                                       | Splash Block         | 4                    | EA                     |                  |              |
| 43                                       | Plumbing             | LS                   | LS                     |                  |              |
| 44                                       | HVAC                 | LS                   | LS                     |                  |              |
| 45                                       | Electrical           | LS                   | LS                     |                  |              |
| 46                                       | Interior Lighting    | LS                   | LS                     |                  |              |
| <b>ADDITIVE ALTERNATE 1 BID SCHEDULE</b> |                      |                      |                        |                  |              |
| <b>ITEM NO.</b>                          | <b>DESCRIPTION</b>   | <b>ESTIMATED QTY</b> | <b>UNIT OF MEASURE</b> | <b>UNIT COST</b> | <b>TOTAL</b> |
| 49                                       | Terrarium            | LS                   | LS                     | LS               |              |
|                                          |                      |                      |                        |                  |              |

**TOTAL BASE BID**

\$ \_\_\_\_\_

**TOTAL ADDITIVE ALTERNATE 1**

\$ \_\_\_\_\_

**TOTAL BID (Base Bid + Add. Alt. 1)**

\$ \_\_\_\_\_

Name of Bidder \_\_\_\_\_

**BID COMPARISON AND AWARD**

If this Proposal shall be accepted and the undersigned shall fail to contract as aforesaid and to give in sums as stated in the Notice to Contractors Inviting Bids, both a faithful Performance Bond, and a Payment Bond as required by Chapter 5 (commencing at Section 3225) and Chapter 7 (commencing at Section 3247), Title 15, Part 4, Division 3, of the California Civil Code, with surety satisfactory to the Owner within the time specified in Section 3-1.03 of the Standard Specifications after the undersigned has received notice of the award of the Contract from the Owner and that the Contract is ready for signature, the Owner may, at its option, determine that the bidder has abandoned the Contract, and thereupon this Proposal and the acceptance thereof shall be null and void, and the forfeiture of the security accompanying this Proposal shall operate and the same shall be the property of the Owner.

Bids are required for the entire work shown in the Base Bid and Additive Alternates 1, Bid Schedules. The lowest bid shall be the lowest total bid price (base bid and additive alternate 1):

The bidder shall set forth for each item of work, in clearly legible figures, a unit price and a total for the item in the respective spaces provided for this purpose. In the case of unit basis items, the amount set forth under the "Total" column shall be the extension of the unit price bid on the basis of the estimated quantity for the item.

The quantities listed in the Proposal are approximate only. Payment for work done will be made at

the contract unit prices bid as applied to the quantities actually constructed or installed.

Contract unit prices bid by the lowest responsive and responsible bidder shall be locked in for the duration of the contract, and the Owner has the right to award additional Additive Alternates at the unit prices bid, if additional funding becomes available. The County reserves the right to award the Base Bid Schedule and/or any Additive Alternate Bid Schedules in any sequence.

Award of the Contract, if awarded, will be to the lowest responsible bidder, for the Total Bid, subject to the Owner's right to reject any or all bids and to waive any informality or irregularity in the bids or bidding. Bids in which the prices are obviously unbalanced may be rejected. **The County may deem non-responsive any bids that contain any mathematical errors.**

Award of the Contract, if awarded, will be made within ninety (90) calendar days from the date specified for the opening of bids. Notwithstanding the foregoing, additive alternates not included in the initial award, may be added to and included into the contract following initial award by the delivery of a Notice to Proceed to Contractor.

Information requested on the Designation of Subcontractors and Bidder DVBE Information forms are required for the total bid amount (i.e., base bid and all additive alternates, if any).

#### PROHIBITED CONTRACTS

Section 67 of the San Diego County Administrative Code provides that the County shall not contract with, and shall reject any bid or proposal submitted by, the person or entities specified below, unless the Board of Supervisors finds that special circumstances exist which justify the approval of such contract:

- a) Persons employed by the County or of public agencies for which the Board of Supervisors is the governing body;
- b) Profit-making firms or businesses in which employees described in subsection (a) serve as officers, principals, partners, or major shareholders;
- c) Persons who, within the immediately preceding twelve (12) months came within the provisions of subsection (a) and who (1) were employed in positions of substantial responsibility in the area of service to be performed by the contract, or (2) participated in any way in developing the contract or its service specifications; and
- d) Profit making firms or businesses in which the former employees described in subsection (c) serve as officers, principals, partners, or major shareholders.

With the affixing of a signature to your response to this solicitation, officer certifies that the above provisions of the Code have been complied with, and that any exception will cause any ensuing contract to be invalid.

#### DRUG AND ALCOHOL POLICY

It is the policy of the Board of Supervisors that in order to attain or maintain a contract with the County, each contractor shall agree that while any contractor or the contractor's employees are performing services for the County, or using County equipment, that the contractor or the contractor's employees:

1. Shall not in any way be impaired because of being under the influence of alcohol or a drug.
2. Shall not possess, consume, or be under the influence of alcohol and/or an illegal drug.
3. Shall not sell, offer, or provide alcohol or a drug to another person.

#### DEBARMENT AND SUSPENSION

Contractor certifies that it, its principals, its employees and its subcontractors:



1. Are not presently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from covered transactions by any State or Federal Department or agency.
2. Have not within a 3-year period preceding this Contract been convicted of, or had a civil judgment rendered against them for, the commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, State, or local) transaction; violation of Federal or State anti-trust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property.
3. Are not presently indicted or otherwise criminally or civilly charged by a government entity (federal, State, or local) with commission of any of the offenses enumerated in the paragraph above; and
4. Have not within a 3-year period preceding this Contract had one or more public transactions (federal, State, or local) terminated for cause or default.

**NONCOLLUSION AFFIDAVIT TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID**

(Title 23 United States Code Section 112 and  
Public Contract Code Section 7106)

State of California                    )  
                                                  )    ss  
                                                  )  
County of San Diego                 )

In accordance with Title 23 United States Code Section 112 and Public Contract Code 7106, (Name) \_\_\_\_\_, being first duly sworn, deposes and says that he or she is (Title) \_\_\_\_\_ of (Company) \_\_\_\_\_ 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 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.

I hereby certify, under penalty of perjury, that the foregoing statement is true and correct.

SIGNATURE OF BIDDER \_\_\_\_\_

DATE \_\_\_\_\_

COUNTY OF SAN DIEGO  
BIDDER/OFFER DVBE INFORMATION

ATTACHMENT B

County of San Diego  
Department of Purchasing and Contracting  
**REPRESENTATIONS AND CERTIFICATIONS**

The following representations and certifications are to be completed, signed and returned with the offer (the term "offer" includes a bid, proposal, quote, statement of qualifications, or any other submission to provide goods and/or services).

**1. BUSINESS TYPE**

☐ For-profit ☐ Non-profit ☐ Government

**2. INTERLOCKING DIRECTORATE**

In accordance with Board of Supervisors Policy A-79, if Offeror is a non-profit and will be subcontracting with a related for-profit entity where an interlocking directorate, management or ownership relationship exists, Offeror must list all such entity(ies) on an attached separate sheet, and authorization must be sought from Board of Supervisors. If Offeror is a non-profit and does not submit such a list, Offeror certifies it has not entered into a subcontract relationship with a related for-profit entity.

List Attached? Yes ☐

**3. BUSINESS REPRESENTATION**

Offeror represents as a part of this offer the following information regarding the ownership, operation, and control of its business:

3.1. Are you a local business with a physical address within the County of San Diego? ☐ Yes ☐ No

3.2. Are you certified by the State of California as a:

☐ Disabled Veteran Business Enterprise(DVBE)

Certification #: \_\_\_\_\_

☐ Small Business Enterprise (SBE)

Certification #: \_\_\_\_\_

3.3. Are you certified by the U.S. Dept Of Veterans' Affairs as:

☐ Veteran Owned Small Business (VOSB)

Certification # \_\_\_\_\_

☐ Service Disabled Veteran Owned Small Business (SDVOSB)

Certification # \_\_\_\_\_

3.4. Estimated percentage of work in this offer to be performed or fulfilled locally (within the geographic boundaries of the County of San Diego): \_\_\_\_\_%

**4. DEBARMENT, SUSPENSION, AND RELATED MATTERS**

4.1. Offeror certifies to the best of its knowledge that neither it nor any of its officers:

4.1.1. Are presently debarred, suspended, declared ineligible, or voluntarily excluded from covered transactions by any state, local, or federal department or agency.

4.1.2. Have within a three (3) year period preceding this agreement been convicted of or had a civil judgment rendered against them for commission of fraud or criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

4.2. Except as allowed for in Section 4.2.5, Offeror hereby certifies to the best of its knowledge that neither it nor any of its officers:

4.2.1. Are presently indicted for or otherwise criminally or civilly charged by a government entity (federal, state, or local) with the commission of any of the offenses enumerated in paragraph 4.1.2 of this certification;

4.2.2. Have within a three (3) year period preceding this agreement had one or more public transactions (federal, state or local) terminated for cause or default;

4.2.3. Are presently the target or subject of any investigation, accusation or charges by any federal, state or local agency or law enforcement, licensing, certification, ethics, or compliance body;

4.2.4. Are proposed for debarment by any state, local, or federal department or agency.

4.2.5. If Offeror is unable to certify Sections 4.2.1, 4.2.2, 4.2.3, or 4.2.4, it certifies that it has disclosed and attached to this Representations and Certifications the reason(s) it cannot do so. The disclosure must include the Section(s), specific relevant facts including dates, contracts, individuals involved, status of actions, and any other relevant information that prevent it from making the requested certification(s). The County reserves the right to disqualify an Offeror based upon information disclosed.

Disclosure Attached? Yes ☐

**5. RELATED WORK**

Offeror certifies to the best of its knowledge that, other than as disclosed in an attached separate sheet, it and its proposed subcontractors, agents, and consultants have not previously contracted with the County to perform work on or related to this project (e.g. preparing related studies or recommendations, components of the statement of work, or plans and specifications).

Disclosure Attached? Yes ☐

**6. CURRENT COST OR PRICING**

Offeror certifies to the best of its knowledge that cost and/or pricing data submitted with this offer, or specifically identified by reference if actual submission of the data is impracticable, are accurate, complete, and current as of the date signed below.

**7. INDEPENDENT PRICING**

Offeror certifies that in relation to this offer:

7.1. The prices in this offer have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices with other offerors, with any competitors, or with any County employee(s) or consultant(s) involved in this or related procurements;

7.2. Unless otherwise required by law, the prices that have been quoted in this offer have not been knowingly disclosed by the Offeror and will not knowingly be disclosed by the Offeror prior to opening, in the case of a bid, or prior to award, in the case of a proposal, directly or indirectly to any other Offeror or to any competitor or with any County employee(s) or consultant(s) involved in this or related procurements; and

7.3. No attempt has been made or will be made by the Offeror to induce any other person or firm to submit or not to submit an offer for the purpose of restricting competition.

**8. ADDITIONAL DISCLOSURES**

Offeror shall report in writing to the County Department of Purchasing and Contracting within five business days of discovering or having any reason to suspect any change in status as certified in the preceding paragraphs. Upon County's request, Offeror shall provide additional information supporting Offeror's Representations and Certifications. Offeror's obligations under this Section 8 shall continue until Offeror is no longer under consideration for award of a contract, or until termination or expiration of any resulting contract(s).

**CERTIFICATION**

The information furnished in Paragraphs 1 through 8 and in the accompanying offer is certified to be factual and correct as of the date submitted and this certification is made under penalty of perjury under the laws of the State of California.

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Title: \_\_\_\_\_ Date: \_\_\_\_\_

Company/Organization: \_\_\_\_\_

**SUBMIT THIS FORM AS DIRECTED IN THE REQUEST FOR SOLICITATION DOCUMENTS OR WITH THE OFFER**

### **DESIGNATION OF SUBCONTRACTORS**

Set forth below is the full name and the location of the place of business of each Subcontractor whom the Bidder proposes to subcontract portions of the work in excess of one-half of one percent of the total bid, or, in the case of construction of streets or highways, including bridges, in excess of one-half of one percent of the total bid or \$10,000, whichever is greater, and the portion of the work which will be done by each Subcontractor for each subcontract.

The Bidder's attention is directed to the provision titled "Subcontracting" of the Special Provisions contained in these Contract Documents.

NOTE: The Bidder understands that if the Bidder fails to specify a Subcontractor for any portion of the work to be performed under the contract in excess of one-half of one percent of the bid, or, in the case of construction of streets or highways, including bridges, in excess of one-half of one percent of the bid or \$10,000, whichever is greater, the Bidder shall be deemed to have agreed to perform such portion, and that the Bidder shall not be permitted to sublet or subcontract that portion of the work except in cases of public emergency or necessity, and then only after a finding, reduced to writing as a public record of the Awarding Authority, setting forth the facts constituting the emergency or necessity in accordance with the provision of the Subletting and Subcontracting Fair Practices Act (Section 4100 et seq. of the California Public Contract Code).

**The "Business Name and Address", the "License No.", and the "Portion of Work to be Subcontracted" that will be done by each Subcontractor (including DVBE Subcontractors) are required at the time of bid submittal.** An inadvertent error in listing the California contractor license number must be corrected by the prime contractor within 24 hours after bid opening by email to the Procurement Contracting Officer listed as contact for this RFB, provided the corrected contractor's license number corresponds to the submitted name and location for that subcontractor, or else the bid may be determined non-responsive. The remainder of the information shall be submitted by all bidders within two business days of bid opening by e-mail to said Procurement Contracting Officer.

**If no Subcontractors are to be employed on the project, enter the word "NONE."**

**DESIGNATION OF SUBCONTRACTORS**

| DESIGNATION OF SUBCONTRACTORS       |                        |                              |                                       |             |
|-------------------------------------|------------------------|------------------------------|---------------------------------------|-------------|
| PORTION OF WORK TO BE SUBCONTRACTED |                        | BUSINESS NAME<br>AND ADDRESS | PERCENTAGE<br>OF<br>TOTAL<br>CONTRACT | LICENSE NO. |
| ITEM<br>NO.                         | DESCRIPTION<br>OF WORK |                              |                                       |             |
|                                     |                        |                              |                                       |             |
|                                     |                        |                              |                                       |             |
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|                                     |                        |                              |                                       |             |

TOTAL % SUBCONTRACTED \_\_\_\_\_

Name of Bidder \_\_\_\_\_

FOR: STELZER PARK RANGER STATION AND VISITOR CENTER ORACLE PROJECT NO. 1021904.

Accompanying this proposal is \_\_\_\_\_

(NOTICE: Insert the words "cash (\$ \_\_\_\_\_)," "cashier's check," "certified check," or "bidder's bond," as the case may be.) in amount equal to at least ten percent of total of the bid.

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

**IMPORTANT NOTICE** *If bidder or other interested person is a corporation, state legal name of corporation, also names of the president, secretary, treasurer and manager thereof; if a co-partnership, state true name of firm, also names of all individual co-partners composing firm; if bidder or other interested person is an individual, state first and last names in full.*

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Licensed in accordance with an act providing for the registration of Contractors,

License No. \_\_\_\_\_ Classification (s) \_\_\_\_\_ Exp. Date \_\_\_\_\_

DIR Registration No. \_\_\_\_\_ Registration Date \_\_\_\_\_ Exp. Date \_\_\_\_\_

I hereby certify, under penalty of perjury, that the foregoing proposal to the Board is true and correct.

( \_\_\_\_\_ )

Legal Name of Bidder

(  
SIGN (   
(  
HERE ( by \_\_\_\_\_ (SEAL)  
( Signature  
(  
(

( \_\_\_\_\_  
Title

**NOTE:** If bidder is a corporation, the legal name of the corporation shall be set forth above together with the signature of the officer or officers authorized to sign contracts on behalf of the corporation; if bidder is a co-partnership, the true name of the firm shall be set forth above together with the signature of the partner or partners authorized to sign contracts in behalf of the co-partnership; and if bidder is an individual, his signature shall be placed above. If signature is by an agent, other than an officer of a corporation or a member of a partnership, a Power of Attorney must be submitted with the bid; otherwise, the bid may be disregarded as irregular and unauthorized.

Business address \_\_\_\_\_

Telephone ( \_\_\_\_\_ ) \_\_\_\_\_ Fax( \_\_\_\_\_ ) \_\_\_\_\_

E-Mail address \_\_\_\_\_

Dated \_\_\_\_\_, 20 \_\_\_\_\_, at \_\_\_\_\_ California

BOND NO. \_\_\_\_\_

**BIDDER'S BOND**

**KNOW ALL MEN BY THESE PRESENTS:**

That we .....  
.....  
as Principal, and  
.....  
as Surety, are held and firmly bound unto the County of San Diego, a political subdivision of the State of California, hereinafter called the County, in the penal sum of TEN PERCENT (10%) OF THE TOTAL AMOUNT OF THE BID of the Principal above named, submitted by said Principal to the County for the work described below, for the payment of which sum in lawful money of the United States, well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

In no case shall the liability of the Surety hereunder exceed the sum of.....  
.....

**THE CONDITION OF THIS OBLIGATION IS SUCH,**

That whereas the Principal has submitted the above-mentioned bid to the County of San Diego for certain construction specifically described as follows, for which bids are to be opened on \_\_\_\_\_ for  
DATE

**STELZER PARK RANGER STATION AND VISITOR CENTER, ORACLE PROJECT NO. 1021904.**

NOW THEREFORE, if the aforesaid principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after said opening, and shall within the period specified therefor, or, if no period be specified, within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the County, in the prescribed form, in accordance with the bid as accepted, and file the two bonds with the County, one to guarantee faithful performance and the other to guarantee payment for labor and materials, as required by law, then this obligation shall be null and void; otherwise, it shall be and remain in full force and virtue.

In the event suit is brought upon this bond by the County and judgment is recovered, the Surety shall pay all costs incurred by the Owner in such suit, including a reasonable attorney's fee to be fixed by the court.

IN WITNESS WHEREOF, We have hereunto set our hands and seals on this ..... day of ..... A.D.  
20.....

.....(SEAL).....  
(SEAL).....  
.....(SEAL).....  
(SEAL).....  
(SEAL).....(SEAL).....  
Surety Principal

**ATTORNEY-IN-FACT ACKNOWLEDGEMENT OF SURETY**

STATE OF ..... )  
COUNTY OF ..... ) ss  
On this ..... day of..... in the year 20.....  
before me .....a notary public in and for said County and State  
personally appeared ..... known to me (or proved to me on the basis of  
satisfactory evidence) to be the person whose name is subscribed to the within instrument as the attorney-in-fact of  
the..... the corporation named as Surety in said instrument, and acknowledged to me that he  
subscribed the name of said corporation thereto as Surety, and his own name as attorney-in-fact.

NOTE: (a) Signature of those executing for .....  
Surety must be properly acknowledged. Notary Public In and for the County of  
(b) The Attorney-in-fact must attach ..... State of  
a certified copy of Power of Attorney.  
California

**COUNTY OF SAN DIEGO  
BIDDER/OFFER DVBE INFORMATION**

**ATTACHMENT B**

DATE: \_\_\_\_\_

ACTIVITY/PROJECT NO. \_\_\_\_\_

PROJECT TITLE: \_\_\_\_\_

BIDDER/OFFEROR: \_\_\_\_\_

BIDDER/OFFEROR REPRESENTATIVE: \_\_\_\_\_

| ITEM NO.                                                      | DESCRIPTION OF WORK, SERVICE OR MATERIAL | NAME OF CERTIFIED DVBE (PRIME, SUBCONTRACTOR, VENDOR) TO BE USED INCLUDING ADDRESS, TELEPHONE AND CERTIFICATION NUMBER. | DOLLAR AMOUNT TO BE PAID THIS DVBE |
|---------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------|
|                                                               |                                          |                                                                                                                         |                                    |
|                                                               |                                          |                                                                                                                         |                                    |
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|                                                               |                                          |                                                                                                                         |                                    |
|                                                               |                                          |                                                                                                                         |                                    |
| TOTAL DOLLARS TO CERTIFIED DVBE (PRIME,/SUBCONTRACTOR/VENDOR) |                                          |                                                                                                                         | \$                                 |

**COMPUTATION OF UTILIZATION AND COMPARISON WITH THE GOAL**

**\*PARTICIPATION REQUIREMENT  
or ESTABLISHED  
GOAL**

**CALCULATION**

|                   |                                                                                                                                                       |                                                                            |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Disabled Veterans | $\frac{\text{Total Amount to DVBE}}{\text{Total Bid/Offer}} \times 100 = \text{Percent of Utilization}$<br>$\text{_____} \times 100 = \text{_____}\%$ | <p align="center">3%</p> <p>*See DVBE information sections for details</p> |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|



**Disabled Veteran Business Enterprise (DVBE) “Good Faith Effort” Package for Public Work (Estimated by the County) to be between \$500,000 and \$1million**

The DVBE Cover Sheet is to be attached for the required certified DVBE documentation of “Good Faith Effort” and must be submitted within two business days of bid opening, offer due date, or individual task order submittal; or the bid or offer may be deemed non-responsive.

Project Title: \_\_\_\_\_

Project/Activity No.: \_\_\_\_\_

Bid/Offer No.: \_\_\_\_\_

Bid/Offer Date: \_\_\_\_\_

Name of Contractor/Firm Submitting Bid/Offer:

\_\_\_\_\_

Please check off the following to insure you have included them in your documentation:

\_\_\_\_\_ Documentation of “Good Faith Effort” (pages 1 thru 3)

\_\_\_\_\_ Attachment of Any Additional Supporting Documentation

PART2/DVBE

**DOCUMENTATION OF GOOD FAITH EFFORT**  
**For Public Work (Estimated by the County) to be between \$500,000 and \$1million**

A. List potential DVBEs that the bidder/offeror solicited for participation in this contract along with dates.

| Certified DVBE Firm | Date of Contact<br>(Mail, Fax, Telephone, etc.) | Responded<br>(Yes/No) |
|---------------------|-------------------------------------------------|-----------------------|
| 1. _____            |                                                 |                       |
| 2. _____            |                                                 |                       |
| 3. _____            |                                                 |                       |
| 4. _____            |                                                 |                       |
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| 10. _____           |                                                 |                       |
| 11. _____           |                                                 |                       |
| 12. _____           |                                                 |                       |
| 13. _____           |                                                 |                       |
| 14. _____           |                                                 |                       |
| 15. _____           |                                                 |                       |

B. DVBE Solicitations

Solicitation Sample:

Bidder/Offeror must attach a sample of the solicitation sent to certified DVBE firms. If phone contact was made, document conversation: date, time, contact person, and business opportunities discussed.

**DOCUMENTATION OF GOOD FAITH EFFORT**  
**For Public Work (Estimated by the County) to be between \$500,000 and \$1million**

Identification of (1) all DVBEs who submitted bids or offers. (2) nature of work, supplies or services offered which are not accepted, (3) dollar amounts of the DVBEs bids/offers not accepted, (4) subcontractors and/or suppliers who will be used instead of the DVBEs, (5) dollar amounts of these subcontractors and/or suppliers' bids/offers, and (6) the reason for the bidder/offeror not accepting the DVBE's bid/offer. Use additional sheets if necessary.

| Name of DVBE<br>(1) | Nature of Work<br>(2) | DVBE Bids/Offer(\$)<br>(3) | Subcontractor/Supplier to be used<br>(4) | Bid/Offer Amount Accepted<br>(5) | Reason Not Accepted<br>(6) |
|---------------------|-----------------------|----------------------------|------------------------------------------|----------------------------------|----------------------------|
|                     |                       |                            |                                          |                                  |                            |
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PART2/DVBE

### **PART III**

#### **DOCUMENTS TO BE EXECUTED BY THE SUCCESSFUL BIDDER (AFTER AWARD OF CONTRACT)**

STATE OF CALIFORNIA  
COUNTY OF SAN DIEGO  
CONTRACT FOR  
STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904

RFB NO.: 10959

THIS CONTRACT, made and concluded, in duplicate, this \_\_\_\_\_ day of \_\_\_\_\_, Two Thousand and \_\_\_\_Twenty-One, between County of San Diego, Owner, by the Director, Department of Purchasing and Contracting, and

Contractor,

ARTICLE I. WITNESSETH, that for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the Owner, the Contractor agrees with the Owner, at the Contractor's own proper cost and expense, to do all the work and furnish all the materials, except such as are mentioned in the specifications to be furnished by the Owner, necessary to construct and complete in a good, workmanlike and substantial manner and to the satisfaction of the Owner, the project titled:

STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904

Said work is to be performed in accordance with the Contract and the Special Provisions annexed hereto and including Addenda Nos. \_\_\_\_\_ and also in accordance with the Standard Specifications of the State of California, Department of Transportation, current edition, Greenbook Standard Specifications for Public Works Construction, current edition, and the modifications to said Standard Specifications and said Amendments contained in Part VII of these Contract Documents.

The work to be done is shown in "Scope of Work (Base Bid and Additive Alternates)", Specifications, and Project Plans in these Contract Documents, in accordance with the Notice to Proceed.

ARTICLE II. And the Contractor agrees to receive and accept the unit and/or lump sum prices shown in the Bid Schedule for the items and quantities actually constructed or installed as full compensation for furnishing all materials and for doing all the work contemplated and embraced in this agreement; also for all loss or damage arising out of the nature of the work aforesaid, or from the action of the elements, or from any unforeseen difficulties or obstructions which may arise or be encountered in the prosecution of the work until its acceptance by the Owner, and for all risks of every description connected with the work; and also for all expenses incurred by or in consequence of the suspension or discontinuance of work and for well and faithfully completing the work, and the whole thereof, in the manner and according to the Plans and Specifications, and the requirements of the Engineer under them.

ARTICLE III. The Owner hereby promises and agrees with the Contractor to employ, and does hereby employ the Contractor to provide the materials and to do the work according to the terms and conditions herein contained and referred to, for the prices aforesaid, and hereby contracts to pay the same at the time, and in the manner and upon the conditions hereinafter set forth, and the Owner and the Contractor for themselves, their heirs, executors, administrators, successors, and assigns, do hereby agree to the full performance of the covenants herein contained.

ARTICLE IV. It is further expressly agreed by and between the parties hereto that should there be any conflict between the terms of this instrument and the Bid or Proposal of the Contractor, then this instrument shall control and nothing herein shall be considered as an acceptance of the terms of the Proposal conflicting herewith.

ARTICLE V. The Owner has obtained from the Director of the Department of Industrial Relations said Director's determinations of the general prevailing rate of per diem wages and the general prevailing rate for holiday and overtime work for the locality in which the project is to be performed. Said determinations are on file and are available in the Office of the Department of Purchasing and Contracting, 5560 Overland Ave., Suite 270, San Diego, California 92123 and are available from the Department of Industrial Relations at [www.dir.ca.gov/DLSR/PWD](http://www.dir.ca.gov/DLSR/PWD). Not less than these rates shall be paid to all workers employed on the project.

ARTICLE VI. The Contract entered into consists of the following contract documents, all of which are component parts of the Contract as if herein set out in full, or attached hereto:

1. Notice to Contractors Inviting Bids
2. Information for Bidders
3. Proposal to the Board
4. Designation of Subcontractors
5. Contract
6. Corporate Certificate
7. Partnership Certificate
8. Contractor's Certificate Regarding Worker's Compensation
9. Performance Bond
10. Payment Bond
11. Special Provisions – Special Conditions
12. Technical Specifications
13. Special Provisions – Caltrans Standard Specifications
14. Project Plans, Standard Plans and Standard Drawings
15. Equipment Rental Rates
16. Addenda Nos. 1,2,3,4,5, and 6, as issued
17. General Information Regarding Compliance with Disabled Veterans Business Enterprise Program
18. Bidder DVBE Information
19. Representations and Certifications

All of the above named contract documents are intended to be complementary. Work required by one of the above named documents and not by others shall be performed as if required by all.

IN WITNESS WHEREOF, the parties to these presents have hereunto set their hands the day and year first above written.

BASIS OF AWARD: Bids are required for the entire work shown in the Base Bid and Additive Alternates 1, Bid Schedules. The lowest bid shall be the lowest total bid price (base bid and alternate additives 1).

TOTAL BID \_\_\_\_\_ By \_\_\_\_\_ Date \_\_\_\_\_  
JOHN M. PELLEGRINO, Director  
Department of Purchasing and Contracting

\_\_\_\_\_  
Contractor Name

\_\_\_\_\_  
Signature of Authorized Official

\_\_\_\_\_  
Contractor Address

\_\_\_\_\_  
Printed Name / Title

\_\_\_\_\_  
City, State, Zip

\_\_\_\_\_  
Contractor License Number

\_\_\_\_\_  
Federal Tax ID / SS

## CORPORATE CERTIFICATE

I, \_\_\_\_\_ certify that I am the Secretary of the Corporation named as Contractor in the foregoing Contract; that \_\_\_\_\_, who signed said Contract on behalf of the Contractor, was then \_\_\_\_\_ of said Corporation; that said Contract was duly signed for and in behalf of said Corporation by authority of its governing body and is within the scope of its corporate powers.

Corporate Name: \_\_\_\_\_

Signature: \_\_\_\_\_ (Corporate Seal)  
Secretary

## PARTNERSHIP CERTIFICATE

STATE OF \_\_\_\_\_ )  
COUNTY OF \_\_\_\_\_ ) ss

On this \_\_\_\_\_ day of \_\_\_\_\_, in the year 20\_\_\_\_, before me \_\_\_\_\_, a Notary Public in and for said County and State, personally appeared \_\_\_\_\_, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person that executed this instrument, on behalf of the partnership and acknowledged to me that the partnership executed it.

Notary's Signature: \_\_\_\_\_

Notary's Name: \_\_\_\_\_  
(Type or Print)

My Commission Expires: \_\_\_\_\_

(Notary Seal)



## CONTRACTOR'S CERTIFICATE REGARDING WORKER'S COMPENSATION

Section 3700 of the Labor Code provides in part as follows:

"Every employer except the State shall secure the payment of compensation in one or more of the following ways:

- (a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this State.
- (b) By securing from the Director of Industrial Relations a certificate of consent to self-insure, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his employees..."

I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for worker's 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.

SIGNATURE: \_\_\_\_\_

BIDDER'S NAME: \_\_\_\_\_  
(Type or Print)

ADDRESS: \_\_\_\_\_  
\_\_\_\_\_

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

**PERFORMANCE BOND**

(Page 1 of 2)

**WHEREAS**, the County of San Diego (hereinafter designated as COUNTY) and \_\_\_\_\_ (hereinafter designated as PRINCIPAL) have entered into a Contract for the furnishing of all materials, labor, services and equipment necessary, convenient and proper to:

**STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904; RFB 10959.**

pursuant to said Contract awarded on \_\_\_\_\_; and all of the documents attached thereto and incorporated by reference, becoming a part of said Contract, are hereby referred to and made a part hereof; and,

**WHEREAS**, said PRINCIPAL is required according to the terms of said Contract and applicable California State law, to furnish a Bond for the faithful Performance of said Contract.

**NOW, THEREFORE**, we, the PRINCIPAL and \_\_\_\_\_ as SURETY, are held and firmly bound unto the COUNTY in the penal sum of: **Amount** (\$ amount), lawful money of the United States of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH** that if said PRINCIPAL, its subcontractors, heirs, executors, administrators, successors or assigns shall in all things stand to and abide by, and well and truly keep and perform all of the covenants, conditions, and agreements in said Contract and any and all alterations thereof made as therein provided, on its or their part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall defend, indemnify and save harmless the COUNTY, its officers, agents, and employees, as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and effect.

And said SURETY for value received, hereby stipulates and agrees that no change, extension of time, alteration, addition or deletion to the terms of said Contract, the accompanying Contract Documents, or to the Work to be performed hereunder shall in any way affect its obligations on this Bond, and the SURETY hereby waives notice of any such change, extension of time, alteration, addition or deletion to the terms of said Contract or to the Contract Documents or to the Work.

In the event the COUNTY terminates the PRINCIPAL's right to complete the Contract, the SURETY shall be obligated, without duplication, for:

- (a) the responsibilities of the PRINCIPAL for correction of defective work and completion of the Contract
- (b) additional legal, design, professional and delay costs resulting from the PRINCIPAL's default, and resulting from the actions or failure to act of the SURETY under this Bond
- (c) damages, including liquidated damages, as specified in the Contract.

In the event of such termination, the COUNTY may, at its sole option:

- (a) collect payment under this Bond and take over and prosecute the Contract to completion by contract or by any other methods it may deem advisable,
- (b) require the SURETY to undertake to perform and complete the Contract itself, through its agents or through independent contractors, or
- (c) require the SURETY, through a process acceptable to the COUNTY, to obtain bids or negotiated proposals from qualified contractors acceptable to the COUNTY for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the COUNTY and the contractor selected with the COUNTY's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to the COUNTY the amount of damages, including actual and liquidated damages, incurred in excess of the balance of the Contract price as a result of the PRINCIPAL's default.

**PERFORMANCE BOND**

(Page 2 of 2)

In the event suit is brought upon this Bond by the COUNTY and judgment is recovered, SURETY shall pay all costs incurred by the COUNTY in such suit, including reasonable attorneys' fees to be fixed by the court in accordance with applicable statutory law.

The SURETY, by the execution of this Bond, represents and warrants that this Bond has also been duly executed by the PRINCIPAL with proper authority, and the SURETY hereby waives any defense which it might have by reason of any failure by the PRINCIPAL to execute or properly execute this Bond.

**IN WITNESS WHEREOF** \_\_\_\_\_ identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the PRINCIPAL and SURETY above named on the \_\_\_\_\_ day of \_\_\_\_\_, 2021.

**PRINCIPAL:****SURETY:**\_\_\_\_\_  
Signature\_\_\_\_\_  
Signature\_\_\_\_\_  
Name\_\_\_\_\_  
Name\_\_\_\_\_  
Title\_\_\_\_\_  
Title\_\_\_\_\_  
Address\_\_\_\_\_  
Address**NOTE TO SURETY COMPANY AND/OR SURETY COMPANY ATTORNEY-IN-FACT:**

The following form of original acknowledgement should be used. If any other form of acknowledgement is used, there must be submitted a certified copy of unrevoked resolution of authority for the attorney-in-fact.

STATE OF CALIFORNIA )  
COUNTY OF SAN DIEGO ) ss.

On \_\_\_\_\_, before me, the undersigned, a Notary Public in and for the State, personally appeared \_\_\_\_\_, known to me to be the duly authorized Attorney-in-Fact of the corporate SURETY named in the within instrument, known to me to be authorized to execute that instrument on behalf of said corporation, known to me to be the person whose name is subscribed to such instrument as the Attorney-in-Fact of said corporation, and acknowledged to me that he (she) subscribed the name of said corporation thereto as SURETY, and his (her) own name as Attorney-in-Fact and that said corporation executed the same.

**WITNESS MY HAND AND OFFICIAL SEAL:**

(SEAL)

\_\_\_\_\_  
Notary Public for the State of California

Original Acknowledgement by Attorney-in-Fact must be attached.  
Corporate seals of PRINCIPAL and SURETY must be attached.

**PAYMENT BOND**

**KNOW ALL MEN BY THESE PRESENTS:** That

WHEREAS, the County of San Diego, a political subdivision of the State of California (hereinafter designated as Owner) on

.....2021 awarded to \_\_\_\_\_. (hereinafter designated as the Principal) a contract for the work described as follows:

STELZER PARK RANGER STATION AND VISITOR CENTER; ORACLE PROJECT NO. 1021904

WHEREAS, said Principal is required Chapter 5 (commencing at Section 3225) and Chapter 7 (commencing at Section 3247), Title 15, Part 4, Division 3 of the California Civil Code to furnish a bond in connection with said contract.

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

THE CONDITION OF THIS OBLIGATION IS SUCH THAT if said Principal, hers/his/its subcontractors, heirs, executors, administrators, successors, or assigns, shall fail to pay any of the persons named in Section 9100 of the California Civil Code, or amounts due under the Unemployment Insurance Code with respect to work or labor performed under the contract, or for any amounts required to be deducted, withheld and paid over to the Employment Development Department from the wages of employees of the contractor and his subcontractors pursuant to Section 13020 of the Unemployment Insurance Code, with respect to such work and labor the Surety or Sureties will pay for the same, in an amount not exceeding the sum hereinabove specified, and also, in case suit is brought upon this bond, a reasonable attorney's fee, to be fixed by the court.

This Bond shall inure to the benefit of any of the persons named in Section 9100 of the California Civil Code, so as to give a right of action to such persons or their assigns in any suit brought upon this bond.

It is further stipulated and agreed that the Surety on this bond shall not be exonerated or released from the obligation of this bond by any change, extension of time for performance, addition, alteration or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement hereinabove described or pertaining or relating to the furnishing of labor, materials or equipment therefor, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining or relating to any scheme or work of improvement hereinabove described, nor by any rescission or attempted rescission of the contract, agreement or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the Owner or Public Entity and original contractor or on the part of any obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Section 9100 of the California Civil Code, and has not been paid the full amount of his claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration or modification herein mentioned.

IN WITNESS WHEREOF this instrument has been duly executed by the Principal and Surety above named, on the ..... day of ..... 2021.

..... (SEAL)  
Principal

By ..... (SEAL)

NOTE: (a) Signature of those executing for  
Surety must be properly acknowledged.  
(b) The Attorney-in-fact must attach  
a certified copy of Power of Attorney.

..... (SEAL)

By ..... (SEAL)  
Attorney-in-Fact

(Attach required acknowledgements)

**PART IV**  
**SPECIAL PROVISIONS - SPECIAL CONDITIONS**  
**(AMENDED)**

**COUNTY OF SAN DIEGO  
SPECIAL PROVISIONS  
FOR  
CONSTRUCTION OF  
STELZER PARK RANGER STATION AND VISITOR CENTER  
ORACLE PROJECT NO. 1021904**

**PART IV - SPECIAL CONDITIONS**

**1. Specifications and Plans**

The work embraced herein shall conform to the provisions in the Standard Specifications of the State of California, Department of Transportation, 2010 edition; and Greenbook Standard Specifications for Public Works, current edition; the modifications to said Standard Specifications and said Amendments contained in Part VII of these Contract Documents, insofar as the same may apply and these Special Provisions.

**2. Beginning of Work, Time of Completion and Liquidated Damages**

The Contractor's attention is directed to Section 8-1.04, "Start of Jobsite Activities" and Section 8-1.10, "Liquidated Damages" of the Standard Specifications, defining responsibility with regard to completing the work within the time specified.

The Contractor shall begin work within fifteen (15) calendar days after receiving the Notice to Proceed and shall diligently prosecute this Contract to completion before expiration of **180 working days** starting on the 15<sup>th</sup> day after receipt of said notice by the Contractor.

In case all the work called for and all the conditions and requirements of the Contract are not completed within the number of working days specified above, liquidated damages of **one thousand nine hundred dollars (\$1,900)** for each and every calendar day required to finish the work in excess of the specified number of working days shall be paid to the Owner.

**3. Project Document Identification and Mailing Information**

All correspondence and all other documents submitted to the Owner for this project shall contain the project title and the number as shown at the top of this page. Documents referred to include, but are not limited to: payrolls, separate payroll certification sheets, Certificates of Insurance, other required forms and submittals. Documents which are not properly identified will be returned to the Contractor.

After award of the Contract ALL correspondence, submittals, etc. for this project are to be addressed to:

DEPARTMENT OF PARKS AND RECREATION  
5500 OVERLAND AVENUE, SUITE 410  
SAN DIEGO, CA 92123  
ATTN: NICK FERRACONE, PARK PROJECT MANAGER

**4. Guarantee**

All work shall be guaranteed by the Contractor for a period of one (1) year from the date of acceptance of the work, against defective workmanship and materials furnished by the Contractor. The Contractor shall promptly replace or repair in a manner satisfactory to the Owner, any such defective work, after notice to do so from the Owner, and upon the Contractor's failure to make such replacement or repairs promptly, the Owner may perform this work and the Contractor, and its sureties shall be liable for the cost thereof.

## **5. Indemnification and Insurance**

Attention is directed to Section 7-1.05, "Indemnification" and Section 7-1.06 "Insurance", of the Standard Specifications, including the "Modifications..." in Part VII of these Contract Documents.

## **6. Permits and Licenses**

Attention is directed to Section 5-1.20B, "Permits, Licenses, Agreements, and Certifications", of the Standard Specifications and these Special Provisions.

The Contractor is required to obtain all permits as required in the project scope.

The Contractor is required to obtain a traffic control permit from the Traffic Engineering Section of the County of San Diego. There is no fee for this permit.

## **7. Existing Utilities and Non-Highway Facilities**

Attention is directed to Section 5-1.36D, "Non-Highway Facilities", of the Standard Specifications and these Special Provisions.

The Contractor's attention is directed to underground facilities marked on the plans.

The Contractor shall take special care to avoid either damage or interruption of service during construction.

The Contractor shall ascertain the exact location of underground facilities and improvements within the construction area before using equipment that may damage such facilities or interfere with their service.

At least 48 hours before starting excavation, the Contractor shall verify the location of existing underground facilities by contacting Underground Service Alert (1-800-422-4133) and by individually contacting operators of gravity sewer systems and certain other utilities which are not members of Underground Service Alert.

In accordance with Section 4215 of the Government Code, if the Contractor while performing the contract discovers any existing main or trunkline utility facilities not identified by the public agency in the Contract Plans or Specifications, the Contractor shall immediately notify the public agency and utility in writing. The public utility, where they are the owner, shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.

An appropriate time extension will be allowed, and the Contractor shall not be assessed liquidated damages for delay in completion of the project, when such delay was caused by the failure of the public agency or the owner of the utility to provide for removal or relocation of such utility facilities.

The Contractor shall be compensated for the costs of locating, repairing damage not due to the failure of the Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Plans and Specifications with reasonable accuracy and for equipment on the project necessarily idled during such work. Such compensation shall be at force account in accordance with the extra work provisions of the Contract.

Full compensation for conforming to the requirements of this provision, not otherwise provided for, shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefore.

## **8. Subcontracting**

Attention is directed to Section 5-1.03, "Subcontracting", of the Standard Specifications, the modifications to said Section 5-1.03 contained in Part VII of these Contract Documents, and these Special Provisions.

The following definitions and requirements shall apply to any subcontract, supplier and equipment rental agreements entered into by the prime contractor relating to this project:

### **a. Definitions**

**"Subcontractor"**: A person, firm or corporation supplying labor and materials or equipment, or labor only, for work at the project for and under separate contract or agreement with, the Contractor.

Each Subcontractor shall be properly licensed by the State of California to perform the contemplated subcontract work.

**"Work at the Project"**: Work to be performed at the location of the project, and any offsite work performed exclusively for the project, including the transportation of materials and supplies to or from the location of the project by employees of the Contractor or any Subcontractor.

**"Owner-Operator"**: A person who has legal or equitable title to equipment and operates the equipment on work at the project; operates only that equipment to which said person has legal or equitable title, has no employees (except where necessary to assist in operating the equipment) and has only one piece of equipment at the project at any one time.

For the purpose of this Contract, owner-operators are considered to be employees of the Contractor or the Subcontractor which engaged their services.

**"Incorporated Owner-Operator"**: A corporation which owns, operates, and maintains one or more items of equipment and rents out the equipment, operated and maintained, for work at the project. For the purpose of this Contract, an incorporated owner-operator is considered to be an equipment rental firm.

**"Equipment Rental Firm"**: A person (other than owner-operator), firm or corporation which rents out equipment, operated and maintained, for work at the project.



For the purpose of this Contract, an equipment rental firm is considered to be a Subcontractor with regard to labor provision only.

**"Supplier":** A person, firm, or corporation which furnishes materials and supplies to the project from a commercial or industrial source.

**"Labor Provisions":** Any requirement regarding wage rates, hours of work, travel and subsistence payments, records, apprentices, safety and health, affirmative action requirements and equal employment opportunity, as set forth in the Contract Documents, or as required by law, rules and regulations.

#### **b. Requirements**

All workers at the project shall come under the applicable labor provisions. Workers include, but are not limited to, employees of the Contractor, Subcontractors and their employees, equipment rental firm employees, and owner-operators. Workers do not include employees of suppliers solely involved in transporting materials and supplies to or from the location of the project.

The Contractor shall notify the Engineer of the name and address of each equipment rental firm which the Contractor has employed to work at the project. Such notice shall be given not later than one working day after the equipment rental firm has begun work at the project.

The Contractor shall bind, by written agreement, each equipment rental firm employed on the project to the conditions of the contract with the Owner regarding labor provisions.

Where the contract provides that the Contractor's organization shall perform contract work amounting to a specified percent of the original total contract price, the following items will be considered:

"Contractor's organization" shall be construed to include only workers employed and paid directly by the Contractor and equipment owned or rented by the Contractor, with or without operators.

"The Contract amount upon which the specified percent requirement is computed includes the cost of materials and manufactured products which are to be purchased or produced by the Contractor under the Contract provisions."

Any clause relating to attorney's fees contained in a subcontract shall not give rise to a cause of action by Contractor against County for indemnity as a result of Contractor's liability to pay such fees, and Contractor waives any right to seek indemnity from County for payment of attorney's fees to or on behalf of a subcontractor.

### **9. Claims and Disputes**

All claims must comply with the False Claims Act.

Any unresolved claims (demands for monetary compensation or damages) arising or related to the performance of this contract shall be resolved by first submitting such claims to mediation, prior to their being taken to formal arbitration or litigation by any party. Any claim which is not resolved by mediation shall be resolved by arbitration pursuant to Section 9-1.22, "Arbitration", of

the Standard Specifications.

Mediation shall be initiated by filing a written notice requesting mediation. All such claims shall be filed and documented in conformance with Section 9-1.17D "Final Payment and Claims", of the Standard Specifications. All mediation shall terminate not later than 180 days after the date of service in person or by mail on the Contractor of the final written decision by the Department on the claim. Mediation of any claim shall not relieve the Contractor of the requirement to file a Complaint in Arbitration within the time period specified in Section 9-1.17C, "Proposed Final Estimate", of the Standard Specifications, as modified in Part VII of these Contract Documents.

The County shall have the right to terminate the contract for cause or convenience at any time without regard to mediation.

Mediation shall be conducted utilizing the American Arbitration Association, or by any other neutral organization agreed to by the parties. The organization conducting the mediation shall hereinafter be known as "Administrator".

1. Costs

The costs for all mediation, including the administrative fees and Mediator compensation, shall be shared equally by all parties. Fees shall be jointly negotiated by all parties directly with the Administrator. The expenses of witnesses for any party shall be paid by the party producing such witnesses.

2. Selection of Mediator

A single mediator, acceptable to all parties, shall be used to mediate the dispute. The mediator will be knowledgeable in construction aspects and will be selected from lists furnished by the Administrator. The initial mediation session shall commence within 30 days of filing, unless otherwise agreed by the parties, or at the direction of the mediator.

3. Conduct of Mediation Sessions

All mediation sessions shall be conducted after the project is field complete unless a claim exceeds \$25,000 and the project has in excess of four months remaining until field completion, or unless all parties agree to immediate mediation. Mediation hearings will be conducted in an informal manner and discovery will not be allowed unless agreed to by all parties. All discussions, statements or admissions will be confidential to the proceedings and may not be used for any other purpose as it relates to the party's legal position.

Spokesperson shall be limited to owner, contractor, subcontractor and supplier personnel and their consultants. The contractor, subcontractor or supplier may have an attorney present and shall advise the other parties no less than five (5) working days before the mediation so that the other parties may also have their attorneys present.

Any resultant agreements from mediation shall be documented in writing, as agreed upon during the mediation, and may be used as the basis for a change order or other directive as appropriate. All mediation results and documentation shall be non-binding and inadmissible for any purpose in any legal proceeding, unless such admission is otherwise agreed in writing by all parties. Mediators shall not be subject to any subpoena or liability and their actions shall not be subject to discovery.

#### 4. Contract Interpretation Disputes

Should it appear to Contractor that Work to be performed or any of the matters relative to the Contract (including without limitation Drawings or Specifications, if any, provided by County) are not satisfactorily detailed or explained therein, or should any questions arise as to the meaning or intent of Contract (including without limitation Drawings or Specifications, if any), Contractor shall first be required to seek an informal resolution to the dispute. Contractor shall bear all costs incurred in giving notice. County will render a determination regarding the issue, which shall be final. If Contractor disagrees with County's decision, or if Contractor contends that County failed to provide a decision, Contractor's sole and exclusive remedy is to file a Claim in accordance with this Section. Contractor shall diligently prosecute the Disputed Work (as defined below) to final completion pending resolution of any Claim.

#### 5. Work Disputes

If a dispute arises under the Contract respecting the true value of any Work performed, the performance or implementation of Work required by Contract, any Work omitted, any extra Work that Contractor may be required to perform or time extensions, respecting the size of any payment to Contractor during the performance of Contract, or of compliance with Contract procedures, Contractor shall first be required to seek an informal resolution to the dispute. Contractor shall bear all costs incurred in giving notice. County will render a determination regarding the issue, which shall be final. If Contractor disagrees with County's decision, or if Contractor contends that County failed to provide a decision, Contractor's sole and exclusive remedy is to file a Claim. Contractor shall diligently prosecute the Disputed Work (as defined below) pending resolution of any Claim.

The claim notice and documentation procedure described in this Section applies to all claims and disputes arising under the Contract, including without limitation, any claim or dispute by any Subcontractor or material supplier.

A voucher, invoice, proposed change, application for payment, cost proposal, request for information ("RFI"), substitution request, Change Order request, or other routine or authorized form of request for payment is not a claim under the Contract. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a Claim under the Contract by submitting a separate Claim in compliance with claim submission requirements.

The provisions of this Section survive termination, breach or completion of the Contract, and constitute a claims procedure by agreement under Government Code Section 930.2. Contractor shall bear all costs incurred in the preparation and submission of a Claim.

#### 6. Informal Dispute Resolution Procedure

Should any clarification, determination, action or inaction by County or County consultants, Work, or any other event, in the opinion of Contractor, exceed the requirements of or not comply with the Contract, or otherwise result in Contractor seeking additional compensation in time or money for any reason (collectively "Disputed Work"), then Contractor, before commencing the Disputed Work, or within fourteen (14) days after Contractor's first knowledge of the Disputed Work, whichever is earlier, shall give County written notice thereof and a cost proposal for the Disputed Work stating clearly and in

detail its objection and reasons for contending the Work or interpretation is outside the requirements of the Contract. Contractor and County shall make good faith attempts to resolve informally any and all such issues, claims and/or disputes. If a written notice and cost proposal for the Disputed Work is not issued within this time period, or if Contractor proceeds with the Disputed Work without first having given the notice required by this Section, Contractor shall waive its rights to further claim on the specific issue.

County will review Contractor's timely notice and cost proposal for Disputed Work and provide a decision within thirty (30) days. If, after receiving the decision, Contractor disagrees with it or still considers the Disputed Work required of it to be outside of the requirements of the Contract, it shall so notify County, in writing, within fourteen (14) days after receiving the decision by submitting a Notice of Potential Claim, that a formal Claim will be issued. Within thirty (30) days of receiving the decision, Contractor shall submit its Claim in the form specified herein and all arguments, justification, cost or estimates, schedule analysis, and detailed documentation supporting its position. Contractor's failure to furnish notification within fourteen (14) days and all justifying documentation within thirty (30) days will result in Contractor waiving its right to the subject Claim. Claims or claim updates stating that damages, total damages (direct and indirect), schedule input and/or any time extension will be determined at a later date shall not comply with this Section and shall result in Contractor waiving its Claim(s).

Claims shall be calculated in the same manner as Change Orders. EXCEPT WHERE PROVIDED BY LAW, OR ELSEWHERE IN THIS CONTRACT (IF APPLICABLE), COUNTY SHALL NOT BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES, AND CLAIMS SHALL NOT INCLUDE SPECIAL OR CONSEQUENTIAL DAMAGES.

If Contractor fails to file a Claim within the time required, then Contractor's sole remedy is to file an application for leave to file a late claim pursuant to Government Code section 930.4.

## 7. Claim Format

All Claims must be in writing and sent to County by registered or certified mail, return receipt requested. The Claim submitted by Contractor shall include, but not be limited to, the following: (a) A cover letter and certification under penalty of perjury of the accuracy of the contents of the Claim; (b) A summary of the Claim including underlying facts, entitlement, schedule analysis, quantum calculations and Contract provisions supporting relief; (c) A list of documents relating to the Claim including Specifications, Drawings, Requests for Clarification/RFIs, schedules, notices of delay, cost calculations and spreadsheets, and any other relevant documents; (d) A chronology of events and correspondence; (e) An analysis of Claim merit; (f) An analysis of Claim cost; and (g) All supporting documents referenced in (c).

## 8. Reserved

## 9. Exclusive Remedy

Contractor's performance of its duties and obligations specified in this Section and submission of a Claim as provided in this Section is Contractor's sole and exclusive remedy for disputes of all types pertaining to the payment of money, extension of time, the adjustment or interpretation of Contract terms or other contractual or tort relief arising from Contract. This exclusive remedy and the limitation of liability (expressed herein and

elsewhere throughout Contract) apply notwithstanding the completion, termination, suspension, cancellation, breach or rescission of the Work or Contract, negligence or strict liability by County, its representatives, consultants or agents, or the transfer of Work or the Project to County for any reason whatsoever. Contractor waives all claims of waiver, estoppel, release, bar, or any other type of excuse for non-compliance with the claim submission requirements. Compliance with the notice and claim submission procedures described is a condition precedent to the right to commence litigation, file a Government Code Claim, or commence any other legal action. If Contractor fails to raise any claim(s) or issue(s) in a timely protest and timely claim, then Contractor may not thereafter assert such claims(s) or issue(s) in any Government Code Claim, subsequent litigation, or legal action. County shall not be deemed to have waived any provision, if at County's sole discretion, a claim is accepted in a manner not in accord with this Section.

#### 10. Actions by County Upon Receipt of Claim

Upon receipt of a Claim, County shall conduct a reasonable review of the Claim and, within a period not to exceed forty-five (45) days, shall provide Contractor a written statement identifying what portion of the Claim is disputed and what portion is undisputed.

County and Contractor may, by mutual written agreement, extend the time periods provided in this Section.

If County needs approval from the Board of Supervisors to provide Contractor a written statement identifying the disputed portion and the undisputed portion of the Claim, and the Board does not meet within the forty-five (45) days or within the mutually agreed to extension of time following receipt of a Claim, County shall have up to three (3) days following the next duly publicly noticed meeting of the governing body after the forty-five (45) day period, or extension, expires to provide Contractor a written statement identifying the disputed portion and the undisputed portion.

#### 11. Payment or Failure to Pay Undisputed Portion of Claim

Any payment due on an undisputed portion of the Claim shall be processed and made within sixty (60) days after County issues its written statement. If County fails to issue a written statement within the time required, the Claim will be deemed rejected in its entirety. A Claim that is denied by reason of County's failure to have responded to the Claim, or its failure to otherwise meet the time requirements of this Section, shall not constitute an adverse finding with regard to the merits of the Claim or the responsibility or qualifications of Contractor.

#### 12. Contractor's Dispute of Written Statement

If Contractor disputes County's written statement, or if County fails to respond to a Claim issued pursuant to this Section within the time prescribed, Contractor may within thirty (30) days from the date of County's response or, if no response was provided, from the date a response was due, demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered or certified mail, return receipt requested, County shall schedule a meet and confer conference to be held within thirty (30) days to further discuss settlement of the dispute.

#### 13. Written Statement by County After Meet and Confer Conference

Within ten (10) business days following the conclusion of the meet and confer conference or if no meet and confer conference was requested, by the conclusion of the meet and confer period, if the Claim or any portion of the Claim remains in dispute, County shall provide Contractor a written statement identifying the portion of the Claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the Claim shall be processed and made within sixty (60) days after County issues its written statement.

#### 14. Nonbinding Mediation

Following the conclusion of the meet and confer process, Contractor must within thirty (30) days identify in writing any portion of the Claim remaining in dispute for submission to nonbinding mediation. Contractor's failure to identify a portion of the Claim remaining in dispute shall be deemed an agreement on Contractor's part with County's written statement. County and Contractor shall share the associated costs of the nonbinding mediation equally. County and Contractor shall mutually agree to a mediator within ten (10) business days after the disputed portion of the Claim has been identified in writing. If the parties cannot agree upon a mediator, each party shall select a mediator and those mediators shall select a qualified neutral third party to mediate with regard to the disputed portion of the Claim. Each party shall bear the fees and costs charged by its respective mediator in connection with the selection of the neutral mediator.

Mediation includes any nonbinding process, including, but not limited to, neutral evaluation or a dispute review board, in which an independent third party or board assists the parties in dispute resolution through negotiation or by issuance of an evaluation. Any mediation utilized shall conform to the timeframes in this Section.

If mediation is unsuccessful, Contractor may pursue other remedies available at law as to the parts of the Claim remaining in dispute. For Claims involving disputed amounts below three hundred seventy-five thousand dollars (\$375,000), County and Contractor agree that resubmission, review and informal resolution of the Claim pursuant to Public Contract Code Section 20104 et seq. shall not be required.

Unless otherwise agreed to by County and Contractor in writing, the mediation conducted pursuant to this Section shall excuse any further obligation under Section 20104.4 of the Public Contract Code to mediate after litigation has been commenced.

The Claim resolution procedures in this Section do not preclude County from requiring arbitration of disputes under private arbitration or the Public Works Contract Arbitration Program, if mediation does not resolve the parties' dispute. County may initiate arbitration by submitting a Request for Arbitration to Contractor in writing. Failure of Contractor to participate in required arbitration shall be deemed a waiver of the amounts in dispute.

#### 15. Amounts Not Paid Timely

Amounts not paid in a timely manner as required by this Section shall bear interest at 7 percent per annum from the date payment was due.

#### 16. Subcontractor Claims

If a Subcontractor or a lower tier subcontractor lacks legal standing to assert a Claim against County because privity of contract does not exist, Contractor may present to

County a Claim on behalf of a Subcontractor or lower tier subcontractor. A Subcontractor may request in writing, either on its own behalf or on behalf of a lower tier subcontractor, that Contractor present a Claim for Work which was performed by the Subcontractor or by a lower tier subcontractor on behalf of the Subcontractor. The Claim submitted by the Subcontractor shall comply with the requirements of the Section above. Within forty-five (45) days of receipt of this written request, Contractor shall notify the Subcontractor in writing as to whether Contractor presented the Claim to County and, if Contractor did not present the Claim, provide the Subcontractor with a statement of the reasons for not having done so. Nothing in this Section shall be deemed to make the Subcontractor or lower tier subcontractor a third-party beneficiary of this Contract, require payment of any funds to the Subcontractor or lower tier subcontractor by County, or excuse any noncompliance with the stop payment requirements set forth in the Civil Code Section 9000 et seq. If County elects to make payment directly to the Subcontractor or lower tier subcontractor whose Claim for Work is presented to County by Contractor, Contractor waives and releases any Claim it may have for funds paid to the Subcontractor or lower tier subcontractor by County.

#### 17. Compliance

The provisions of this Section constitute a non-judicial Claim settlement procedure that, pursuant to Section 930.2 of the California Government Code, shall constitute a condition precedent to submission of a valid Claim under the California Government Code. Contractor shall bear all costs incurred in the preparation, submission and administration of a Claim. Any Claims presented in accordance with the Government Code must affirmatively indicate Contractor's prior compliance with the Claims procedure herein and the previous dispositions of the Claims asserted. Pursuant to Government Code Section 930.2, the one (1) year period in Government Code Section 911.2 shall be reduced to one hundred and fifty (150) days from either accrual of the cause of action, substantial completion or termination of the Contract, whichever occurs first; in all other respects, the Government Code shall apply unchanged.

Failure to submit and administer Claims as required in this Section shall waive Contractor's right to Claim on any specific issues not included in a timely submitted Claim. Claim(s) or issue(s) not raised in a timely protest and timely Claim submitted under this Section may not be asserted in any subsequent meet and confer conference, mediation, arbitration, Government Code Claim, or legal action.

County shall not be deemed to waive any provision under this Section, if at County's sole discretion, a Claim is administered in a manner not in accord with this Section. Waivers or modifications of this Section 4.4 may only be made through a signed Change Order approved as to form by legal counsel for both County and Contractor; oral or implied modifications shall be ineffective.

#### 18. Filing of Government Code Claims

If Contractor still remains unsatisfied and desires to preserve its right to pursue the matter further, Contractor must then file a Claim with County, pursuant to Government Code Sections 900 et seq. or Sections 910, et seq.

### **10. Furnishing Materials**

The Contractor's attention is directed to Section 6-2.03, "Department-Furnished Materials", of the Standard Specifications and these Special Provisions.

Materials to be furnished by the Owner are NONE.

California Public Contract Code prohibits surface mining operations which are subject to the Surface Mining and Reclamation Act of 1975 (SMARA) from selling California mined construction material to a local agency unless the operation is identified in a list referred to as the 3098 List. Contractor shall provide to the Engineer, satisfactory evidence that all California surface mined minerals (including but not limited to aggregate, sand, gravel, crushed stone, road base, fill materials, and any other mineral materials) furnished by Contractor for this project are from operations appearing on the 3098 List. The list can be viewed at the Department of Conservation's Office of Mine Reclamation (OMR) website at [www.conservation.ca.gov/OMR/ab\\_3098\\_list/index.htm](http://www.conservation.ca.gov/OMR/ab_3098_list/index.htm).

## **11. Stockpiling and Equipment Storage**

Stockpile and equipment storage locations shall be selected by the Contractor, subject to written approval by the Engineer. When any material or equipment is to be stored outside the highway or street right of way, or other County property, the Contractor shall first obtain a written permit from the property owner on whose property the storage is to be made; and the Contractor shall file with the Engineer said permit, or a certified true copy thereof, together with a written release from the property owner absolving the County from any and all responsibility in connection with the storage of materials or equipment on said property.

The Contractor shall leave all storage areas in a neat and clean condition, satisfactory to the Engineer, and in accordance with the provisions of the storage permits. The Contractor shall create no attractive nuisance. All storage areas shall be locked and secured when not in active use. The County is not responsible for any damage to or loss of equipment, materials, or other items stored on the project site.

Full compensation for conforming to the requirements of this provision shall be considered as included in the contract price paid for the various items of work, and no additional compensation will be allowed therefor.

## **12. Public Safety**

As modified and supplemented by these special conditions the Contractor shall provide for the safety of traffic and the public in conformance with the provisions in Section 7-1.04, "Public Safety," of the Standard Specifications and these special provisions.

The Contractor shall install temporary railing (Type K) between a lane open to public traffic and an excavation, obstacle or storage area when the following conditions exist:

- A. Excavations - The near edge of the excavation is 12 feet or less from the edge of the lane, except:
  - 1. Excavations covered with sheet steel or concrete covers of adequate thickness to prevent accidental entry by traffic or the public.
  - 2. Excavations less than one foot deep.
  - 3. Trenches less than one foot wide for irrigation pipe or electrical conduit, or excavations less than one foot in diameter.



4. Excavations parallel to the lane for the purpose of pavement widening or reconstruction.
  5. Excavations in side slopes, where the slope is steeper than 4:1 (horizontal: vertical).
  6. Excavations protected by existing barrier or railing.
- B. Temporarily Unprotected Permanent Obstacles -The work includes the installation of a fixed obstacle together with a protective system, such as a sign structure together with protective railing, and the Contractor elects to install the obstacle prior to installing the protective system; or the Contractor, for the Contractor's convenience and with permission of the Engineer, removes a portion of an existing protective railing at an obstacle and does not replace such railing complete in place during the same day.
- C. Storage Areas-Material or equipment is stored within 12 feet of the lane and the storage is not otherwise prohibited by the provisions of the Standard Specifications and these special provisions.

The approach end of temporary railing (Type K), installed in conformance with the provisions in this section "Public Safety" and in Section 7-1.04, "Public Safety," of the Standard Specifications, shall be offset a minimum of 15 feet from the edge of the traffic lane open to public traffic. The temporary railing shall be installed on a skew toward the edge of the traffic lane of not more than one foot transversely to 10 feet longitudinally with respect to the edge of the traffic lane. If the 15-foot minimum offset cannot be achieved, the temporary railing shall be installed on the 10 to 1 skew to obtain the maximum available offset between the approach end of the railing and the edge of the traffic lane, and an array of temporary crash cushion modules shall be installed at the approach end of the temporary railing.

When traffic cones or delineators are used to delineate a temporary edge of a traffic lane, the line of cones or delineators shall be considered to be the edge of the traffic lane, however, the Contractor shall not reduce the width of an existing lane to less than 10 feet without written approval from the Engineer.

When work is not in progress on a trench or other excavation that required closure of an adjacent lane, the traffic cones or portable delineators used for the lane closure shall be placed off of and adjacent to the edge of the traveled way. The spacing of the cones or delineators shall be not more than the spacing used for the lane closure.

Suspended loads or equipment shall not be moved nor positioned over public traffic or pedestrians.

Full compensation for conforming to the provisions in this section "Public Safety," including furnishing and installing temporary railing (Type K) and temporary crash cushion modules, shall be considered as included in the contract prices paid for the various items of work involved and no additional compensation will be allowed therefor.

### **13. Progress Schedule**

Attention is directed to Section 8-1.02C (5), "Baseline Schedule", of the Standard Specifications and these Special Provisions.

The **Contractor shall, within seven (7) working days after receiving the Notice to Proceed and prior to starting work, submit a schedule of proposed operations to the County Project Manager/Engineer for approval.** The schedule shall outline the Contractor's proposed Order of Work, including start and completion dates of each salient feature of the work in procurement of materials, equipment, amenities, furnishings, plants, etc. per the construction documents. Upon

approval of this schedule by the Engineer, the Contractor may begin work.

The progress schedule submitted shall be consistent in all respects with the time and order of work requirements of the Contract. Project schedule shall include work complete in Gantt chart format, which includes work complete and milestones for work to be completed.

As the work progresses and upon written request by the Engineer, the Contractor shall submit within five (5) working days of the date of the written request a supplementary schedule consistent with the actual progress of the work.

Subsequent to the time that submittal of a progress schedule is required in accordance with these specifications, no progress payments will be made for any work until a satisfactory schedule has been submitted to the Engineer.

If any change in the progress schedule is to be made or becomes necessary due to unforeseen circumstances, the Contractor shall so notify the Engineer immediately in writing and may, upon approval by the Engineer, change the Order of Work and/or schedule of operations.

Attention is directed to "Maintaining Traffic" of these Special Provisions regarding the work hours for this project.

Work scheduled on Saturdays, Sundays or Holiday must receive prior approval from the Engineer.

#### **14. Survey Staking**

Setting stakes shall be in accordance with Section 5-1.26, "Construction Surveys", of the Standard Specifications and these Special Provisions.

All survey staking will be performed by the Contractor.

The expense incurred in replacing said stakes, which the Contractor may have failed to preserve, including travel time, shall be borne by the Contractor.

The Contractor is required to examine carefully all construction stakes and by visual inspection of stakes and string lines, forms, and headers set therefrom, interpret and confirm that the line and grade information is in accordance with the Plans. If there is an apparent error or lack of understanding as to what is meant by the staking, the Contractor shall request an interpretation of staking from the Engineer before doing any work.

#### **15. Trench Plating**

All unrestored voids, trenches, holes, excavations, etc., that are in the pedestrian or traveled way shall be protected through the use of adequately designed barricades and structural steel plates that will support legal vehicle loads.

All plates shall provide complete coverage to prevent any person, bicycle, motorcycle or motor vehicle from being endangered due to plate movement causing separations or gaps. Plates shall be installed with anchors, with the plate surfaces reasonably smooth and all vertical edges transitioned with cold-mix.

Structural steel plates shall have a non-skid surface.

All structural steel plates placed over surface voids, such as trenches and other areas to be protected in the public right-of-way shall conform to the following:

- a. Owner's name shall be legible and permanently affixed on each plate.
- b. When steel plates are placed within the public right-of-way, the Contractor shall erect sign(s) in the immediate area of the trench plate(s) identifying its name with a 24-hour number. Minimum height of letters and numbers shall be two inches.
- c. The Contractor will immediately mobilize necessary personnel and equipment after being notified by the Engineer or the Owner's emergency services section of a repair need. This includes, but is not limited to, plate anchors, cold-mix, asphalt concrete to transition/ramp from the existing roadway or sidewalk to the plate surface and back down.
- d. Failure to respond to the emergency request within two hours will be grounds for Owner repairs that will be invoiced at double the actual cost including overhead or \$500 per incident, whichever is greater.
- e. Steel plates used for bridging must extend a minimum of 300 mm (12") beyond the edges of the trench.
- f. Steel plate bridging shall be installed to operate with minimum noise.
- g. The trench shall be adequately shored to support the bridging and traffic loads.
- h. Temporary paving with cold asphalt concrete shall be used to feather the edges of the plates, if Method (2) is used.
- i. Bridging shall be secured against displacement by using adjustable cleats, shims or other devices.

Transverse or longitudinal cuts in the right-of-way that cannot be properly completed within a work day shall be protected by structural steel plate bridging with a non-skid surface and shoring may be required to preserve unobstructed traffic flow.

As required by the Owner, structural steel plate bridging and shoring shall be installed using either Method (1) or (2):

Method (1) (For posted speeds greater than 45 mph):

The pavement shall be cold planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate. An alternate method may be used as approved by the Engineer.

Method (2) (For posted speeds equal to or less than 45 mph):

Approach plate(s) and ending plate(s) (if longitudinal placement) shall be attached to the roadway by a minimum of 2 dowels pre-drilled into the corners of the plate and 2" into the pavement. Subsequent plates are to be butted evenly (both horizontally and vertically) to each other(s). Fine graded asphalt concrete shall be compacted to form ramps, maximum

slope 8.5% with a minimum 12" taper to cover all edges of the steel plates. When steel plates are removed, the dowel holes in the pavement shall be backfilled with either graded fines of asphalt concrete mix, concrete slurry or an equivalent slurry satisfactory to the Engineer.

The Contractor shall be responsible for the maintenance of the structural steel bridging plates, shoring and asphalt concrete ramps.

Unless specifically noted, structural steel plate bridging should not exceed 4 consecutive working days in any given week, unless otherwise approved by the Engineer. Backfilling of excavations shall be covered with a minimum 3" temporary layer of cold asphalt concrete.

The following table shows the required minimal thickness of steel plate bridging required for a given trench width:

| Trench Width (Feet) | Minimum Plate Thickness (Inch) |
|---------------------|--------------------------------|
| 1.0                 | 1/2                            |
| 1.5                 | 3/4                            |
| 2.0                 | 7/8                            |
| 3.0                 | 1                              |
| 4.0                 | 1-1/4                          |

Note: For spans greater than 4 feet, a structural design shall be prepared by a Registered Civil Engineer and approved by the Owner.

Structural steel plate bridging shall be designed for HS 20-44 truck loading per Caltrans Bridge Design per Specifications Manual. The Contractor shall maintain on the steel plate a non-skid surface having a minimum coefficient of friction equivalent to 0.35 as determined by either California Test Method 342 ANSI/ASTM 3-274.

A "ROUGH ROAD" sign (W33) with black lettering on an orange background may be used in advance of structural steel plate bridging.

Full compensation for conforming to the requirements of this provision shall be considered as included in the contract price paid for the various items of work and no additional compensation will be allowed therefor.

## **16. Tests of Materials**

The following conditions and materials, as related to this Contract, will be tested by the Owner in addition to the required manufacturers or other tests specified: relative compaction, concrete.

**The Contractor shall give the Engineer written notice seventy-two (72) hours before the day on which testing services will be required.**

Tests will be made by the Owner in such number and at such locations as deemed necessary by the Engineer to ensure compliance with the specifications; however, the costs of retesting any portion of the work which has failed the initial tests taken by the Owner shall be borne by the Contractor.

## **17. Federal and State Environmental Compliance**

The Owner reserves the right to terminate, amend, or modify at any time, any item or items of work as necessary to comply with either State or Federal environmental requirements enacted after the Contract has been awarded.

If the Contract is amended or modified by contract change order as herein provided, and such changes result in additional or new items of work, the Contractor shall receive compensation for direct costs incurred in accordance with either Section 4-1.05, "Changes and Extra Work", or Section 9-1.04, "Force Account", of the Standard Specifications.

The Owner reserves the right to terminate all work under this Contract, if in the opinion of the Engineer such termination is necessary in order to comply with either State or Federal environmental requirements. In the event all work is terminated as a result of such a determination by the Engineer, the Contractor shall receive compensation for the total actual and direct costs incurred to the date of said termination, and in addition a markup of twenty percent (20%) will be paid. Such payment shall constitute full compensation for all work embraced by this Contract, and no additional compensation will be allowed therefore.

## **18. Control of Work**

Order of work shall conform to Section 5, "Control of Work," of the Standard Specifications and these Special Provisions.

Prior to commencement of any work on the project, a Preconstruction Conference will be held at the County Engineer's office for the purpose of review and discussion of the project, progress schedule and construction procedures. At the discretion of the Engineer, periodic meetings, involving project personnel (Contractor, Utility Companies, County, or other), will be held for the purpose of coordinating project activities.

## **19. Dust Control**

Throughout all phases of construction, including suspension of work, and until final acceptance of the project, the Contractor shall keep the work site clean and free from rubbish and debris. The Contractor shall also abate dust nuisance by cleaning or sweeping and sprinkling with water or other means as necessary. The use of water resulting in mud on public streets will not be permitted as a substitute for cleaning, sweeping, or other methods.

Full compensation for furnishing and applying water for dust control, including that caused by public traffic, shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed, therefore.

## **20. Maintaining Traffic**

Attention is directed to Section 7-1.03, "Public Convenience"; Section 7-1.04, "Public Safety"; and Section 12, "Temporary Traffic Control", of the Standard Specifications; and these Special Provisions.

The Contractor shall provide traffic control and warning signs and safety devices in accordance with "Part 6 - Temporary Traffic Control" of the "California Manual on Uniform Traffic Control

Devices for Streets and Highways", dated 2009 and said Section 12 of the Standard Specifications. Warning signs and safety devices shall be supplied by the Contractor. The above-referenced manual is available from the State Department of Transportation.

Whenever construction activity will disrupt or impede access to any business, the Contractor shall, by written notice, inform each affected business of the nature and expected duration of the disruptive construction activity. Such written notice shall be delivered to each affected business a minimum of two weeks prior to the start of the disruptive construction activity.

Notification:

Permittee agrees to indemnify, hold harmless and defend the County and each of its officers and employees from any liability or responsibility for accident, loss or damaged to persons or property arising by reason of the work done by permittee, or permittee's agents, employees or representatives.

Whenever construction activity will disrupt or impede access to any residence/business, the contractor shall inform each affected residence/business by written notice the nature and expected duration of the disruptive construction activity. Such written notice shall be delivered to each affected residence/business a minimum of two (2) weeks prior to the start of the disruptive construction activity.

Devices:

Actual work area shall be protected with either orange reflectorized post delineators or by barricades sufficient in number to prevent entry of both vehicles and pedestrians except as may be noted elsewhere.

Flagging:

Flagging operation shall use alternate one-way movement to pass traffic through the construction area.

Traffic shall be controlled by flaggers as required. Flaggers shall be in constant communication with each other during the flagging operation. Advance flaggers shall be positioned upstream to warn traffic when queues develop. Additional flaggers may be required at intersections.

Where the one-lane section is short enough so that each end is visible from the other end, traffic will be controlled by means of a flagger at each end of the section. They should be able to communicate with each other verbally or by means of signals. These signals should not be such as to be mistaken for flagging signals. Where the end of one-way section is not visible from the other end, the flaggers shall maintain contact by means of radio or field telephones so that a flagger may know when to allow traffic to proceed into the section.

Flaggers shall be positioned near crest of hill allowing flaggers sufficient visibility of approaching traffic. Flaggers shall be positioned so that they are easily visible to approaching traffic.

Access:

Emergency vehicle access shall be maintained at all times.

Adequate provisions shall be made for pedestrian traffic.

Adequate sight distance shall be maintained at all intersections in the vicinity of the work zone. If sight distance is affected by the traffic control, the contractor shall provide adequate distance per the County of San Diego Public Road Standards. The use of mirrors, or such devices, is not

acceptable as an alternative to providing adequate sight distance.

General:

Contractor shall be responsible for supplying and maintaining all traffic control devices for both the construction area and the detour.

The Contractor shall be responsible for supplying, installing and maintaining all traffic control devices as shown on the plan along with additional traffic control devices that may be required to ensure safe movement of traffic and pedestrians through work area.

The provisions of this section may be modified or altered if, in the opinion of the Engineer, public traffic will be better served, and the work expedited. Said modifications or alterations shall not be adopted until approved in writing by the Engineer.

Any open trenches within the construction area shall be adequately protected with barricades and spoil piles to prevent entry of vehicles and pedestrians, or as indicated in the plans.

All trenches shall be back-filled and paved or plate-bridged overnight. All temporary steel plate bridging shall have non-skid surfaces. Non-skid surfaces on the temporary steel plate bridging as well as the method of installing the temporary steel plate bridging and shoring shall be as specified in Section 602.1, "Temporary Steel Plate Bridging -- With a Non-Skid Surface" of the most current Caltrans Encroachment Manual. Unless approved by the County Inspector, use of steel plate bridging shall not exceed 4 consecutive working days in any given week. At the end of every work day, steel plate bridging shall not exceed 50 feet in length, unless approved by the County Inspector. Steel plates shall have AC ramps on all edges. Open trenches are not allowed during non-working hours.

All dirt and debris shall be removed from the roadway each day before completion of work. Street must be maintained in drivable condition at all times. All dirt and debris removed shall be legally disposed of at an appropriate off-site location. Full compensation for dirt and debris removal and disposal, shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefore.

All advance warning signs, delineators, and barricades shall be removed from the roadway at the end of work each day (except W20-1 signs, if plate-bridging overnight.)

The Contractor is to replace roadway and all signing to normal conditions at the completion of work.

Personal vehicles of the Contractor's employees shall not be parked on the traveled way at any time, including any section closed to public traffic.

Lane closures shall conform to the provisions of the Standard Specifications. The lane or lanes to be closed shall be as approved by the Engineer. The use of reflective traffic delineators to direct traffic away from excavations shall be considered as a lane closure.

The provisions in this section may be modified or altered if, in the opinion of the Engineer, public traffic will be better served, and work expedited. Said modifications or alterations shall not be adopted until approved in writing by the Engineer.

Full compensation for conforming to the requirements of these Special Provisions, and said Sections 7 and 12 of the Standard Specifications, shall be considered as included in the contract

lump sum price paid for Traffic Control, and no additional compensation will be allowed therefor.

## **21. Sound Control Requirements**

Sound control shall conform to the provisions in Section 14-8, "Noise and Vibration", Subsection 14-8.02 "Noise Control" of the Standard Specifications and these Special Provisions.

The noise level from the Contractor's operations shall conform to Chapter 4 of Division 6 of Title 3 of Section 1 (commencing with Section 36.410) of San Diego County Code relating to noise control and abatement as added by Ordinance No. 9962 (New Series). This is available at: <http://www.sdcounty.ca.gov/dplu/docs/NO.pdf>.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefore.

## **22. Biological Resources**

### **Environmental Training:**

Preconstruction worker environmental awareness training for construction crews to address sensitive resources that occur or have the potential to occur in the project area. Training is estimated to last one hour and will be held during the preconstruction meeting. Supervising representatives of all trades and all subcontractors must attend. Supervisors will be responsible for training each worker before they begin working on the site. Training will cover all mitigation measures included in the proposed project's Mitigation Monitoring and Reporting Program (MMRP). The County will provide the training at no additional cost to the Contractor beyond the scope of work in the construction documents.

### **Ground Disturbing Activities:**

The Contractor shall notify the County Project Manager of the schedule for and duration of all ground-disturbing activities a minimum of five working days prior to the start of ground-disturbing activities.

### **Vegetation Removal and Ground-Disturbing Activities:**

The Contractor shall avoid vegetation removal and ground-disturbing activities during the bird breeding season (February 15 to September 1) to mitigate impacts on nesting birds and raptors. If vegetation removal and/or ground-disturbing activities cannot be avoided during this time period, a nesting bird survey shall be conducted no more than 72 hours prior to vegetation removal and/or ground-disturbing activities by a qualified avian biologist through the entirety of the project area and required buffers zones (typically ranging from 300-feet to 900-feet, to be determined by the biologist). The biologist will be retained by the County at no additional cost to the Contractor beyond the scope of work in the construction documents. If the survey results are positive, an avoidance buffer around all active nests will be implemented during construction (typically ranging from 150-feet to 900-feet, to be determined by the qualified avian biologist). If the survey results are negative, monitoring may not be required.

If monitoring is required, nest monitoring shall occur for all active nests when construction activities are occurring adjacent to buffers. Monitoring will occur during at least the first 2 days of initial construction activities to ascertain if the buffer is sufficient. Buffer expansions will be implemented if nest disturbance is noted during monitoring. Upon establishing sufficient



avoidance of nest disturbance ongoing monitoring shall be conducted at least once per week or more if determined necessary by the qualified avian biologist.

If the level of disturbance increases or significantly changes, full-time monitoring may be required again. Upon completion of work activities the monitor will survey for 1 hour on the day that work is complete. If nesting activity is observed at the nest, the nest will then be monitored on a weekly basis. If no activity is observed, the nest will be monitored the following day for 1 hour to determine nest status.

For active nests outside of construction activities and buffers no nest monitoring is required.

If construction is delayed due to monitoring requirements an appropriate time extension will be allowed and the Contractor shall not be assessed liquidated damages for delay in completion of the project, when such delay was caused by monitoring requirements.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

## **23. Cultural Resources**

### **Archeological Monitoring:**

A qualified archaeologist shall observe all ground-disturbing activities related to the Contract. The County will retain the archeologist at no additional cost to the Contractor beyond the scope of work in the construction documents. The following measures shall be implemented:

- a) All proposed ground disturbance, including grading and excavation, will be monitored by a qualified archaeologist(s) per the County.
- b) Prior to the start of construction, a monitoring plan will be prepared with procedures to follow in the event of an unanticipated discovery, and reporting requirements.
- c) The archaeologist shall attend the pre-construction meeting to inform all personnel involved with the project of the possibility of archaeological materials being encountered during construction.
- d) If intact subsurface deposits are identified during construction, the archaeologist will be authorized to divert construction activities away from the find and will be given sufficient time to investigate and determine significance. No soil will be exported off site until a determination can be made regarding the significance of the resource specifically if Native American resources are encountered.
- e) Recovered items will be treated and curated in accordance with current professional standards per the qualified archeologist.
- f) The archeologist will provide a final report of the monitoring program and its results and will provide interpretations of any recovered cultural materials.

### **Protection of Human Remains:**

Should human remains be identified during ground-disturbing activities related to the project, the following procedures shall be followed:

- a) No further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:
  - 1) The County Project Manager is notified, and
  - 2) The County Coroner is contacted to determine that no investigation of the cause of death is required. If the Coroner determines the remains are Native American, then the Coroner will contact the Native American Heritage Commission (NAHC) to follow

proper procedures.

- b) Under certain conditions, the County or its authorized representative will rebury the Native American human remains and associated grave goods on the property in a location not subject to further disturbance.
- c) Ground penetrating radar (GPR) shall be used as part of the human remains survey and canine forensics shall be considered.
- d) Human remains are defined as:
  - 1) Fragmented or disarticulated human bone with no associated artifacts or grave goods.
  - 2) Cremations, including the soil surrounding the deposit.
  - 3) Interments, including the soils surrounding the deposit.
  - 4) Associated grave goods.

In consultation among the County archaeologist, project archaeologist, and Native American monitor, additional measures (e.g., wet-screening of soils adjacent to the deposit or on site) may be required to determine the extent of the burial.

#### Native American Monitoring:

A Tribal member shall monitor all project-related ground disturbance. The County will retain the monitor at no additional cost to the Contractor beyond the scope of work in the construction documents.

If construction is delayed due to monitoring requirements an appropriate time extension will be allowed and the Contractor shall not be assessed liquidated damages for delay in completion of the project, when such delay was caused by monitoring requirements.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

#### **24. Best Management Practices (BMPs)**

The Contractor shall implement the following BMPs:

- a) Implement appropriate construction scheduling and sequencing to reduce the amount and duration of soil exposed to vehicle tracking.
- b) Limit vehicle speeds to 5 miles per hour in the project area.
- c) Conduct regular watering of roadways to prevent and alleviate dust generation, but do not apply in quantities that would allow for water ponding.
- d) Fence/flag and maintain limits of construction areas throughout the construction activities.
- e) Implement appropriate stormwater BMPs during the rainy season (October 1 to April 30) to reduce erosion and control siltation. BMPs may include the use of silt fences, fiber rolls, and organic soil tackifiers (e.g., guar gum).
- f) Require equipment to be maintained in good tune and reduce excessive idling time.
- g) Utilize alternative fueled equipment and vehicles, such as renewable diesel, renewable natural gas, compressed natural gas, or electric, when feasible.
- h) Require older equipment be retrofitted with advanced engine controls, such as diesel particulate filters, selective catalytic reduction, or cooled exhaust gas recirculation, where feasible.
- i) Make efficient use of finite natural resources. Use building and finishing products that contain locally sourced and recycled materials, where feasible.
- j) Recycle/reuse all construction and demolition debris to the extent feasible.

## **25. Highway Construction Equipment**

Attention is directed to Section 7-1.01O, "Vehicle Code", and Section 5-1.37B, "Load Limitations" of the Standard Specifications.

## **26. Payments**

Attention is directed to Section 9, "Payment" of the Standard Specifications and these Special Provisions.

In determining the partial payments to be made to the Contractor, only the following listed materials will be considered for inclusion in the payment as materials furnished but not incorporated in the work:

### **NOT APPLICABLE FOR THIS PROJECT**

The cutoff date for preparation of monthly estimates shall be at the close of work on the 20th day of the month; or if the 20th day of the month falls on a non-working day, at the close of work on the latest working day prior to the 20th day of the month; or on a date mutually agreed upon by the Contractor and the Engineer. The Department shall make monthly payments to the Contractor within 30 calendar days after the monthly estimate cutoff date.

When requested by the Engineer, the Contractor shall prepare and submit for approval a breakdown estimate covering each lump sum item. The sum of the items listed in the breakdown estimate shall equal the contract lump sum price or prices. An unbalanced breakdown estimate, providing for overpayment to the Contractor on items of work which would be performed first, will not be accepted. The breakdown estimate shall be approved by the Engineer before any partial payment estimate is prepared.

For the purpose of making partial payments pursuant to Section 9-1.06, "Partial Payments", of the Standard Specifications, the amount set forth for the contract items of work hereinafter listed shall be deemed to be the maximum value of the contract item of work which will be recognized for progress payment purposes:

Partial payment to contractor shall be based on supplier's invoice to contractor. Contractor shall submit materials invoice and storage location within California with progress payment for reimbursement.

After acceptance of the contract pursuant to Section 5-1.46, "Final Inspection and Contract Acceptance", of the Standard Specifications, the amount, if any, payable for a contract item of work in excess of the maximum value for progress payment purposes hereinabove listed for the item, will be included for payment in the first estimate made after acceptance of the Contract.

## **27. Disposing of Materials**

The Contractor shall be responsible for disposal of brush, trash, debris, and surplus materials in a safe and legal manner. Unless otherwise specified, said materials shall be disposed of outside the project limits in accordance with Section 5-1.20B(4), "Contractor – Property Owner Agreement", of the Standard Specifications. The Contractor shall recycle all materials to the extent feasible.

## **28. Trade Names and Alternatives**

Attention is directed to Section 6-3.02, "Specific Brand or Trade Name and Substitutions", of the Standard Specifications and these Special Provisions.

Whenever any material, article, or process is indicated or specified by trade, patent, or proprietary name or name of manufacturer or specified by a list of trade, patent, or proprietary names or names of manufacturers, such specifications for material, article or process, unless marked "no substitution", shall be deemed to be followed by the words "or approved equal".

## **29. Subsurface Investigation**

Attention is directed to Section 2-1.30, "Job Site and Document Examination", of the Standard Specifications.

The following reports are available for review at and may be downloaded from the County of San Diego BuyNet website at <http://buynet.sdcountry.ca.gov>. These reports are provided for informational purposes only and are not part of this Contract:

### **Geotechnical Report**

## **30. Inspections & Special Inspections**

The Contractor shall coordinate, schedule and facilitate all required inspections and special inspections. The Contractor shall provide the Engineer with a minimum of 72 hours advance notice of all inspections and special inspections.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

## **31. Stormwater Quality Management Plan (SWQMP)**

The Contractor shall follow the Stormwater Quality Management Plan (SWQMP) included in Part 5 of the Bid Documents. The Contractor shall ensure regular site inspections are performed by a Qualified Stormwater Planner (QSP) and that erosion control and stormwater best management practices meet all current regulations and are regularly evaluated and reported upon.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

## **32. As-Built Construction Documents (also known as Record Documents)**

The Contractor shall provide complete and accurate as-built documents including, but not limited to, plans and specifications for all improvements performed under the Contract within fifteen (15)

days of notice of substantial completion.

Full compensation for conforming to the requirements of this section shall be considered as included in the contract prices paid for the various items of work, and no additional compensation will be allowed therefor.

### **33. Field Orders**

Field orders are to facilitate decisions made in the field by the Resident Engineer and reduce approval delays.

The Resident Engineer is authorized to approve field orders for changes necessary for the successful completion and function of the project within the dollar limit established in the bid schedule.

The Resident Engineer will prepare a field order form for each approved change and submit such form with the next monthly progress payment. The field order form shall describe the reason the change is required, the work to be performed and the amount of compensation to be paid the Contractor. It shall also contain the Contractor's signature acknowledging that the compensation constitutes full payment for the work to be performed.

### **34. Public Disclosure of Gifts and Campaign Contributions**

NOTE: This Special Condition does not apply to the initial contract for the project. It only applies to Contract Change Orders that require Board of Supervisor approval.

- a. San Diego County Charter Section 1000.1 requires that when a service contract is to be considered by the Board of Supervisors for approval, amendment, or extension, the Contractor and the registered lobbyists of the Contractor shall make the following disclosures:
  - 1) All gifts reportable pursuant to the provisions of the Political Reform Act to any member of the Board of Supervisors or to the immediate family of such member during the year preceding the date of the disclosure.
  - 2) All federal, State and local campaign contributions made to any member of the Board of Supervisors or his or her controlled committees during the year preceding the date of the disclosure.
  - 3) Or a disclosure that there are no gifts or campaign contributions to disclose.
- b. The Contractor's disclosure shall include gifts and campaign contributions from any natural person or entity constituting the Contractor and from any principal owner and principal officer of the Contractor.
- c. Contractor shall submit a written certification that the disclosure requirements have been complied with.
- d. This Clause does not apply to contracts between the County of San Diego and other governmental entities.

- e. The disclosure shall be made at least four (4) calendar days prior to the date of the meeting of the Board of Supervisors at which the approval, amendment, or extension is to be considered by the Board.
- f. The required written disclosure shall be filed with the Clerk of the Board of Supervisors, on a form prescribed by the Clerk. The Clerk of the Board shall make all disclosures available to the public on the County's Internet site after they are filed with the Clerk and prior to the day on which the Board acts on the service contract.
- g. Supplemental Disclosures. Gifts or campaign contributions made subsequent to the required written disclosure, but prior to the Board's decision, and any gift or campaign contribution inadvertently not included in the written disclosure, shall be disclosed in writing at the meeting of the Board of Supervisors prior to the Board's decision to approve, amend or extend the service contract.
- h. Failure to Comply. If subsequent to Board approval of an amendment or extension of the service contract, the disclosure is found to be incomplete or inaccurate due to intentional misconduct or gross negligence, the service contract may be voided at the discretion of the Board of Supervisors.
- i. Contract Voidable. If subsequent to approval, amendment or extension of this contract by the Board of Supervisors, the Board finds that the disclosure required by San Diego County Charter Section 1000.1 is substantially incomplete or inaccurate due to intentional misconduct or gross negligence of the Contractor or the Contractor's registered lobbyist, the contract may be voided at the sole discretion of the Board of Supervisors. All terms and conditions of the contract, including the County's obligation to pay for services received, shall remain in effect until the effective date of the Board's action to void the contract, and all contractual provisions set forth in the contract that by their terms survive the expiration or termination of the contract shall continue to remain in effect.
- j. Cost of Implementation. The County of San Diego's cost for implementing the disclosures required by this clause shall be paid by the Contractor at the time the initial disclosure is filed with the Clerk of the Board.
- k. Disclosure Forms are available at the Clerk of the Board's office at the County Administration Center, 1600 Pacific Highway, Room 402, San Diego, CA and on the Clerk of the Board's Internet Site <http://www.sdcountry.ca.gov/cob/index.html>. Original copies of the Disclosure Forms are to be filed at the Clerk of the Board's office.

### **35. Relations with California Regional Water Quality Control Board**

This project lies within the boundaries of the San Diego Regional Water Quality Control Board (RWQCB).

[http://www.swrcb.ca.gov/sandiego/water\\_issues/programs/stormwater/sd\\_stormwater.shtml](http://www.swrcb.ca.gov/sandiego/water_issues/programs/stormwater/sd_stormwater.shtml)

This project shall conform to the permits and modifications thereto. The NPDES general construction permit will not apply to projects where construction activities disturb less than 1 acre in a common plan of development. The Contractor shall maintain copies of the permits at the project site and shall make them available during construction.

The Contractor shall know and comply with provisions of Federal, State, and local regulations and

requirements that govern the Contractor's operations and storm water and non-storm water discharges from the project site and areas of disturbance outside the project limits during construction. Attention is directed to Sections 7, "Legal Relations and Responsibility to the Public", as modified by the County.

Water pollution control requirements shall apply to storm water and non-storm water discharges from areas outside the project site which are directly and exclusively related to construction activities for this contract including, but not limited to, material borrow areas, staging areas, storage yards and access roads. The Contractor shall implement, inspect and maintain the required BMPs for those areas. Installing, inspecting and maintaining BMPs on areas outside the County right of way not specifically arranged and provided for by the County for the execution of this contract, will not be paid for.

Unless arrangements for disturbance of areas outside the project limits are made by the Department of Public Works and made part of this contract, it is expressly agreed that the County of San Diego assumes no responsibility whatsoever to the Contractor or property owner with respect to any arrangements made between the Contractor and property owner to allow disturbance of areas outside the project limits.

The Contractor shall be responsible for penalties assessed on the Contractor or the County as a result of the Contractor's failure to comply with the provisions in "Water Pollution Control" of these special provisions or with the applicable provisions of the Federal, State, and local regulations and requirements.

Penalties as used in this section shall include fines, penalties, and damages, whether proposed, assessed, or levied against the County or the Contractor, including those levied under the Federal Clean Water Act and the State Porter-Cologne Water Quality Control Act, by governmental agencies or as a result of citizen suits. Penalties shall also include payments made or costs incurred in settlement for alleged violations of applicable laws, regulations, or requirements. Costs incurred could include sums spent instead of penalties, in mitigation or to remediate or correct violations.

## **WITHHOLDS**

The County will withhold money due the Contractor, in an amount estimated by the County, to include the full amount of penalties and mitigation costs proposed, assessed, or levied as a result of the Contractor's violation of the permits, or Federal or State law, regulations, or requirements. Funds will be withheld by the County until final disposition of these costs has been made. The Contractor shall remain liable for the full amount until the potential liability is finally resolved with the entity seeking the penalties. Instead of the withhold, the Contractor may provide a suitable bond in favor of the County to cover the highest estimated liability for any disputed penalties proposed as a result of the Contractor's violation of the permits, law, regulations, or requirements.

If a regulatory agency identifies a failure to comply with the permits and modifications thereto, or other Federal, State, or local requirements, the County will withhold money due the Contractor, subject to the following:

- A. The County will give the Contractor 30 days notice of the County's intention to withhold funds from payments which may become due to the Contractor before acceptance of the contract. Funds withheld after acceptance of the contract will be made without prior notice to the Contractor.

- B. No withholds of additional amounts out of payments will be made if the amount to be withheld does not exceed the amount being withheld from partial payments in accordance with Section 9-1.16, "Progress Payments," of the Standard Specifications.
- C. If the County has withheld funds and it is subsequently determined that the County is not subject to the entire amount of the costs and liabilities assessed or proposed in connection with the matter for which the withhold was made, the County will return the excess amount withheld to the Contractor in the progress payment following the determination. If the matter is resolved for less than the amount withheld, the County will pay interest at a rate of 6 percent per year on the excess withhold.

The Contractor shall notify the Engineer immediately upon request from the regulatory agencies to enter, inspect, sample, monitor, or otherwise access the project site or the Contractor's records pertaining to water pollution control work. The Contractor and the County shall provide copies of correspondence, notices of violation, enforcement actions, or proposed fines by regulatory agencies to the requesting regulatory agency.

### **36. State Prevailing and Federal Minimum Wages**

Attention is directed to Section 7-1.02K, "Labor Code", of the Standard Specifications and also to the modification of said Section contained in Part VII of these Contract Documents.

The project is a "public work" in accordance with Labor Code § 1720, et seq. It is the sole responsibility of the Contractor to ensure that all workers employed in the execution of the contract are paid the correct prevailing wage rate of wages.

State general prevailing wage rates determined by the Director of Industrial Relations for the locality in which the work is to be done, are available at the Department of Purchasing and Contracting, 5560 Overland Avenue, Suite 270, San Diego, California 92123. These wage rates are not included in the Proposal and Contract for the project. Changes, if any, to the general prevailing wage rates will be available at the same location. Said rates are also available at <http://www.dir.ca.gov/opri/DPreWageDetermination.htm>.

Any Contractor who is awarded a public works project and intends to use a craft or classification not shown on the general prevailing wage determinations, shall be required to pay the wage rate of that craft or classification most closely related to it as shown in the general determinations effective at the time of the call for bids.

Not less than the State general prevailing rate of per diem wages and the State general prevailing rate for holiday and overtime work, as determined by the Director of the Department of Industrial Relations as determined by the Secretary of Labor, shall be paid by the Contractor and Subcontractors to all laborers and mechanics employed on the project.



**GENERAL WAGE DECISION**

[INSERT MOST CURRENT GENERAL PREVAILING WAGE DETERMINATION AFTER BID  
OPENING]

[www.dir.ca.gov/OPRL/PWD/index.htm](http://www.dir.ca.gov/OPRL/PWD/index.htm)

**REFERENCE ATTACHMENT “A”  
GENERAL WAGE DECISION**

**PART V**  
**TECHNICAL SPECIFICATIONS**

# PROJECT MANUAL

for

## **STELZER PARK**

## **RANGER STATION**

## **11470 WILDCAT CAYNON ROAD**

## **LAKE SIDE, CA 92040**

Issue Date: January 21, 2021  
For Bidding And Construction

### **OWNER**

#### **DEPARTMENT OF PARKS AND RECREATION**

5500 Overland Drive, Suite 410  
San Diego, CA 92123  
619/561-0580

### **ARCHITECT**

#### **Matalon Architecture & Planning**

888 Prospect Street, Suite 200  
La Jolla, CA 92037  
858/263-2781

Project No. 19001.00

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**11470 WILDCAT CANYON ROAD**  
**SAN DIEGO, CA 92040**

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**SECTION 020013  
GEOTECHNICAL DATA**

**PART - GENERAL**

**1.01 SUBSURFACE INVESTIGATION**

- A. Soil and subsurface investigations were conducted at the Site the results of which are in the report are available by request from Owner, and are for information only.

**1.02 INTERPRETATION**

- A. The report identified above is not part of the Contract Documents, it is for information only. Soil and subsurface investigations were conducted for the purpose of design only. Subsurface investigation information is made available to the Contractor solely as a matter of convenience and general information.
- B. The Owner and Architect disclaim all responsibility for the accuracy of information prepared by others to be completely representative of conditions and materials which may be encountered and as being adequate for the purposes of construction.
- C. The Owner and Architect further disclaim responsibility for interpretation by Contractor and others of soil and subsurface investigation information, such as in projecting soil-bearing values, rock profiles, presence and scope of boulders and cobbles, soil stability and the presence, level and extent of underground water.
- D. Conditions found after execution of the Agreement to be materially different from those reported and which are not customarily encountered in the geographic area shall be governed by provisions of the General Conditions and Supplementary Conditions for unforeseen conditions.

**1.03 SOIL AND SUBSURFACE INVESTIGATIONS BY CONTRACTOR**

- A. The Contractor is encouraged to review the report of subsurface investigation for the Project site and similar sites in the area.
- B. The Contractor is also encouraged to examine the site, make additional tests, borings and other exploratory operations as they deem appropriate, and make an independent determination as to the nature, character, and extent of the materials and conditions to be found.
- C. All additional tests, borings and other exploratory operations shall be performed with no change in the Contract Sum.
- D. Additional on-site tests, borings, and other exploratory operations may be performed prior to execution of the Contract only if approved in writing, by the Owner. Make requests through the Architect. All such Work must name as additionally insured parties the Owner and other such entities as the Owner directs.
- E. Upon conclusion of additional on-site tests, borings and other exploratory operations, restore the site to its original state, to the satisfaction of the Owner.

**PART 2 – PRODUCTS**

NOT USED

**PART 3 – EXCUTION**

NOT USED

**END OF SECTION**



# County of San Diego

DEPARTMENT OF ENVIRONMENTAL HEALTH  
COMMUNITY HEALTH DIVISION  
5500 OVERLAND AVE. SUITE #110, SAN DIEGO, CA 92123  
(858) 694-2888 FAX (858) 694-3549  
1-800-253-9933  
[www.sdcdeh.org](http://www.sdcdeh.org)

AMY HARBERT  
ASSISTANT DIRECTOR

September 2, 2020

TO: Nick Ferracone, Project Manager  
Park Development  
Department of Parks and Recreation

FROM: John-Ross Glueck, Chief  
Community Health Division  
Department of Environmental Health

**ASBESTOS/LEAD PRE-DEMOLITION SURVEY REPORT: RANGER'S STATION AT  
STELZER PARK, 11470 WILDCAT CANYON ROAD, LAKESIDE, CA 92040**

The attached electronic staff report provides results of the above referenced project. The report specifies recommendations to reduce/eliminate any identified problems.

If you have further questions, or desire a hard copy of this report and are unable to print from the electronic format, please contact James Welker, Industrial Hygienist at (858) 694-2097 or e-mail [james.welker@sdcounty.ca.gov](mailto:james.welker@sdcounty.ca.gov).

John-Ross Glueck, Chief  
Community Health Division  
Department of Environmental Health

JRG: jw: COPS-816 report.docx

Attachment

cc: [Josh.Bugiel@sdcounty.ca.gov](mailto:Josh.Bugiel@sdcounty.ca.gov)





# COUNTY OF SAN DIEGO

## INTER-DEPARTMENTAL CORRESPONDENCE

September 2, 2020

TO: Mark Middlestead, Industrial Hygienist III  
Occupational Health Program  
Community Health Division

FROM: James Welker, Industrial Hygienist II  
Occupational Health Program  
Community Health Division

### **ASBESTOS/LEAD PRE-DEMOLITION SURVEY REPORT: RANGER'S STATION AT STELZER PARK, 11470 WILDCAT CANYON ROAD, LAKESIDE, CA 92040**

#### **SUMMARY**

After a request by Nick Ferracone, Project Manager, Park Development, Department of Parks and Recreation (DPR), I conducted an asbestos and lead-based paint assessment of the Ranger Station Building located at Stelzer Park in Lakeside, California. The survey was requested in anticipation of demolishing the Ranger Station to build a new one.

All suspect building materials sampled from the Stelzer County Park Ranger Station Building tested negative for asbestos, however **one item that could not be safely assessed is the Roof Penetration Mastic which must be assumed and treated as an asbestos containing material**. In addition, paint building components were not identified with lead-based paint ( $\geq 1.0$  mg/cm<sup>2</sup>); however, painted surfaces may contain lead at lower concentrations.

*The results in this report provide general depictions of suspect asbestos and lead materials in the assessed building. Due to various factors such as the age of the building, unknown remodel and paint history, there could be areas of asbestos materials and Lead Based Paint (LBP) components that were not identified. Although this report is helpful for developing scopes of abatement work, the contractor should be mindful of these limitations.*

For more detailed information, please see the DISCUSSION and RECOMMENDATIONS sections that follow.

#### **DISCUSSION**

The Occupational Health Program (OHP) was requested to perform an asbestos and lead survey of the Ranger Station located at the Stelzer County Park. The Ranger Station has two buildings consisting of an office, as well as a Visitor's Center add-on shed where animals are kept.

The Ranger Station is located on a raised subfloor that is in fair condition. The interior of the Ranger Station consists of wood walls, flooring, and ceilings with some painted drywall walls. The exterior consists of painted wood siding, and window and door components. The structure has a metal roof with

some pipe penetration areas that could not be tested for asbestos and therefore must be assumed to contain asbestos.

### Asbestos

Samples were collected of materials suspected of containing asbestos. The samples were analyzed by LA Testing. The **assumed** asbestos material is listed in the table below. This material is **assumed** to be an Asbestos-Containing Material (ACM) because it could not be safely tested. ACMs contain greater than one percent (1.0%) asbestos. All of the other sampled materials tested negative for asbestos. Analytical results of all materials are provided in the attached *Asbestos Bulk Sample Report*.

| Material Description | Material Location               | Asbestos Result | Photos |
|----------------------|---------------------------------|-----------------|--------|
| Gray Roof Mastic     | Roof at pipe/ vent penetrations | *               | 1 & 2  |

\* The gray roof mastic should be assumed to contain asbestos since the material was not accessible due to the instability of the roof.

### Lead-Based Paint

Representative painted surfaces were tested using a Niton XL X-Ray Fluorescence (XRF) analyzer, which is a direct reading instrument that can detect lead at high concentrations and expresses lead concentrations in mg/cm<sup>2</sup>. According to the HUD guidelines, a sample that has a lead concentration of 1.0 mg/cm<sup>2</sup> or greater is identified as a lead-based paint (LBP) or having "high" amounts of lead.

None of the paints tested as part of the survey were considered LBP. Analytical results of the sampling are provided in the attached *Lead-Based Paint Sample Report*. Note, lead could be present in lower amounts than specified in the attached results and employees must be protected accordingly per Cal/OSHA requirements; [https://www.dir.ca.gov/title8/1532\\_1.html](https://www.dir.ca.gov/title8/1532_1.html).

## CONCLUSIONS/RECOMMENDATIONS

### GENERAL

1. The County must inform all contractors and/or affected County personnel of the results of this survey.
  - a. A copy of this survey should be provided as part of the bid proposal package. This document will assist the selected Contractor in taking appropriate precautions (e.g. training, personal protective equipment, exposure monitoring etc.) to protect their workers from hazards identified in this report. Cal/OSHA has specific regulations pertaining to these types of hazards, and contractors have the responsibility of protecting their workers. Contractors should contact our office with questions about this report prior to submitting their bid proposals.
  - b. Prior to work activities, DPR must notify affected County employees of the presence, location and quantity of asbestos materials that will be impacted by the proposed construction activities. Furthermore, they must be aware of the precautions taken by the Contractor to control work activities (e.g. work practices and controls). DPR must communicate the information in this report to employees working adjacent (i.e. near) the proposed work area either verbally or in writing.

2. The Contractor is responsible for complying with all Cal/OSHA requirements including the Asbestos (<https://www.dir.ca.gov/title8/1529.html>), and California Environmental Protection Agency (Cal/EPA) requirements regarding waste disposal.
3. OHP must monitor work activities where asbestos materials are disturbed. Inspection of pre-existing conditions, verification of proper set-up, and on-site project surveillance help to ensure appropriate methods are being utilized to prevent exposure to the public, county employees, and property. The existing internal agreement (IA) would need to be increased to cover this work.
4. The Contractor must supply the County with copies of all hazardous waste manifests, receipts, bill of lading etc. for regulated waste taken off-site. If necessary, OHP can assist in obtaining an EPA Identification Number.
5. This survey addressed only those suspect building materials that were accessible. If suspect asbestos and/or lead materials not addressed in this report are discovered during the demolition activities, stop work. OHP must then be immediately contacted for assessment of the suspect material(s) before continuing with the demolition activities.
6. The Contractor must take measures to prevent exposure to County property, County employees, and the public. DPR should determine an appropriate mechanism to keep the public and unauthorized County personnel out of the work zones (e.g., site security, barriers).

#### **ASBESTOS**

7. The assumed asbestos-containing roof mastic must be removed prior to general demolition activities. An appropriately licensed contractor who is registered with Cal/OSHA to perform asbestos-related work must perform disturbance and/or removal of assumed ACM. Cal/OSHA requirements for removal work and other applicable regulations pertaining to ACM must be followed during construction activities. OHP must be contacted, with sufficient notice, to monitor the asbestos abatement of the assumed asbestos-containing roof mastic.
8. The contractor must submit an Asbestos Workplan indicating the proposed abatement methods and control measures they will use to remove the asbestos materials. The County, prior to job start-up, must review the Asbestos Workplan.
9. Notification must be made to Cal/OSHA prior to asbestos-related work. A 10-day notification to the Air Pollution Control District (APCD) must be made prior to demolition activities. Furthermore, the APCD may need to be notified prior to asbestos activities when friable ACMs are disturbed, non-friable ACMs become friable, or if mechanical methods are used to remove ACMs.
10. Roof mastic is typically considered non-friable and can be disposed as non-friable, non-hazardous waste.
11. As per APCD rules, a copy of this survey must be kept onsite during demolition activities.

#### **LEAD**

12. The contractor should assume that those surfaces that did not contain LBP or "high" concentrations of lead, contain lead at lower levels and they must protect their employees accordingly. The contractor should be aware that due to the unknown painting history of the

building, small patches of "high" concentration LBP may be present that were not identified in this survey. For paint disturbing activities on "low" concentration components, general precautions must be taken to minimize the release of chips, dust, and debris inside the building.

**OTHER**

13. The contractor must address other potential hazardous waste/recycling issues outside the primary scope of this survey. Remaining hazardous materials must be removed from the structures prior to demolition, and managed/disposed of appropriately (e.g. hazardous waste, universal waste, electronic waste etc.).

If you have any questions, please contact me.



James Welker, Industrial Hygienist II  
County of San Diego  
Occupational Health Program  
5500 Overland Ave., Suite 110  
San Diego, CA 92123

jw: COPS-816 report.docx





Photo 1: Picture of metal roof with penetrations.



Photo 2: Close-up of Assumed Asbestos Roof Mastic on vent and pipe penetrations.



County of San Diego  
Department of Environmental Health  
**Asbestos Bulk Samples**

**Project ID:** DEH2020-COPS-000816

**Project Name:** Pre-Work Asbestos /Lead Survey: Stelzer Park Ranger Station Demo

**Facility Name:** Stelzer Park Ranger Station

**Site Address:** 11470 Wildcat Canyon Rd, Lakeside

DEH2018-COBS-001321

**Collected By:** James Welker

**Date Collected:** 08/21/2020

| <u>Sample #</u> | <u>Material Description</u>                 | <u>Sample Location</u>                                | <u>Material Location</u> | <u>%<br/>Asbestos</u> | <u>Asbestos Type</u> | <u>Friable</u> | <u>Analysis<br/>Type</u> |
|-----------------|---------------------------------------------|-------------------------------------------------------|--------------------------|-----------------------|----------------------|----------------|--------------------------|
| 01              | 2 Layer beige vinyl flooring                | Visitor's Center, south                               |                          |                       | ND                   | N/A            | PLM                      |
| 02              | Glue associated with 2 Layer Beige VFT      | Visitor's Center, south                               |                          |                       | ND                   | N/A            | PLM                      |
| 03              | 12" x 12" Beige vinyl floor tile            | N Office area, center                                 |                          |                       | ND                   | N/A            | PLM                      |
| 04              | Glue associated with 12" beige vft          | N Office area, center                                 |                          |                       | ND                   | N/A            | PLM                      |
| 05              | 12" x 12" Beige vinyl floor tile            | S Ranger's office entry room,<br>south (top layer)    |                          |                       | ND                   | N/A            | PLM                      |
| 06              | Glue associated with 12" beige vft          | S Ranger's Office entry room,<br>south (top layer)    |                          |                       | ND                   | N/A            | PLM                      |
| 07              | Beige linoleum                              | S Ranger's Office entry room,<br>south (bottom layer) |                          |                       | ND                   | N/A            | PLM                      |
| 08              | 12" x 12" Beige vinyl floor tile            | Ranger Office staff restroom<br>closet                |                          |                       | ND                   | N/A            | PLM                      |
| 09              | Clear glue associated with 12" Beige vft    | Ranger Office staff restroom<br>closet                |                          |                       | ND                   | N/A            | PLM                      |
| 10              | Tan multi-color sheet flooring/<br>linoleum | Ranger office staff restroom<br>closet                |                          |                       | ND                   | N/A            | PLM                      |
| 11              | Residual brown mastic (from base<br>cove)   | Ranger Office staff restroom<br>closet, west wall     |                          |                       | ND                   | N/A            | PLM                      |

ND = None Detected; N/A = Not Applicable; PLM = Polarized Light Microscopy; XRD = X-Ray Diffraction; TEM = Transmission Electron Microscopy; SEM = Scanning Electron Microscopy  
Asbestos Types include: Chrysotile, Amosite, Crocidolite, Actinolite, Tremolite and Anthophyllite

|           |                                                  |                                                 |  |                |                   |           |     |
|-----------|--------------------------------------------------|-------------------------------------------------|--|----------------|-------------------|-----------|-----|
| 12        | 4" Light tan vinyl base cove                     | North/ old office side, north wall              |  |                | ND                | N/A       | PLM |
| 13        | Yellow adhesive associated with 4" Light tan vbc | North/ old office side, north wall              |  |                | ND                | N/A       | PLM |
| 14        | 4" Light tan vinyl base cove                     | Ranger Office front entry room, west wall       |  |                | ND                | N/A       | PLM |
| 15        | Yellow adhesive associated with 4" Light tan vbc | Ranger Office front entry room, west wall       |  |                | ND                | N/A       | PLM |
| 16        | Residual brown mastic (from base cove)           | Ranger Office staff restroom closet, north wall |  |                | ND                | N/A       | PLM |
| 17        | Drywall/ Joint Compound composite                | Ranger's Office, south wall                     |  |                | ND                | N/A       | PLM |
| 18        | Drywall/ Joint Compound composite                | Ranger's Office, north/ old side, south wall    |  |                | ND                | N/A       | PLM |
| 19        | Drywall/ Joint Compound composite                | Ranger's Office, north/ old side, east wall     |  |                | ND                | N/A       | PLM |
| <b>NC</b> | <b>Roof Penetration Mastic</b>                   | <b>Office Roof, at pipe penetrations</b>        |  | <b>Assumed</b> | <b>Chrysotile</b> | <b>No</b> |     |



County of San Diego  
Department of Environmental Health  
**Lead-Based Paint Samples**

**Project ID:** DEH2020-COPS-000816

**Facility Name:** Stelzer Park Ranger Station

**Project Name:** Pre-Work Asb/Lead Survey: Stelzer Park Ranger Station Demo

**Site Address:** 11470 Wildcat Canyon Rd, Lakeside

DEH2018-COBS-001321

**Collected By:** James Welker

**Date Collected:** 08/21/2020

| <u>Sample #</u> | <u>Sample Location</u> | <u>Room</u>                 | <u>Side</u> | <u>Material Description</u> | <u>XRF Reading<br/>(mg/cm<sup>2</sup>)</u> | <u>LBP</u> |
|-----------------|------------------------|-----------------------------|-------------|-----------------------------|--------------------------------------------|------------|
| 07              | Interior               | Visitor's Center            | A           | Wall, Wood, Green           | 0                                          | No         |
| 08              | Interior               | Visitor's Center            | B           | Wall, Wood, Green           | 0                                          | No         |
| 09              | Interior               | Visitor's Center            | C           | Wall, Wood, Green           | 0                                          | No         |
| 10              | Interior               | Visitor's Center            | D           | Wall, Wood, Green           | 0                                          | No         |
| 12              | Interior               | Visitor's Center            | C           | Door Frame, Wood, White     | 0                                          | No         |
| 13              | Interior               | Visitor's Center            | C           | Door, Wood, White           | 0                                          | No         |
| 16              | Interior               | Visitor's Center            |             | Beam Support, Wood, White   | 0.01                                       | No         |
| 17              | Interior               | Visitor's Center            |             | Beam Support, Wood, White   | 0                                          | No         |
| 18              | Interior               | Visitor's Center            |             | Ceiling, Wood, White        | 0                                          | No         |
| 19              | Interior               | Visitor's Center            |             | Ceiling, Wood, White        | 0                                          | No         |
| 20              | Interior               | Visitor's Center            |             | Beam Support, Wood, White   | 0                                          | No         |
| 21              | Interior               | Ranger's office, entry room | A           | Wall, Wood, White           | 0                                          | No         |
| 22              | Interior               | Ranger's office, entry room | B           | Wall, Wood, White           | 0                                          | No         |
| 23              | Interior               | Ranger's office, entry room | C           | Wall, Wood, White           | 0                                          | No         |
| 24              | Interior               | Ranger's office, entry room | D           | Wall, Wood, White           | 0                                          | No         |

XRF = Xray fluorescence analyzer

LBP = Lead-based paint



|    |          |                                          |   |                                  |      |    |
|----|----------|------------------------------------------|---|----------------------------------|------|----|
| 25 | Interior | Ranger's office, entry room              | D | Door Frame, Wood, White          | 0    | No |
| 26 | Interior | Ranger's office, entry room              | D | Door Casing, Wood, Brown         | 0    | No |
| 27 | Interior | Ranger's office, entry room              | D | Window Frame, Metal, Black       | 0.01 | No |
| 28 | Interior | Ranger's office, Ops Office              | A | Wall, Wood, White                | 0    | No |
| 29 | Interior | Ranger's office, Ops Office              | B | Wall, Wood, White                | 0    | No |
| 30 | Interior | Ranger's office, Ops Office              | C | Wall, Wood, White                | 0    | No |
| 31 | Interior | Ranger's office, Ops Office              | D | Wall, Wood, White                | 0    | No |
| 32 | Interior | Ranger's office, Ops Office              | D | Door Frame, Wood, White          | 0    | No |
| 33 | Interior | Ranger's office, Ops Office              | B | Window Frame, Wood, White        | 0    | No |
| 34 | Interior | Ranger's office, Ops Office              | B | Window Sash, Vinyl, White        | 0    | No |
| 36 | Interior | Ranger's office, Ops Office              |   | Beam Support, Wood, White        | 0    | No |
| 37 | Interior | Ranger's office, North office (old side) | A | Wall, Drywall, White             | 0    | No |
| 38 | Interior | Ranger's office, North office (old side) | B | Wall, Drywall, White             | 0    | No |
| 39 | Interior | Ranger's office, North office (old side) | C | Wall, Drywall, White             | 0    | No |
| 41 | Interior | Ranger's office, North office (old side) | D | Wall, Drywall, White             | 0    | No |
| 42 | Interior | Ranger's office, North office (old side) |   | Ceiling, Drywall, White          | 0    | No |
| 43 | Exterior | Ranger's office building, outside        | A | Wall, Wood, Brown                | 0.01 | No |
| 44 | Exterior | Ranger's office building, outside        | A | Corner Molding, Wood, Brown      | 0    | No |
| 45 | Exterior | Ranger's office building, outside        | B | Wall, Wood, Brown                | 0    | No |
| 46 | Exterior | Ranger's office building, outside        | B | Window Frame, Wood, Brown        | 0.01 | No |
| 47 | Exterior | Ranger's office building, outside        | B | Window Frame, Metal, Black       | 0    | No |
| 48 | Exterior | Ranger's office building, outside        | B | Window Sash, Vinyl, White        | 0    | No |
| 49 | Exterior | Ranger's office building, outside        | B | Foundation wall, Concrete, Brown | 0    | No |
| 50 | Exterior | Ranger's office building, outside        | B | Beam Support, Wood, Brown        | 0    | No |
| 51 | Exterior | Ranger's office building, outside        | C | Wall, Wood, Brown                | 0    | No |
| 52 | Exterior | Ranger's office building, outside        | C | Window Frame, Metal, Black       | 0    | No |
| 53 | Exterior | Ranger's office building, outside        | C | Beam Support, Wood, Brown        | 0    | No |
| 54 | Exterior | Ranger's office building, outside        | C | Door, Wood, Brown                | 0    | No |

XRF = Xray fluorescence analyzer

LBP = Lead-based paint

|    |          |                                   |   |                            |      |    |
|----|----------|-----------------------------------|---|----------------------------|------|----|
| 55 | Exterior | Ranger's office building, outside | D | Door Frame, Wood, Brown    | 0    | No |
| 56 | Exterior | Ranger's office building, outside | D | Door, Wood, Brown          | 0    | No |
| 57 | Exterior | Ranger's office building, outside | D | Wall, Wood, Brown          | 0    | No |
| 58 | Exterior | Ranger's office building, outside | D | Beam Support, Wood, Brown  | 0    | No |
| 59 | Exterior | Ranger's office building, outside | D | Beam Support, Metal, Brown | 0.01 | No |
| 60 | Exterior | Ranger's office building, outside | D | Roof cap, Metal, Brown     | 0.01 | No |

### APCD BUILDING SURVEY INFORMATION

|                                                                                                             |                                                                          |                           |                 |
|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------|-----------------|
| <b>Inspection Date(s):</b> August 21, 2020                                                                  |                                                                          |                           |                 |
| <b>Inspection Scope/Purpose:</b> Pre-Demolition Asbestos Survey                                             |                                                                          |                           |                 |
| <b>Project Number:</b> 000816                                                                               |                                                                          |                           |                 |
| <b>BUILDING INFORMATION</b>                                                                                 |                                                                          |                           |                 |
| <b>Name</b>                                                                                                 | Stelzer County Park                                                      |                           |                 |
| <b>Address</b>                                                                                              | 11470 Wildcat Canyon Road, Lakeside, CA                                  |                           |                 |
| <b>Owner</b>                                                                                                | County of San Diego                                                      |                           |                 |
| <b>Owner Address</b>                                                                                        | 5560 Overland Ave, 4 <sup>th</sup> Floor, San Diego, CA 92123            |                           |                 |
| <b>Owner Phone Number</b>                                                                                   | (858) 654-3610                                                           |                           |                 |
| <b>INSPECTOR INFORMATION</b>                                                                                |                                                                          |                           |                 |
| <b>Name, Title, CAC #</b>                                                                                   | James Welker, Industrial Hygienist (CAC#03-3487)                         |                           |                 |
| <b>Employer Name</b>                                                                                        | County of San Diego                                                      |                           |                 |
| <b>Employer Address</b>                                                                                     | 5500 Overland Ave, Ste 110, San Diego, CA 92123                          |                           |                 |
| <b>LABORATORY INFORMATION</b>                                                                               |                                                                          |                           |                 |
| <b>Name, Address, Phone</b>                                                                                 | LA Testing, 520 Mission Street, South Pasadena, CA 91030; (323) 254-9960 |                           |                 |
| <b>NVLAP Code</b>                                                                                           | # 200232-0                                                               |                           |                 |
| <b>Lab Test Methods</b>                                                                                     | EPA 600/R-93/116                                                         |                           |                 |
| <i>Note: The above lab has conducted the analysis in accordance with San Diego County APCD Rule 1206(h)</i> |                                                                          |                           |                 |
| <b>SAMPLE INFORMATION</b>                                                                                   |                                                                          |                           |                 |
| <b>Materials Tested</b>                                                                                     | <b>Locations</b>                                                         | <b>% Asbestos/Assumed</b> | <b>Comments</b> |
| (see report)                                                                                                |                                                                          |                           |                 |

**SECTION 033000**  
**CAST-IN-PLACE CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
  - 1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
- C. Mix Design: Submit proposed concrete mix design.
  - 1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
  - 2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
  - 3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
- D. Verification Samples: Submit sample chips of specified colors indicating pigment numbers and required dosage rates, for subsequent comparison to installed concrete.
- E. Samples: Submit samples of underslab vapor retarder to be used.
- F. Samples: Submit two, 12 inch long samples of waterstops and construction joint devices.
- G. Test Reports: Submit report for each test or series of tests specified.
- H. Test Reports: Submit termite-resistant sheet manufacturer's summary of independent laboratory and field testing for effectiveness in subterranean termite exclusion.
- I. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
- J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.03 QUALITY ASSURANCE**

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

**PART 2 PRODUCTS (SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)**

**2.01 FORMWORK**

- A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
  - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.

2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

## **2.02 REINFORCEMENT MATERIALS**

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
  1. Type: Deformed billet-steel bars.
  2. Finish: Unfinished, unless otherwise indicated.
- B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
  1. Form: Flat Sheets.
  2. WWR Style: 4 x 8-W6 x W10.
- C. Reinforcement Accessories:
  1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
  2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
  3. Provide galvanized or plastic components for placement within 1-1/2 inches of weathering surfaces.

## **2.03 CONCRETE MATERIALS**

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

## **2.04 ADMIXTURES**

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.
- C. Shrinkage Reducing Admixture:
  1. ASTM C494/C494M, Type S.

## **2.05 ACCESSORY MATERIALS**

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

2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.
3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

## **2.06 BONDING AND JOINTING PRODUCTS**

- A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.
  1. Manufacturers:
    - a. Euclid Chemical Company; [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - b. Kaufman Products Inc; SureBond: [www.kaufmanproducts.net/#sle](http://www.kaufmanproducts.net/#sle).
    - c. SpecChem, LLC; [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - d. W. R. Meadows, Inc; ACRY-LOK-: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- B. Waterstops, Chemical-Resistant: Extruded, thermoplastic, virgin rubber; no recycled or reclaimed material or pigments allowed.
- C. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
- D. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

## **2.07 CURING MATERIALS**

- A. Curing Compound, Non-dissipating: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.
  1. Vehicle: Water-based.
  2. Gloss: Low.
  3. Solids by Mass: 15 percent, minimum.
  4. VOC Content: OTC compliant.
  5. Manufacturers:
    - a. Kaufman Products Inc; Krystal 15 Emulsion: [www.kaufmanproducts.net/#sle](http://www.kaufmanproducts.net/#sle).
    - b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Dress & Seal WB: [www.lmcc.com/#sle](http://www.lmcc.com/#sle).
    - c. The QUIKRETE Companies; QUIKRETE® Acrylic Concrete Cure & Seal: [www.quikrete.com/#sle](http://www.quikrete.com/#sle).
    - d. SpecChem, LLC; Cure and Seal WB 25: [www.specchemllc.com/#sle](http://www.specchemllc.com/#sle).
    - e. W. R. Meadows, Inc; VOCOMP-20: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
- B. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.
- C. Water: Potable, not detrimental to concrete.

## **2.08 CONCRETE MIX DESIGN**

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
  1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
- C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
  1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
  2. Water-Cement Ratio: Maximum 45 percent by weight.
  3. Maximum Slump: 4 inches.
  4. Maximum Aggregate Size: 1 inch.

## **2.09 MIXING**

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
  - 1. Use latex bonding agent only for non-load-bearing applications.
- E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.
- F. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

### **3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS**

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

### **3.04 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Notify Architect not less than 24 hours prior to commencement of placement operations.
- D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.
- F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.
- G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### **3.05 SLAB JOINTING**

- A. Locate joints as indicated on drawings.

- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
  - 1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
- E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

### **3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES**

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

### **3.07 CONCRETE FINISHING**

- A. Repair surface defects, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
  - 1. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
- D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
  - 1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, and thin set ceramic tile.
  - 2. Decorative Exposed Surfaces: Trowel as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, surfaces to receive liquid hardeners, surfaces to be polished, and all other exposed slab surfaces.
- E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

### **3.08 CURING AND PROTECTION**

- A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
  - 1. Normal concrete: Not less than seven days.
- C. Surfaces Not in Contact with Forms:
  - 1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.



2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water-fog spray or saturated burlap.
  - a. Spraying: Spray water over floor slab areas and maintain wet.
  - b. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
3. Final Curing: Begin after initial curing but before surface is dry.
  - a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.
  - b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

### **3.09 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Provide free access to concrete operations at project site and cooperate with appointed firm.
- C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

### **3.10 DEFECTIVE CONCRETE**

- A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.
- C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

### **3.11 PROTECTION**

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

**END OF SECTION**

**SECTION 042900  
ENGINEERED UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

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

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar and grout.
- C. Shop Drawings: Indicate bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.
- D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.
- E. Design Data: Indicate required mortar strength, unit assembly strength in each plane, and supporting test data.
- F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

**1.04 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Conform to CBC2019 ACI18-14.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

**1.05 MOCK-UP**

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories, structural backup, reinforcement, and grout in mock-up.
- B. Locate where directed.
- C. Approved mock-up may remain as part of the Work.

**1.06 DELIVERY, STORAGE, AND HANDLING**

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

**1.07 FIELD CONDITIONS**

- A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

**PART 2 PRODUCTS (SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)**

**2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
  - 2. Special Shapes: Provide non-standard blocks configured for corners.

3. Load-Bearing Units: ASTM C90, medium weight.
  - a. Hollow block, as indicated.
  - b. Exposed Faces: Manufacturer's standard color and texture.

## **2.02 MORTAR AND GROUT MATERIALS**

- A. Portland Cement: ASTM C150/C150M, Type II; color as required to produce approved color sample.
- B. Mortar Aggregate: ASTM C144.
- C. Grout Aggregate: ASTM C404.
- D. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  1. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
  2. Manufacturers:
    - a. Davis Colors: [www.daviscolors.com/#sle](http://www.daviscolors.com/#sle).
    - b. Lambert Corporation: [www.lambertusa.com/#sle](http://www.lambertusa.com/#sle).
    - c. Solomon Colors, Inc.; [ ]: [www.solomoncolors.com/#sle](http://www.solomoncolors.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- E. Water: Clean and potable.

## **2.03 REINFORCEMENT AND ANCHORAGE**

- A. Manufacturers:
  1. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
  2. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
  3. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Reinforcing Steel: Type specified in Section 032000; size as indicated on drawings; galvanized finish.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

## **2.04 FLASHINGS**

- A. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane, or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

## **2.05 ACCESSORIES**

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
  1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
- C. Building Paper: ASTM D226/D226M, Type I ("No. 15") asphalt felt.

## **2.06 LINTELS**

- A. Precast Concrete Lintels: U-Shaped type, 8 x wall thickness inch size, 2000 psi strength at 28 days.

## **2.07 MORTAR MIXES**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  1. Masonry below grade and in contact with earth; Type S.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

## **2.08 MORTAR MIXING**

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Add mortar color in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
- D. Do not use anti-freeze compounds to lower the freezing point of mortar.
- E. If water is lost by evaporation, re-temper only within two hours of mixing.

## **2.09 GROUT MIXES**

- A. Bond Beams and Lintels: 2000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
- B. Engineered Masonry: 2000 psi strength at 28 days; 8-10 inches slump; provide premixed type in accordance with ASTM C 94/C 94M.
  - 1. Fine grout for spaces with smallest horizontal dimension of 2 inches or less.
  - 2. Coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

## **2.10 GROUT MIXING**

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

## **2.11 PRECONSTRUCTION TESTING**

- A. Compressive Strength: Where indicated, test masonry prisms in accordance with ASTM C1314.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

## **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Clean reinforcement of loose rust.
- C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.
- D. For areas where high-lift grouting will be employed, provide cleanout openings as follows:
  - 1. Hollow Masonry: Not less than 8 inches high at the bottom of each cell to be grouted, formed by cutting out face shell of masonry unit.

## **3.03 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave, flush on surfaces to receive waterproofing membrane.

## **3.04 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.

- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where walls are to receive stucco finish and resilient base is scheduled.

### **3.05 REINFORCEMENT AND ANCHORAGE**

- A. Reinforcement Bars: Secure at locations indicated and to avoid displacement during grouting. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.
- B. Anchors: Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.
- C. Wall Ties: Install wall ties at locations indicated, spaced at not more than 24 inches on center horizontally and 16 inches on center vertically, unless otherwise indicated on drawings.
- D. Reinforced Hollow Unit Masonry: Keep vertical cores to be grouted clear of mortar, including bed area of first course.
  - 1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

### **3.06 MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
  - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
  - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
  - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### **3.07 GROUTING**

- A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.
- B. Low-Lift Grouting:
  - 1. Limit height of pours to 12 inches.
  - 2. Limit height of masonry to 16 inches above each pour.
  - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
  - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:
  - 1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
  - 2. Clean out masonry cells and other cavities to be grouted by high pressure water spray or compressed air. Remove debris, allow to dry, and inspect before sealing cleanout openings.
  - 3. Hollow Masonry: Limit lifts to maximum 4 feet and pours to maximum height of 24 feet.
  - 4. Place grout for spanning elements in single, continuous pour.

### **3.08 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.

- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

### **3.09 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.10 TOLERANCES**

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.11 CUTTING AND FITTING**

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### **3.12 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with recommended procedures in ASTM C780, testing with same frequency as masonry samples.
- D. Test and evaluate grout in accordance with ASTM C1019 procedures.
  - 1. Test with same frequency as specified for masonry units.
- E. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C1314 and for flexural bond strength in accordance with ASTM C1072 or ASTM E518/E518M; perform tests and evaluate results.

### **3.13 CLEANING**

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Use non-metallic tools in cleaning operations.

### **3.14 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

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**SECTION 047300**  
**MANUFACTURED STONE MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

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

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for AMSMV units, mortar, lath, and water-resistive barrier, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Color charts.
  - 4. Installation methods.
- C. Shop Drawings: Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on drawings.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 12 inches square, representing actual product, color, patterns and texture.
- F. Samples: Submit four samples of AMSMV units to illustrate color, texture, and extremes of color range.
- G. Evaluation Service Reports: Show compliance with specified requirements of ICC-ES AC51.
- H. Manufacturer's Certificate: Certify that AMSMV units and mortar meet or exceed specified requirements.
- I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- J. Specimen Warranty.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum ten years of documented experience.
  - 1. Current producer member of the Masonry Veneer Manufacturers Association.
- B. Installer Qualifications: Company specializing in performing work of type specified, with at least five years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Prevent mechanical damage and contamination by other materials.
- C. Protect products from precipitation combined with freezing temperatures. Do not install products with visible frozen moisture.
- D. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.



## **1.06 FIELD CONDITIONS**

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

## **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Provide 50 year manufacturer warranty for AMSMV.
- D. Provide 15 year manufacturer warranty for mortar and other installation materials used in exterior installations over steel or wood framing.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Adhered manufactured stone masonry veneer (AMSMV):
  - 1. Any current producer member of the Masonry Veneer Manufacturers Association.
  - 2. Boral USA: [www.culturedstone.com/#sle](http://www.culturedstone.com/#sle).
  - 3. Coronado Stone Products: [www.coronado.com/#sle](http://www.coronado.com/#sle).
  - 4. Eldorado Stone: [www.eldoradostone.com/#sle](http://www.eldoradostone.com/#sle).

### **2.02 ADHERED MANUFACTURED STONE MASONRY VENEER (AMSMV)**

- A. AMSMV: Cast masonry units using a mixture of cement, lightweight aggregates, concrete additives and color pigments to replicate appearance of natural stone and designed to be applied with a cementitious mortar to a backing surface, complying with ASTM C1670/C1670M and ICC-ES AC51.
  - 1. Style: As indicated on drawings.
  - 2. Color, Texture, Range, Special Shapes: As indicated on drawings.
  - 3. Walls: Provide with blended color/texture:
- B. AMSMV Trim: Provide wall caps, drip ledges, and corner stones.

### **2.03 MORTAR APPLICATIONS**

- A. Use only factory premixed packaged dry materials for mortar, with addition of water only at project site.
  - 1. Exception: If a specified mix design is not available in a premixed dry package, provide equivalent mix design using standard non-premixed materials.
- B. Mortar Color: Natural gray unless otherwise indicated.
- C. Dash Bond Coat: One part Portland cement, with maximum two parts sand.
- D. Scratch Coat Mortars: Scratch coat mortars for application directly to metal lath.
  - 1. Prepackaged/Preblended: ASTM C1714/C1714M, Type N or Type S.
- E. Setting Bed Mortars: Setting bed used to adhere AMSMV units to cement board.
  - 1. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.
- F. Pointing Mortars: Pointing or grouting mortars used to fill the joints between individual AMSMV units once the setting bed mortar has sufficiently cured.
  - 1. Prepackaged/Preblended Latex Modified: ANSI A118.4 or ANSI A118.15.

### **2.04 MORTAR MIXES**

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
  - 1. Type: Type S.
  - 2. Color: Standard gray.

## **2.05 ACCESSORIES**

- A. Lath: As specified in Section 092236.23.
- B. Casing Beads, Weep Screeds, and Joint Accessories: As specified in Section 092236.23.
- C. Water-Resistive Barrier: See Section 072500.
- D. Flashings: As specified in Section 042000.
- E. Rainscreen Drainage Material:
- F. Cleaning Solution: Non-acidic, not harmful to AMSMV work or adjacent materials, approved by AMSMV manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that backup wall system construction complies with AMSMV manufacturer's instructions, MVMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.
- B. Verify that substrates to receive mortar scratch coat or setting bed comply with AMSMV manufacturer's instructions, MVMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51:
  - 1. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.
- C. Verify that related items provided under other sections are properly sized and located.
- D. Verify that built-in items are in proper location, and ready for installation of AMSMV.

### **3.02 INSTALLATION - WATER-RESISTIVE BARRIER**

- A. Where required by AMSMV manufacturer's instructions, MVMA (AMSV), NCMA TEK 20-01, ASTM C1780 or ICC-ES AC51, install 2 layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.
- B. Apply water-resistive barrier horizontally with upper layer lapped over lower layer minimum 2 inches.
- C. Lap water-resistive barrier minimum 6 inches at vertical joints.
- D. In two layer applications, start with two horizontal layers at bottom of exterior wall or structure.

### **3.03 INSTALLATION - SCRATCH COAT**

- A. Apply mortar scratch coat of 1/2 inch nominal to cover metal lath in accordance with ASTM C926. Scratch surface when somewhat firm. If scratch coat dries before applying setting bed mortar and AMSMV, moisten scratch coat by misting it with water.

### **3.04 INSTALLATION - AMSMV**

- A. Install AMSMV with a cementitious mortar setting bed to a scratch coat backing surface, in accordance with AMSMV manufacturer's instructions, MVMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.
- B. Mortar Joints: Concave.
  - 1. Style: Tight fit joints.
- C. Seal all joints at wall openings and penetrations with sealant approved for use with AMSMV.

### **3.05 INSTALLATION - MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Extend metal flashings through exterior face of AMSMV and terminate in an angled drip with hemmed edge.

- C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### **3.06 TOLERANCES**

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
- E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

### **3.07 CUTTING AND FITTING**

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

### **3.08 CLEANING**

- A. Remove excess mortar and mortar smears as work progresses.
- B. Replace defective mortar. Match adjacent work.
- C. Clean AMSMV in accordance with manufacturer's installation instructions.
- D. Clean soiled surfaces with cleaning solution.
- E. Use non-metallic tools in cleaning operations.

### **3.09 PROTECTION**

- A. Protect finished work from rain during and for 48 hours following installation.
- B. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 055000**  
**METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
  - 2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
    - a. Include the following, as applicable:
      - 1) Design criteria.
      - 2) Engineering analysis depicting stresses and deflections.
      - 3) Member sizes and gages.
      - 4) Details of connections.
      - 5) Support reactions.
      - 6) Bracing requirements.
- C. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 1, 1, 1, and 1 requirements.
- D. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.
- E. Designer's Qualification Statement.
- F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

**1.03 QUALITY ASSURANCE**

- A. Design under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in California.
- B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

**PART 2 PRODUCTS (SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)**

**2.01 MATERIALS - STEEL**

- A. Steel Sections, Angles, Channels, Plates, Bars and Rods: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Fittings: ASTM A1011/A1011M.
- F. Fasteners, Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

## **2.02 FABRICATION**

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

## **2.03 FABRICATED ITEMS**

- A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
  - 1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
  - 2. Rungs: one inch diameter solid round bar spaced 12 inches on center.
  - 3. Space rungs 7 inches from wall surface.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support; prime paint finish.
- C. Door Frames for Overhead Door Openings: Channel sections; galvanized and prime paint finish.
- D. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

## **2.04 FINISHES - STEEL**

- A. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete and items to be imbedded in masonry.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

## **2.05 FABRICATION TOLERANCES**

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

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

#### **3.03 INSTALLATION**

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

#### **3.04 TOLERANCES**

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

**END OF SECTION**

**SECTION 061000**  
**ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Samples: For rough carpentry members that will be exposed to view, submit two samples, 8by8 inch in size illustrating wood grain, color, and general appearance.
- D. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.03 DELIVERY, STORAGE, AND HANDLING**

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

**1.04 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS (SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)**

**2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
  - 2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

**2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Stud Framing (2 by 2 through 2 by 6 ):
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 2.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

### **2.03 EXPOSED DIMENSION LUMBER**

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- C. Sizes: Nominal sizes as indicated on drawings.
- D. Surfacing: S4S.
- E. Moisture Content: S-dry or MC19.
- F. Stud Framing (2 by 2 through 2 by 6 ):
  - 1. Species: Douglas Fir.
  - 2. Grade: Clear.
- G. Decorative Exterior Wood Brackets
  - 1. Species: Douglas Fir.
  - 2. Grade: Select Heart.

### **2.04 EXPOSED BOARDS**

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: Kiln-dry (15 percent maximum).
- C. Surfacing: S4S.
- D. Species: Douglas Fir.
- E. Grade: No. 2, 2 Common, or Construction.

### **2.05 CONSTRUCTION PANELS**

- A. Roof Sheathing: Any Plywood, PS-1 or PS 2 type, rated Structural I Sheathing.
  - 1. Bond Classification: Exterior.
  - 2. Span Rating: 32/16.
  - 3. Performance Category: 3/4 PERF CAT.
- B. Wall Sheathing: Plywood, PS 1, or PS-2 Grade C-D, Exposure I.
- C. Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- D. Other Applications:
  - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
  - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
  - 3. Other Locations: PS 1, C-D Plugged or better.

### **2.06 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
  - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
  - 3. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
  - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- C. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.



1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- D. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.
- E. Building Paper: Water resistant Kraft paper.

## **2.07 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Fire Retardant Treatment:
  1. Manufacturers:
    - a. Arch Wood Protection, Inc: [www.wolmanizedwood.com](http://www.wolmanizedwood.com).
    - b. Hoover Treated Wood Products, Inc: [www.frtw.com](http://www.frtw.com).
    - c. Osmose, Inc: [www.osmose.com](http://www.osmose.com).
  2. Exterior Type: AWWA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
    - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    - b. Treat exposed exterior rough carpentry items
    - c. Do not use treated wood in direct contact with the ground.
  3. Interior Type A: AWWA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    - b. All interior rough carpentry items are to be fire retardant treated.
    - c. Treat rough carpentry items as indicated .
    - d. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
  1. Manufacturers:
    - a. Arch Wood Protection, Inc: [www.wolmanizedwood.com](http://www.wolmanizedwood.com).
    - b. Koppers Performance Chemicals, Inc: [www.koppersperformancechemicals.com](http://www.koppersperformancechemicals.com).
    - c. Viance, LLC: [www.treatedwood.com](http://www.treatedwood.com).
  2. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber exposed to weather.
    - c. Treat lumber in contact with roofing, flashing, or waterproofing.
    - d. Treat lumber in contact with masonry or concrete.
    - e. Treat lumber less than 18 inches above grade.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

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

### **3.02 INSTALLATION - GENERAL**

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

### **3.03 FRAMING INSTALLATION**

- A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength.
- B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.
- C. Install structural members full length without splices unless otherwise specifically detailed.
- D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes.
- E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.
- F. Provide bridging at joists in excess of 8 feet span at mid-span. Fit solid blocking at ends of members.
- G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

### **3.04 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- E. Provide the following specific non-structural framing and blocking:
  - 1. Cabinets and shelf supports.
  - 2. Wall brackets.
  - 3. Handrails.
  - 4. Grab bars.
  - 5. Towel and bath accessories.
  - 6. Wall-mounted door stops.

### **3.05 ROOF-RELATED CARPENTRY**

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

### **3.06 INSTALLATION OF CONSTRUCTION PANELS**

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

### **3.07 TOLERANCES**

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

### **3.08 CLEANING**

- A. Comply with applicable regulations.
- B. Do not burn scrap on project site.
- C. Do not burn scraps that have been pressure treated.
- D. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- E. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- F. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

**SECTION 061753**  
**SHOP-FABRICATED WOOD TRUSSES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.
- C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
  - 1. Include identification of engineering software used for design.
  - 2. Provide shop drawings stamped or sealed by design engineer.
- D. Designer's Qualification Statement.
- E. Fabricator's Qualification Statement.

**1.03 QUALITY ASSURANCE**

- A. Designer Qualifications: Perform design by or under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in California.
- B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Handle and erect trusses in accordance with TPI BCSI 1.
- B. Store trusses in vertical position resting on bearing ends.
- C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

**PART 2 PRODUCTS (SEE STRUCTURAL DRAWINGS FOR ADDITIONAL REQUIREMENTS)**

**2.01 TRUSSES**

- A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.
  - 1. Species and Grade: Douglas Fir, WWPA G-5 Grade .
  - 2. Connectors: Steel plate.
  - 3. Structural Design: Comply with applicable code for structural loading criteria.
  - 4. Fire Retardance: Comply with applicable code(s); provide factory pressure treated wood.
  - 5. Decay Resistance: Provide factory preservative pressure treated wood.

**2.02 MATERIALS**

- A. Lumber:
  - 1. Moisture Content: Between 7 and 9 percent.
- B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G90/Z275 coating; die stamped with integral teeth; thickness as indicated.
- C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

### **2.03 ACCESSORIES**

- A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.
- B. Fasteners: Electrogalvanized steel, type to suit application.
- C. Bearing Plates: Electrogalvanized steel.

### **2.04 WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWP A U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Fire Retardant Treatment, Interior Type A: AWP A U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated, maximum flame spread index of 25 when tested in accordance with ASTM E84 and with no evidence of significant combustion when test is extended for an additional 20 minutes; kiln-dried after treatment to maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - 1. Marking: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  - 2. Products:
    - a. Koppers, Inc: <http://www.koppersperformancechemicals.com/#sle>.
    - b. Viance, LLC; D-Blaze: [www.treatedwood.com/#sle](http://www.treatedwood.com/#sle).
- C. Preservative Pressure Treatment of Plywood: AWP A U1, Use Category UC3B using waterborne preservative to 0.25 lb/cu ft retention.
  - 1. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
  - 2. Marking: Mark each piece with stamp of an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWP A standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that supports and openings are ready to receive trusses.

### **3.02 PREPARATION**

- A. Coordinate placement of bearing items.

### **3.03 ERECTION**

- A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.
- B. Set members level and plumb, in correct position.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Do not field cut or alter structural members without approval of Architect.
- E. Install permanent bridging and bracing.
- F. Install headers and supports to frame openings required.
- G. Frame openings between trusses with lumber in accordance with Section 061000.
- H. Coordinate placement of decking with work of this section.
- I. After erection, touch-up primed surfaces with primer consistent with shop coat.

### **3.04 SITE APPLIED WOOD TREATMENT**

- A. Treat all site-sawn cuts of pressure-treated wood using same type of treatment (i.e. preservative or fire-retardant).

- B. Apply preservative treatment to non-pressure-treated wood wherever it will come into contact with cementitious materials, roofing, asphaltic materials, or metals.
- C. Apply treatment in accordance with manufacturer's instructions.
- D. Allow field-applied treatment to dry prior to erecting members.

**3.05 TOLERANCES**

- A. Framing Members: 1/2 inch maximum, from true position.

**END OF SECTION**

**SECTION 064100**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  - 2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
  - 3. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

**1.04 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
  - 3. Single Source Responsibility: Provide and install this work from single fabricator.
- B. Quality Certification:
  - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
  - 5. Replace, repair, or rework all work for which certification is refused.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.06 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
  - 3. Finish - Concealed Surfaces: Manufacturer's option.
  - 4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
  - 5. Door and Drawer Front Retention Profiles: Fixed panel.
  - 6. Casework Construction Type: Type A - Frameless.
  - 7. Interface Style for Cabinet and Door: Style 2 - Finish Inset; reveal overlay.
  - 8. Layout for Cabinet and Door Fronts: Flush panel.
    - a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
  - 9. Cabinet Design Series: As indicated on drawings.
  - 10. Adjustable Shelf Loading: 50 lbs. per sq. ft.
  - 11. Cabinet Style: Flush overlay.
  - 12. Cabinet Doors and Drawer Fronts: Flush style.
  - 13. Drawer Side Construction: Multiple-dovetailed.
  - 14. Drawer Construction Technique: Dovetail joints.

### **2.02 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 2. Panolam Industries International, Inc; Nevamar: [www.nevamar.com](http://www.nevamar.com).
  - 3. Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
- B. Thermally Fused Laminate (TFL): Melamine resin, NEMA LD 3, Type VGL laminate panels.
- C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- D. Provide specific types as indicated.
  - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as scheduled.
  - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as scheduled, finish as scheduled.
  - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, color as selected, finish as scheduled.
  - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, color as selected, finish as scheduled.
  - 5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as scheduled.
  - 6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

### **2.03 COUNTERTOPS**

- A. Countertops are specified in Section 123600.

### **2.04 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Fasteners: Size and type to suit application.



- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- D. Concealed Joint Fasteners: Threaded steel.
- E. Grommets: Standard painted metal grommets for cut-outs, in color to match adjacent surface.

## **2.05 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using surface mounted metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.
- C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- D. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- E. Catches: Magnetic.
- F. Drawer Slides:
  - 1. Type: Extension types as indicated.
  - 2. Static Load Capacity: Commercial grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
  - 5. Features: Provide self closing/stay closed type.
  - 6. Manufacturers:
    - a. Accuride International, Inc; Heavy-Duty Drawer Slides: [www accuride.com/#sle](http://www accuride.com/#sle).
    - b. Grass America Inc: [www.grassusa.com/#sle](http://www.grassusa.com/#sle).
    - c. Hettich America, LP: [www.hettich.com/sle](http://www.hettich.com/sle).
    - d. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: [www.knappeandvogt.com/#sle](http://www.knappeandvogt.com/#sle).
- G. Hinges: European style concealed self-closing type, steel with polished finish.
  - 1. Manufacturers:
    - a. Grass America Inc; Tiomos Hinge System: [www.grassusa.com/#sle](http://www.grassusa.com/#sle).
    - b. Hardware Resources: [www.hardwareresources.com/#sle](http://www.hardwareresources.com/#sle).
    - c. Hettich America, LP: [www.hettich.com/sle](http://www.hettich.com/sle).
    - d. Julius Blum, Inc: [www.blum.com](http://www.blum.com).

## **2.06 FABRICATION**

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

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

#### **3.03 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

#### **3.04 CLEANING**

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

**END OF SECTION**

**SECTION 071300**  
**SHEET WATERPROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
- D. Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.03 QUALITY ASSURANCE**

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

**1.04 FIELD CONDITIONS**

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

**1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a 10 year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide 10 year joint contractor/manufacturer warranty for waterproofing failing to resist penetration of water , except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.
- D. Warranty against water infiltration and defects of materials and workmanship for period of ten years. Full warranty that covers labor and workmanship, including labor for access to waterproofing, for watertight warranty.

**PART 2 PRODUCTS**

**2.01 WATERPROOFING APPLICATIONS**

- A. Self-Adhered Modified Bituminous Sheet Waterproofing: Use at Vertical below grade vertical walls.
  - 1. Cover with drainage panel.

**2.02 MEMBRANE MATERIALS**

- A. Self-Adhered Modified Bituminous Sheet Membrane:
  - 1. Thickness: 60 mil, 0.060 inch, minimum.
  - 2. Sheet Width: 36 inch, minimum.

3. Termite Resistance: 100 percent when tested in accordance with ICC-ES AC380.
4. Tensile Strength:
  - a. Film: 5000 pounds per square inch, minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches per minute.
  - b. Membrane: 325 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
5. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
6. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
7. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
8. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
9. Lap Adhesion Strength: 5 pounds per inch, minimum, when tested according to ASTM D1876.
10. Puncture Resistance: 50 pounds, minimum, measured in accordance with ASTM E154/E154M.
11. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
12. Hydrostatic Resistance: Resists the weight of 200 feet when tested according to ASTM D5385/D5385M.
13. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
14. Manufacturers:
  - a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: [www.carlisleccw.com/#sle](http://www.carlisleccw.com/#sle).
  - b. GCP Applied Technologies; "Bituthene 3000": [www.gcpat.com/sle](http://www.gcpat.com/sle).
  - c. Henry Company: [www.henry.com/sle](http://www.henry.com/sle).
  - d. Right Pointe Company with Right Prime: [www.rightpointe.com/sle](http://www.rightpointe.com/sle).
  - e. W.R. Meadows, Inc: [www.wrmeadows.com](http://www.wrmeadows.com).
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Membrane Sealant: As recommended by membrane manufacturer.
- D. Termination Bars: Aluminum; compatible with membrane and adhesives.
- E. Surface Conditioner: type, compatible with membrane.
- F. Adhesives: As recommended by membrane manufacturer.
- G. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

### **2.03 ATTACHMENT MATERIALS**

- A. Battens: As recommended by membrane manufacturer..
- B. Disc Washers and Screws: As recommended by membrane manufacturer..
- C. Reglet Strip Devices: As recommended by membrane manufacturer..

### **2.04 ACCESSORIES**

- A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- B. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
  1. Composition: Dimpled polystyrene core; polypropylene filter fabric.
    - a. Manufacturers:
      - 1) Epro Services, Inc.: [www.eproserv.com](http://www.eproserv.com).
      - 2) Mar-flex Waterproofing & Building Products; ArmorDrain 150: [www.mar-flex.com/#sle](http://www.mar-flex.com/#sle).
      - 3) W.R. Meadows, Inc; Mel-Drain 5012: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).

- C. Cant Strips: Premolded composition material.
- D. Flexible Flashings: Type recommended by membrane manufacturer.
- E. Counterflashings: Galvanized steel sheet, 0.023 inch thick.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

#### **3.02 PREPARATION**

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.
- E. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
  - 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
  - 2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
  - 3. Remove and replace areas of defective concrete as specified in Section 033000.
  - 4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
  - 5. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

#### **3.03 INSTALLATION - MEMBRANE**

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
- D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- G. Coordinate with drain installation; refer to Section 221006.
- H. Install building expansion joints at locations as indicated on drawings.
- I. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- J. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 8 inches at subsequent plies laid in shingle fashion.

- K. Seal membrane and flashings to adjoining surfaces.

#### **3.04 INSTALLATION - DRAINAGE PANEL**

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.
- B. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

#### **3.05 FIELD QUALITY CONTROL**

- A. Owner will provide testing services in accordance with Section 014000 - Quality Requirements. Contractor shall provide temporary construction and materials for testing.
- B. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.
- C. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.
- D. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
- E. When area is proven watertight, drain water and remove dam.

#### **3.06 PROTECTION**

- A. Do not permit traffic over unprotected or uncovered membrane.

**END OF SECTION**

**SECTION 072100**  
**THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.
- B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.
- E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

**1.03 QUALITY ASSURANCE**

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); [www.airbarrier.org/#sle](http://www.airbarrier.org/#sle):
  - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
  - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

**1.04 FIELD CONDITIONS**

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

**PART 2 PRODUCTS**

**2.01 BATT INSULATION MATERIALS (ROOF R=30, WALLS R=19)**

- A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.
- B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.

4. Manufacturers:
  - a. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - b. Johns Manville: [www.jm.com](http://www.jm.com).
  - c. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- C. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
  1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
  3. Thermal Resistance: R-value of Roofs =30, walls=19.
  4. Manufacturers:
    - a. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
    - c. ROCKWOOL (ROXUL, Inc): [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - d. Thermafiber, Inc: [www.thermafiber.com/#sle](http://www.thermafiber.com/#sle).
- D. Flexible Blanket Insulation: Thin profile insulation that complies with complex shapes, unfaced; flame spread index of 5 (five) and smoke development index of 10 (ten) or less when tested in accordance with ASTM E84.
  1. Color: Gray.
  2. Thickness: 3/8 inch.
  3. Manufacturers:
    - a. Dow Chemical Company:  
[consumer.dow.com/en-us/industry/ind-building-construction.html/#sle](http://consumer.dow.com/en-us/industry/ind-building-construction.html/#sle).

## **2.02 ACCESSORIES**

- A. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- B. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

### **3.02 BATT INSTALLATION**

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

### **3.03 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:
  1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).
  2. Notify in ABAA writing of schedule for air barrier work, and allow adequate time for testing and inspection.
  3. Cooperate with ABAA testing agency.
  4. Allow access to air barrier work areas and staging.



5. Do not cover air barrier work until tested, inspected, and accepted.

### **3.04 PROTECTION**

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

**END OF SECTION**

**SECTION 072500**  
**WEATHER BARRIER MEMBRANE (WBM)**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 DEFINITIONS**

- A. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

**1.03 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test.
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- D. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.
- E. Manufacturer's Installation Instructions: Indicate preparation.
- F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.
- G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.
- H. Testing Agency Qualification Statement.
- I. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

**1.05 QUALITY ASSURANCE**

- A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); [www.airbarrier.org/#sle](http://www.airbarrier.org/#sle):
  - 1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
  - 2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

## **1.06 FIELD CONDITIONS**

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

## **1.07 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a 10 year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide 10 year joint contractor/manufacturer warranty for waterproofing failing to resist penetration of water , except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.
- D. Warranty against water infiltration and defects of materials and workmanship for period of ten years. Full warranty that covers labor and workmanship, including labor for access to waterproofing, for watertight warranty.

## **PART 2 PRODUCTS**

### **2.01 WEATHER BARRIER ASSEMBLIES**

- A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.
  - 1. Under Portland cement stucco, use two separate layers of building paper.

### **2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)**

- A. Building Paper: Asphalt-saturated Kraft building paper complying with requirements of ICC-ES AC38 Grade D.
  - 1. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of five hours, when tested in accordance with AATCC Test Method 127.
  - 2. Manufacturers:
    - a. Fortifiber Building Systems Group; Super Jumbo Tex 60 Minute: [www.fortifiber.com/#sle](http://www.fortifiber.com/#sle).

### **2.03 SEALANTS**

- A. Silicone Sealant: Type as specified in Section 079005.
- B. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.
- C. **Apply silicone sealant to fastener heads.**

### **2.04 ADHESIVES**

- A. Non-Curing Adhesive : Compatible with sheet seal and substrate, permanently non-curing.

### **2.05 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
  - 1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
  - 2. Manufacturers:
    - a. DuPont Building Innovations; FlexWrap NF: [www.dupont.com/#sle](http://www.dupont.com/#sle).
    - b. Fortifiber Building Systems Group: [www.fortifiber.com](http://www.fortifiber.com).
    - c. SIGA Cover Inc: [www.sigacover.com/#sle](http://www.sigacover.com/#sle).
    - d. Carlisle Coatings and Waterproofing, Inc.; [www.carlisle-ccw.com](http://www.carlisle-ccw.com).
- C. Thinners and Cleaners: As recommended by material manufacturer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

#### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Mechanically Fastened Sheets - On Exterior:
  - 1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
  - 2. Overlap seams as recommended by manufacturer but at least 6 inches.
  - 3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
  - 4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
  - 5. Install water-resistive barrier over jamb flashings.
  - 6. Install head flashings under weather barrier.
  - 7. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.
- E. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  - 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
  - 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
  - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

#### **3.04 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Coordination of ABAA Tests and Inspections:
  - 1. Provide testing and inspection required by ABAA QAP.
  - 2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
  - 3. Cooperate with ABAA testing agency.
  - 4. Allow access to air barrier work areas and staging.
  - 5. Do not cover air barrier work until tested, inspected, and accepted.

- C. Do not cover installed weather barriers until required inspections have been completed.
- D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.
- E. Take digital photographs of each portion of the installation prior to covering up.

**3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.
- B. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

**END OF SECTION**

**SECTION 073113**  
**ASPHALT SHINGLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating material characteristics.
- C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.
- D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.
- E. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Shingles: 25 sq ft of each type and color.

**1.03 QUALITY ASSURANCE**

**1.04 FIELD CONDITIONS**

- A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

**1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide lifetime manufacturer's warranty for coverage against black streaks caused by algae.
- D. Provide five year manufacturer's warranty for wind damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Algae Resistant Asphalt Shingles:
  - 1. Atlas Roofing Corporation: [www.atlasroofing.com/#sle](http://www.atlasroofing.com/#sle).
  - 2. GAF; Timberline Ultra HD Shingles with StainGuard Plus: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. IKO Industries Inc: [www.iko.com/#sle](http://www.iko.com/#sle).
  - 4. Owens Corning Corp: [www.owenscorning.com/#sle](http://www.owenscorning.com/#sle).

**2.02 ASPHALT SHINGLES**

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462.
  - 1. Fire Resistance: Class A, complying with ASTM E108.
  - 2. Wind Resistance: Class A, when tested in accordance with ASTM D3161.
  - 3. Warranted Wind Speed: Not greater than 60 mph.
  - 4. Algae Resistant.

5. Self-sealing type.
6. Style: Square.
7. Color: As selected by Architect.

## **2.03 SHEET MATERIALS**

- A. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
  1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
  2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
  3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
  4. Water Vapor Permeance: 0.067 perm, when tested in accordance with ASTM E96/E96M, Procedure A (desiccant method).
  5. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
  6. Liquid Water Transmission: Passes ASTM D4869/D4869M.
  7. Functional Temperature Range: Minus 70 degrees F to 212 degrees F.
  8. Manufacturers:
    - a. GCP Applied Technologies; "Ice And Water Shield"; [www.gcpat.com/sle](http://www.gcpat.com/sle).
    - b. System Components Corporation, Inc; FelTex SA300: [www.systemcomponents.net/#sle](http://www.systemcomponents.net/#sle).

## **2.04 ACCESSORIES**

- A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch head diameter, 12 gage, 0.109 inch nail shank diameter, 1-1/2 inch long and complying with ASTM F1667.

## **2.05 METAL FLASHINGS**

- A. Metal Flashings: Provide sheet metal eave edge, ridge, and other flashing indicated.
  1. Form flashings to protect roofing materials from physical damage and shed water.
  2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
  3. Hem exposed edges of flashings minimum 1/4 inch on underside.
  4. Coat concealed surfaces of flashings with bituminous paint.
- B. Steel Sheet Metal: Prefinished and galvanized steel sheet, 26 gage, 0.0179 inch minimum thickness, G90/Z275 hot-dipped galvanized; PVC coated, color as selected.
- C. Bituminous Paint: Acid and alkali resistant type; black color.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.
- B. Verify that roof deck is of sufficient thickness to accept fasteners.
- C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- D. Verify roof openings are correctly framed.
- E. Verify deck surfaces are dry, free of ridges, warps, or voids.

### **3.02 PREPARATION**

- A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.
- B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
- C. Broom clean deck surfaces before installing underlayment or eave protection.

- D. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with plastic cement, and secure flange with nails spaced 6 inches on center.

### **3.03 INSTALLATION - EAVE PROTECTION MEMBRANE**

- A. Install eave protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.
- B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

### **3.04 INSTALLATION - UNDERLAYMENT**

- A. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches, stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.
- B. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

### **3.05 INSTALLATION - METAL FLASHING AND ACCESSORIES**

- A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
- C. Secure in place with nails at 6 inches on center, and conceal fastenings.
- D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

### **3.06 INSTALLATION - SHINGLES**

- A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.
  - 1. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
  - 2. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
- B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
- C. Project first course of shingles 3/4 inch beyond fascia boards.
- D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
- E. Extend shingles on both slopes across valley in a weave pattern and fasten, extend shingles a minimum of 12 inches beyond valley center line to achieve woven valley, and concealing valley protection.
- F. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.
- G. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.
- H. Complete installation to provide weather tight service.

### **3.07 PROTECTION**

- A. Do not permit traffic over finished roof surface.

**END OF SECTION**



**SECTION 074646**  
**FIBER-CEMENT SIDING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
  - 1. Manufacturer's requirements for related materials to be installed by others.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation methods, including nail patterns.
- C. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).
- D. Installer's Qualification Statement.
- E. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.
- F. Warranty: Submit copy of manufacturer's warranty, made out in Owner's name, showing that it has been registered with manufacturer.

**1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store products under waterproof cover and elevated above grade, on a flat surface.

**1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Provide multi-year manufacturer warranty as indicated under Siding article sub-heading "Warranty".

**PART 2 PRODUCTS**

**2.01 FIBER-CEMENT SIDING**

- A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying to ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
  - 1. Style: Standard lap style.
  - 2. Texture: Simulated rough sawn grain.
  - 3. Length: 12 ft, nominal.
  - 4. Width (Height): 8-1/4 inches.
  - 5. Thickness: 5/16 inch, nominal.
  - 6. Finish: Unfinished.
  - 7. Color: As selected by Architect from manufacturers full range of available colors.
  - 8. Warranty: 50 year limited; transferable.
  - 9. Manufacturers:
    - a. Allura, a division of Plycem USA, Inc: [www.allurausa.com/#sle](http://www.allurausa.com/#sle).
    - b. CertainTeed Corporation : [www.certainteed.com](http://www.certainteed.com).
    - c. James Hardie Building Products, Inc: [www.jameshardie.com/#sle](http://www.jameshardie.com/#sle).

- d. Nichiha USA, Inc: [www.nichiha.com/#sle](http://www.nichiha.com/#sle).
- B. Shingle Panels: Panels giving appearance of multiple shingles made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
  - 1. Style: Random width, staggered edge.
  - 2. Texture: Smooth.
  - 3. Length: 48 inches.
  - 4. Width (Height): 7 inches.
  - 5. Thickness: 1/4 inch, nominal.
  - 6. Finish: Unfinished.
  - 7. Warranty: 50 year limited; transferable.
  - 8. Manufacturers:
    - a. Allura, a division of Plycem USA, Inc: [www.allurausa.com/#sle](http://www.allurausa.com/#sle).
    - b. GAF WeatherSide Fiber-Cement Siding: [www.gaf.com/#sle](http://www.gaf.com/#sle).
    - c. James Hardie Building Products, Inc: [www.jameshardie.com/#sle](http://www.jameshardie.com/#sle).
    - d. Nichiha USA, Inc: [www.nichiha.com/#sle](http://www.nichiha.com/#sle).

## **2.02 ACCESSORIES**

- A. Trim: Same material and texture as siding.
- B. Fiber Cement Siding Metal Trim: Extruded aluminum alloy 6063-T5 temper.
  - 1. Dimension and Layout: As indicated on drawings.
  - 2. Finish: Powder coating.
    - a. Color: As selected by Architect.
- C. Fasteners: Galvanized or corrosion resistant; length as required to penetrate minimum 1-1/4 inch.
- D. Sealant: Elastomeric, polyurethane or silyl-terminated polyether/polyurethane, and capable of being painted.
- E. Joint Sealer: As specified in Section 079005.
- F. Finish Paint: Latex house paint acceptable to siding manufacturer; primer recommended by paint manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.
- B. Verify that water-resistive barrier has been installed over substrate completely and correctly.
- C. Do not begin until unacceptable conditions have been corrected.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Install Sheet Metal Flashing:
  - 1. Above door and window trim and casings.
  - 2. Above horizontal trim in field of siding.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and recommendations.
  - 1. Read warranty and comply with terms necessary to maintain warranty coverage.
  - 2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
  - 3. Use trim details indicated on drawings.
  - 4. Touch up field cut edges before installing.

- 5. Pre-drill nail holes if necessary to prevent breakage.
- B. Over Wood Sheathing: Fasten siding through sheathing into studs.
- C. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.
- D. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.
- E. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, and other surfaces where water may collect.
- F. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.
- G. Finish Painting: Within one week after installation, paint siding and trim with one coat primer and two coats finish paint.

#### **3.04 PROTECTION**

- A. Protect installed products until Date of Substantial Completion.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 076200**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

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

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 10 X10 inch in size illustrating metal finish color.

**1.04 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

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

**PART 2 PRODUCTS**

**2.01 SHEET MATERIALS**

- A. Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; mill finish.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage, (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
  - 1. Acrylic Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
  - 2. Color: As selected by Architect from manufacturer's standard colors.

**2.02 ACCESSORIES**

- A. Sealant: Type specified in Section 079005.

**2.03 FABRICATION**

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

## **2.04 GUTTER AND DOWNSPOUT FABRICATION**

- A. Gutters: SMACNA (ASMM), Rectangular profile.
- B. Downspouts: Rectangular profile, 2" x 3".
- C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).
- D. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
  - 2. Gutter Supports: Brackets.
  - 3. Downspout Supports: Brackets.
- E. Downspout Boots: Steel.
- F. Seal metal joints.

## **2.05 ACCESSORIES**

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
- C. Slip Sheet: Rosin sized building paper.
- D. Primer: Zinc chromate type.
- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- G. Plastic Cement: ASTM D4586/D4586M, Type I.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 INSTALLATION**

- A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.
- F. Secure gutters and downspouts in place with concealed fasteners.
- G. Connect downspouts to downspout boots, and grout connection watertight.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements, for field inspection requirements.

- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

**SECTION 079200**  
**JOINT SEALANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation as specified in Section 016116.
- G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- H. Installation Plan: Submit at least four weeks prior to start of installation.
- I. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- J. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- K. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- L. Installation Log: Submit filled out log for each length or instance of sealant installed.
- M. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
- C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
  2. Compatibility Testing: In accordance with ASTM C1087.
  3. Allow sufficient time for testing to avoid delaying the work.
- D. Installation Plan: Include schedule of sealed joints, including the following.
1. Joint width indicated in Contract Documents.
  2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
  3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
  4. Approximate date of installation, for evaluation of thermal movement influence.
  5. Installation Log Form: Include the following data fields, with known information filled out.
    - a. Unique identification of each length or instance of sealant installed.
    - b. Location on project.
    - c. Sealant used.
    - d. Date of installation.
    - e. Name of installer.
    - f. Actual joint width; provide space to indicate maximum and minimum width.
    - g. Actual joint depth to face of backing material at centerline of joint.
    - h. Air temperature.
- E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
  2. Name(s) of sealant manufacturers' field representatives who will be observing
  3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    - a. Test date.
    - b. Location on project.
    - c. Sealant used.
    - d. Copy of test method documents.
    - e. Age of sealant upon date of testing.
    - f. Test results, modeled after the sample form in the test method document.
    - g. Indicate use of photographic record of test.
- F. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.
- G. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
  2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    - a. For each different sealant and substrate combination, allow for one test every 12 inches in the first 10 linear feet of joint and one test every 24 inches thereafter.
    - b. If any failures occur in the first 10 linear feet, continue testing at 12 inch intervals at no extra cost to Owner.
  3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.



- H. Field Adhesion Test Procedures:
  - 1. Allow sealants to fully cure as recommended by manufacturer before testing.
  - 2. Have a copy of the test method document available during tests.
  - 3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
  - 4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- I. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.
- J. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

#### **1.04 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Adhesives Technology Corporation: [www.atcepoxy.com](http://www.atcepoxy.com).
  - 2. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 3. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 4. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  - 5. Fortifiber Building Systems Group: [www.fortifiber.com](http://www.fortifiber.com).
  - 6. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - 7. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com/sle](http://www.momentive.com/sle).
  - 8. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 9. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 10. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 11. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 12. W.R. Meadows, Inc: [www.wrmeadows.com](http://www.wrmeadows.com).
- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
  - 1. Adhesives Technology Corporation: [www.atcepoxy.com](http://www.atcepoxy.com).
  - 2. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 3. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 4. Dayton Superior Corporation: [www.daytonsuperior.com](http://www.daytonsuperior.com).
  - 5. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  - 6. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 7. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 8. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 9. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 10. W.R. Meadows, Inc: [www.wrmeadows.com](http://www.wrmeadows.com).

#### **2.02 JOINT SEALANT APPLICATIONS**

- A. Scope:
  - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.

- a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
- a. Joints between door, window, and other frames and adjacent construction.
  - b. Other joints indicated below.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; clear.
  2. Narrow Control Joints in Interior Concrete Slabs: Self-leveling polyurethane sealant.
- D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

### **2.03 JOINT SEALANTS - GENERAL**

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

### **2.04 NONSAG JOINT SEALANTS**

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
  2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
  5. Color: To be selected by Architect from manufacturer's standard range.
  6. Cure Type: Single-component, neutral moisture curing.
  7. Service Temperature Range: Minus 20 to 180 degrees F.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: Clear.
- C. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's standard range.
  4. Service Temperature Range: Minus 40 to 180 degrees F.

### **2.05 SELF-LEVELING SEALANTS**

- A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
  2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
  3. Color: To be selected by Architect from manufacturer's standard range.
  4. Service Temperature Range: Minus 40 to 180 degrees F.

- B. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
  - 1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.

## **2.06 ACCESSORIES**

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  - 1. Open Cell: 40 to 50 percent larger in diameter than joint width.
  - 2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
  - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
  - 2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
  - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
  - 4. Record each test on Preinstallation Adhesion Test Log as indicated.
  - 5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
  - 6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
  - 1. Width/depth ratio of 2:1.
  - 2. Neck dimension no greater than 1/3 of the joint width.

- 3. Surface bond area on each side not less than 75 percent of joint width.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

#### **3.04 FIELD QUALITY CONTROL**

- A. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

#### **3.05 POST-OCCUPANCY**

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

**END OF SECTION**

**SECTION 081213**  
**HOLLOW METAL FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.
- B. Frames for doors set flush with wall surface.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Samples: Submit one sample of frame metal, 2 inch by 2 inch, showing factory finishes, colors, and surface textures.
- E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide hollow metal frames from SDI Certified manufacturer: [www.steeldoor.org/sdicertified.php](http://www.steeldoor.org/sdicertified.php).
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Hollow Metal Frames with Integral Casings:
  - 1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Curries, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Republic Doors, an Allegion brand: [www.republicdoor.com/#sle](http://www.republicdoor.com/#sle).
  - 4. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).
- B. Hollow Metal Frames with Applied Casings:
  - 1. IDP - International Door Products Corp: [www.idpframes.com/#sle](http://www.idpframes.com/#sle).
  - 2. Timely Industries, Inc: [www.timelyframes.com/#sle](http://www.timelyframes.com/#sle).

**2.02 PERFORMANCE REQUIREMENTS**

- A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.
- B. Door Frame Type: Provide hollow metal door frames with either integral casing or applied casings.

1. Contractor's Option: Provide one of the frame types specified at no extra cost to the Owner, including field or factory finishing.
- C. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- D. Accessibility: Comply with ICC A117.1 and ADA Standards.
- E. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.
- F. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- G. Zinc Coating: Components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise.
- H. Frames for Doors Set Flush with Wall Finish: Frame is set onto wall surface with reinforced rolled edge perforated side strips and in-swinging or out-swinging door is provided with invisible hinges.

### **2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS**

- A. Frame Finish: Factory primed and field finished.
- B. Exterior Door Frames: Knock-down type.
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
    - d. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
  2. Weatherstripping: Refer to Section 087100.
- C. Interior Door Frames, Non-Fire Rated: Knock-down type.
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
    - d. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

### **2.04 HOLLOW METAL DOOR FRAMES WITH APPLIED CASINGS**

- A. Frame Type: Knockdown, slip-on drywall frames; separate jambs and head with separate snap-on casings both sides; factory-applied primer on exposed surfaces.
  1. Frame Material: Cold-rolled steel complying with ASTM A1008/A1008M.
  2. Casing Material: Formed steel.
  3. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M
  4. Casing Profile: As indicated.
  5. Finish: Factory prime, field finish.

### **2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

## **2.06 ACCESSORIES**

- A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Comply with glazing installation requirements of Section 088000.
- D. Install door hardware as specified in Section 087100.
- E. Touch up damaged factory finishes.

### **3.03 TOLERANCES**

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

### **3.04 SCHEDULE**

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

**END OF SECTION**

**SECTION 081416**  
**FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
  - 2. Include certification program label.
- D. Samples: Submit two samples of door construction, 10 x10 inch in size cut from top corner of door.
- E. Samples: Submit two samples of door veneer, 10 x 10 inch in size illustrating wood grain, stain color, and sheen.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- G. Manufacturer's Installation Instructions: Indicate special installation instructions.
- H. Manufacturer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Specimen warranty.
- K. Warranty, executed in Owner's name.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
  - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- C. Quality Certification:
  - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.



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

#### **1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Eggers Industries: [www.eggersindustries.com](http://www.eggersindustries.com).
  - 2. Graham Wood Doors: [www.grahamdoors.com](http://www.grahamdoors.com).
  - 3. Haley Brothers: [www.haleybros.com](http://www.haleybros.com).
  - 4. Marshfield DoorSystems, Inc: [www.marshfielddoors.com](http://www.marshfielddoors.com).
  - 5. Oregon Door: [www.oregondoor.com](http://www.oregondoor.com).

#### **2.02 DOORS**

- A. Doors: Refer to drawings for locations and additional requirements.
  - 1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.
  - 2. Wood veneer or MOD facing for field opaque finish .

#### **2.03 DOOR AND PANEL CORES**

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

#### **2.04 DOOR FACINGS**

- A. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.
- B. Facing Adhesive: Type I - waterproof.

#### **2.05 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
  - 1. Exception: Doors to be field finished.

- G. Provide edge clearances in accordance with the quality standard specified.

## **2.06 ACCESSORIES**

- A. Metal Louvers:
  - 1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.
  - 2. Louver Blade: Inverted V blade, sight proof, light proof.
  - 3. Louver Free Area: 50 percent.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Field-Finished Doors: Trimming to fit is acceptable.
  - 1. Adjust width of non-rated doors by cutting equally on both jamb edges.
  - 2. Trim maximum of 3/4 inch off bottom edges.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Install door louvers plumb and level.

### **3.03 TOLERANCES**

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

### **3.04 ADJUSTING**

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

### **3.05 SCHEDULE**

- A. Refer to See contract drawings for Door and Frame Schedule: .

**END OF SECTION**

**SECTION 081433**  
**STILE AND RAIL WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria.
- D. Samples: Submit two samples of door construction, 8 x 8 inch in size cut from top corner of door.
- E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Manufacturer's Qualification Statement.
- H. Installer's Qualification Statement.
- I. Warranty, executed in Owner's name.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
  - 1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
  - 2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- C. Quality Certification:
  - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

**1.04 DELIVERY, STORAGE, AND HANDLING**

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

## **1.05 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Stile and Rail Wood Doors:
  - 1. Eggers Industries: [www.eggersindustries.com](http://www.eggersindustries.com).
  - 2. Karon, Inc: [www.karonadoor.com](http://www.karonadoor.com).
  - 3. Maiman Company: [www.maiman.com](http://www.maiman.com).
  - 4. Marshfield DoorSystems, Inc: [www.marshfielddoors.com](http://www.marshfielddoors.com).

### **2.02 DOORS**

- A. Quality Level: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Transparent finish where indicated on drawings.
- C. Wood veneer facing for field opaque finish as indicated on drawings.

### **2.03 DOOR AND PANEL FACINGS**

- A. Materials for Opaque Finishes: Medium density overlay (MDO).
- B. Adhesive: Type I - Waterproof.

### **2.04 COMPONENTS**

- A. Panel Molding: Wood of same species as door facing, molded stop applied one-side, mitered corners; prepared for countersink style tamper proof screws.

### **2.05 DOOR CONSTRUCTION**

- A. Vertical Exposed Edge of Stiles: Of same species as veneer facing.
- B. Fit door edge trim to edge of stiles after applying veneer facing.
- C. Bond edge banding to cores.
- D. Panels: Flat.
- E. At exterior doors, provide aluminum flashing at the top and bottom rail for full thickness and width of door.
- F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.
- G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- H. Cut and configure exterior door edge to receive recessed weatherstripping devices. Provide edge clearances in accordance with referenced quality standards.

### **2.06 ACCESSORIES**

- A. Hollow Metal Door Frames: As specified in Section 081213.
- B. Door Hardware: As specified in Section 087100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

- C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standards.
- B. Field-Finished Doors: Trimming to fit is acceptable.
- C. Adjust width of non-rated doors by cutting equally on both jamb edges.
- D. Trim door height by cutting bottom edges to a maximum of 3/4 inch.
- E. Machine cut for hardware.
- F. Coordinate installation of doors with installation of frames and hardware.

### **3.03 TOLERANCES**

- A. Comply with specified quality standard for fit, clearance, and joinery tolerances.
- B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inch surface area.

### **3.04 ADJUSTING**

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

### **3.05 SCHEDULE - SEE DRAWINGS**

**END OF SECTION**

**SECTION 083639**  
**MESH DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Samples: Submit two panel finish samples, 10 x 10 inch in size, illustrating color and finish.
- E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- F. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.03 QUALITY ASSURANCE**

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

**1.04 WARRANTY**

- A. See Section 017800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Mesh Doors - Basis of Design: Rasco Industries, Inc. - Bug Blocker Door System, [www.bugblocker.com](http://www.bugblocker.com), 800-537-3802.

**2.02 WOOD DOOR COMPONENTS**

- A. Wood Doors: Stile and rail with mesh insert; standard lift operating style with track and hardware; complying with DASHA 102, Commercial application.
  - 1. Door Nominal Thickness: 1-3/4 inches thick.
  - 2. Finish: Factory primed; field finished as indicated in Section 099113.

**2.03 MESH DOOR COMPONENTS**

- A. Doors shall be sized for openings as scheduled on the drawings.
- B. Stainless steel screen mesh type door which shall be installed in conjunction with an overhead door.
- C. The Screen Door shall provide free area for ventilation, while restricting access for insects, birds, animals, or other unauthorized entry.

D. The screening shall be of 304 stainless steel wire mesh in either of the following configurations:

- |    |          |       |               |                |           |
|----|----------|-------|---------------|----------------|-----------|
| 1. | Type     | Mesh  | Wire Diameter | Opening Size   | Free Area |
| 2. | Standard | 12x12 | 0.023"        | 0.0603 in. sq. | 51.8%     |
- a. Meets Federal Specification Standard A-A-1037b Dated April 19, 1990 For Type I, Class I Wire Fabric. Meets The ASTM Standard Specification For Industrial Wire Cloth And Screens, Designation E 437-85.

## **2.04 MATERIALS**

- A. Lumber: Softwood; Dougla Fir species; kiln dried, preservative treated.
- B. Stainless Steel Wire Mesh: ASTM E 437-85. Standard Specification For Industrial Wire Cloth And Screens.
- C. Wood Primer Paint: Exterior latex type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

### **3.02 PREPARATION**

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.
- B. Apply primer to wood frame.

### **3.03 INSTALLATION**

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Fit and align door assembly including hardware.
- D. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 079005.

### **3.04 TOLERANCES**

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

### **3.05 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

### **3.06 CLEANING**

- A. Clean doors and frames.
- B. Remove labels and visible markings.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**

**SECTION 085313**  
**VINYL WINDOWS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Performance Requirements: As specified in PART 2, with the following additional requirements:
- B. Forced Entry Resistance: Conform to ASTM F588 requirements for performance level 10 for window type A.
- C. System Design: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of window.
  - 1. Calculate design pressures in accordance with applicable code
  - 2. Measure performance of units by testing in accordance with ASTM E330, using test pressure equal to 1.5 times the design wind pressure and 10 second duration of maximum load.
- D. Deflection: Limit member deflection to 1/200 of the longer dimension with full recovery of glazing materials.
- E. Air Infiltration: Limit air infiltration through assembly to 0.3 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E283.
- F. Water Leakage: None, when measured in accordance with ASTM E331.
- G. Design Temperature Range: 120 F degrees.

**1.03 ADMINISTRATIVE REQUIREMENTS**

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

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.
- C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements
- D. Samples: Submit two corner sections, 10 by 10 inch in size, illustrating window frame section.
- E. Submit two samples of operating hardware.
- F. Manufacturer's Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.



- H. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.
- I. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 QUALITY ASSURANCE**

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

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
- B. Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

#### **1.07 FIELD CONDITIONS**

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

#### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same. Include coverage for degradation of color finish.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Vinyl Windows:
  - 1. Alside, Inc: [www.alside.com](http://www.alside.com).
  - 2. Jeld-wen Windows and Doors, [www.jeld-wen.com](http://www.jeld-wen.com)
  - 3. Milgard Manufacturing Inc] [www.milgard.com](http://www.milgard.com) Milgard
  - 4. Pella Corporation; Encompass by Pella Vinyl Windows: [www.pellacommercial.com/#sle](http://www.pellacommercial.com/#sle).

#### **2.02 DESCRIPTION**

- A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
  - 1. Configuration: As indicated on drawings.
    - a. Product Type: DW - Dual windows, FW - Fixed window, and HS - Horizontal sliding window in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
  - 2. Sliding Glass Doors: Match window frame style and color.
  - 3. Color: Color as selected.
  - 4. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
  - 5. Operable Units: Double weatherstripped.
  - 6. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.

7. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
  8. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.
  9. Mounting Flange: Integral to frame assembly, providing weather stop at entire perimeter of frame.
  10. Insect Screens: Tight fitting for operating sash location.
- B. Performance Requirements: Provide products that comply with the following:
1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
    - a. Performance Class (PC): AW.
  2. Performance Validation: Windows shall comply with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated by having AAMA, WDMA, or CSA certified label, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction.
  3. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of window wall.

## **2.03 PERFORMANCE REQUIREMENTS**

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
1. Performance Grade (PG): Equivalent to or greater than specified design pressure.
- B. Design Pressure: In accordance with applicable codes.
- C. Condensation Resistance Factor: CRF of 50, minimum, the lower value of the glass and frame window components and determined in accordance with AAMA 1503.
- D. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.
- E. Forced Entry Resistance (FER): Tested to comply with ASTM F588 requirements having at least Grade 10 performance for each required window assembly.

## **2.04 COMPONENTS**

- A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.
1. Glass Stops: Snap-on PVC glazing bead with color to match sash and frame.
  2. Glazing Tape: Closed cell foam type with double sided adhesive.
  3. Setting Blocks: Manufacturer's standard.
- B. Windows: Extruded, hollow, tubular, ultra-violet resistant polyvinyl chloride (PVC) with integral color; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
1. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440 C30.
  2. Configuration: Fixed, non-operable, horizontal sliding, and single hung sash.
  3. Color: Color as selected.
- C. Frame Depth: 2-11/16 inch.
- D. Insect Screens: Aluminum, extruded or roll-formed frame with mitered and reinforced corners; apply screen mesh taut to frame; secure to window with hardware to allow easy removal.
1. Hardware: Manufacturer's standard; quantity as required per screen.
  2. Screen Mesh: Vinyl-coated fiberglass, window manufacturer's 18 x 16 mesh.
  3. Frame Finish: Manufacturer's standard, color to match window frame and sash color.
- E. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.
- F. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
1. Color: Black.

- G. Operable Sash Weatherstripping: Wool pile; permanently resilient, profiled to maintain weather seal in accordance with AAMA 701/702.
- H. Fasteners: Stainless steel.
- I. Accessories: Provide related flashings, anchorage and attachment devices as necessary for full assembly.
- J. Glazing Sealant: As specified in Section 088000.
- K. Exterior Window Sills: Refer to drawings.
- L. Sealants for Setting Window Sill Pan Flashing: Provide silicone sealant; in compliance with ASTM E2112 installation practices.

## **2.05 GLASS AND GLAZING MATERIALS**

- A. Glass and Glazing Materials: As specified in Section 088000 of Types described below:

## **2.06 SEALANT MATERIALS**

- A. Perimeter Sealant and Backing Materials: As specified in Section 079005.
- B. Glazing Sealant: As specified in Section 088000.
- C. Sealant Used Within System (Not Used for Glazing): As specified in Section 079005.

## **2.07 HARDWARE**

- A. Horizontal Sliding Sash: Rigid PVC interfacing tracks with screw adjustable nylon rollers in steel bracket, provide two sets for each operating sash and opening stops in head and sill track as required.
- B. Vertical Sliding Sash: Metal and nylon spiral friction slide cylinder, provide two for each sash and jamb.
- C. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.
- D. Sash lock: Lever handle with cam lock.
- E. Finish For Exposed Hardware: baked enamel.

## **2.08 FABRICATION**

- A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.
- B. Form sills and stools in one piece. Slope sills for wash.
- C. Form snap-in glass stops, closure molds, weather stops, and flashings of extruded PVC for tight fit into window frame section.
- D. Form weather stop flange to perimeter of unit.
- E. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- F. Arrange fasteners to be concealed from view.
- G. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.
- H. Assemble insect screen frame, miter and reinforced frame corners. Fit mesh taut into frame and secure. Fit frame with four spring loaded steel pin retainers.
- I. Double weatherstrip operable units.
- J. Factory glaze window units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify wall openings and adjoining air and vapor seal materials are ready to receive this work.

### **3.02 INSTALLATION**

- A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.
- C. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.
- D. Set sill members and sill flashing in continuous bead of sealant.
- E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- F. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- G. Install operating hardware.
- H. Install glass in accordance with Section 088000, to glazing method required to achieve performance criteria.
- I. Install perimeter sealant and backing materials in accordance with Section 079005.

### **3.03 TOLERANCES**

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

### **3.04 FIELD QUALITY CONTROL**

- A. Provide services of vinyl window manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 014000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed vinyl windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
  - 1. Conduct tests on individual windows prior to 5 percent and 50 percent completion of this work.
  - 2. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf.
  - 3. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 6.27 psf.
    - a. Maximum allowable rate of air leakage is 0.10 cfm/sq ft.
- D. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

### **3.05 ADJUSTING**

- A. Adjust hardware for smooth operation and secure weathertight closure.

### **3.06 CLEANING**

- A. Remove protective material from pre-finished surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.
- C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

**END OF SECTION**

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 SUMMARY:**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein..

**1.2 References:** Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.

1. Builders Hardware Manufacturing Association (BHMA)
2. NFPA 101 Life Safety Code
3. NFPA 80 -Fire Doors and Windows
4. ANSI-A156.xx- Various Performance Standards for Finish Hardware
5. UL10C – Positive Pressure Fire Test of Door Assemblies
6. ANSI-A117.1 – Accessible and Usable Buildings and Facilities
7. DHI /ANSI A115.IG – Installation Guide for Doors and Hardware
8. ICC – International Building Code

**B. Intent of Hardware Groups**

1. Should items of hardware not definitely specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware are incorrectly specified, or omitted, but are required for completion of the Work, a written statement of such omission, error, or other discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or, furnish such items in the type and quality established by this specification, and appropriate to the service intended.

**1.3 SUBSTITUTIONS:**

- A. Comply with Division 1.

**1.4 SUBMITTALS:**

- A. Comply with Division 1.

- B. Special Submittal Requirements: Combine submittals of this Section with Sections listed below to ensure the "design intent" of the system/assembly is understood and can be reviewed together.

- C. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Wiring diagrams for each electric product specified. Coordinate voltage with electrical before submitting.
4. Submit 6 copies of catalog cuts with hardware schedule.
5. Provide 9001-Quality Management and 14001-Environmental Management for products listed in Materials Section 2.2

- D. Shop Drawings - Hardware Schedule: Submit 6 complete reproducible copy of detailed hardware schedule in a vertical format.

1. List groups and suffixes in proper sequence.
2. Completely describe door and list architectural door number.

3. Manufacturer, product name, and catalog number.
4. Function, type, and style.
5. Size and finish of each item.
6. Mounting heights.
7. Explanation of abbreviations and symbols used within schedule.
8. Detailed wiring diagrams, specially developed for each opening, indicating all electric hardware, security equipment and access control equipment, and door and frame rough-ins required for specific opening.

E. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

1. Templates, wiring diagrams and "reviewed Hardware Schedule" of electrical terms to electrical for coordination and verification of voltages and locations.

F. Samples: (If requested by the Architect)

1. 1 sample of Lever and Rose/Escutcheon design, (pair).
2. 3 samples of metal finishes

G. Contract Closeout Submittals: Comply with Division 1 including specific requirements indicated.

1. Operating and maintenance manuals: Submit 3 sets containing the following.
  - a. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Name, address, and phone number of local representative for each manufacturer.
  - d. Parts list for each product.
2. Copy of final hardware schedule, edited to reflect, "As installed".
3. Copy of final keying schedule
4. As installed "Wiring Diagrams" for each piece of hardware connected to power, both low voltage and 110 volts.
5. One set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

## 1.5 QUALITY ASSURANCE

A. Comply with Division 1.

1. Statement of qualification for distributor and installers.
2. Statement of compliance with regulatory requirements and single source responsibility.
3. Distributor's Qualifications: Firm with 3 years' experience in the distribution of commercial hardware.
  - a. Distributor to employ full time Architectural Hardware Consultants (AHC) for the purpose of scheduling and coordinating hardware and establishing keying schedule.
  - b. Hardware Schedule shall be prepared and signed by an AHC.
4. Installer's Qualifications: Firm with 3 years experienced in installation of similar hardware to that required for this Project, including specific requirements indicated.
5. Regulatory Label Requirements: Provide testing agency label or stamp on hardware for labeled openings.
  - a. Provide UL listed hardware for labeled and 20-minute openings in conformance with requirements for class of opening scheduled.
  - b. Underwriters Laboratories requirements have precedence over this specification where conflict exists.

6. Single Source Responsibility: Except where specified in hardware schedule, furnish products of only one manufacturer for each type of hardware.
- B. Review Project for extent of finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, notify the Architect in writing and furnish hardware in compliance with the Specification unless otherwise directed in writing by the Architect.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Comply with Division 1.
  1. Deliver products in original unopened packaging with legible manufacturer's identification.
  2. Package hardware to prevent damage during transit and storage.
  3. Mark hardware to correspond with "reviewed hardware schedule".
  4. Deliver hardware to door and frame manufacturer upon request.
- B. Storage and Protection: Comply with manufacturer's recommendations.

#### 1.7 PROJECT CONDITIONS:

- A. 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 the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.
- B. Review Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

#### 1.8 WARRANTY:

- A. Refer to Conditions of the Contract
- B. Manufacturer's Warranty:
  1. Closers: Ten years
  2. Exit Devices: Five Years
  3. Locksets & Cylinders: Three years
  4. All other Hardware: Two years.

#### 1.9 OWNER'S INSTRUCTION:

- A. Instruct Owner's personnel in operation and maintenance of hardware units.

#### 1.10 MAINTENANCE:

- A. Extra Service Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 Closeout Submittals Section.
  1. Special Tools: Provide special wrenches and tools applicable to each different or special hardware component.
  2. Maintenance Tools: Provide maintenance tools and accessories supplied by hardware component manufacturer.
  3. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra service materials.
- B. Maintenance Service: Submit for Owner's consideration maintenance service agreement for electronic products installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS:

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

| <u>Item:</u>           | <u>Manufacturer:</u> | <u>Approved:</u>      |
|------------------------|----------------------|-----------------------|
| Hinges                 | Stanley              | Hager                 |
| Continuous Hinges      | Stanley              | ABH                   |
| Locksets               | Best                 | No Substitution       |
| Cylinders              | Best                 | No Substitution       |
| Exit Devices           | Precision            | Dorma                 |
| Closers                | Dorma                | Stanley               |
| Access Control System  | dormakaba            | By Others             |
| Automatic Operators    | Dorma                | Stanley               |
| Push/Pull Plates       | Trimco               | Burns, Rockwood       |
| Push/Pull Bars         | Trimco               | Burns, Rockwood       |
| Protection Plates      | Trimco               | Burns, Rockwood       |
| Overhead Stops         | ABH                  | Rixson, Glynn Johnson |
| Door Stops             | Trimco               | Burns, Rockwood       |
| Flush Bolts            | Trimco               | ABH, Burns            |
| Coordinator & Brackets | Trimco               | ABH, Burns            |
| Threshold & Gasketing  | National Guard       | Reese, K.N. Crowder   |

### 2.2 MATERIALS:

- A. Hinges: Shall be Five Knuckle Ball bearing hinges

1. Template screw hole locations
2. Bearings are to be fully hardened.
3. Bearing shell is to be consistent shape with barrel.
4. Minimum of 2 permanently lubricated non-detachable bearings on standard weight hinge and 4 permanently lubricated bearing on heavy weight hinges.
5. Equip with easily seated, non-rising pins.
6. Non-Removable Pin screws shall be slotted stainless steel screws.
7. Hinges shall be full polished, front, back and barrel.
8. Hinge pin is to be fully plated.
9. Bearing assembly is to be installed after plating.
10. Sufficient size to allow 180-degree swing of door
11. Furnish five knuckles with flush ball bearings
12. Provide hinge type as listed in schedule.
13. Furnish 3 hinges per leaf to 7-foot 6-inch height. Add one for each additional 30 inches in height or fraction thereof.
14. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
15. UL10C listed for Fire rated doors.

- B. Geared Continuous Hinges:

1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
2. Anti-spinning through fastener
3. UL10C listed for 3-hour Fire rating
4. Non-handed
5. Lifetime warranty
6. Provide Fire Pins for 3-hour fire ratings
7. Sufficient size to permit door to swing 180 degrees

- C. Cylindrical Type Locks and Latchsets:



1. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be UL10C listed.
2. Provide 9001-Quality Management and 14001-Environmental Management.
3. Fit modified ANSI A115.2 door preparation.
4. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
5. Locksets to have anti-rotational studs that are thru-bolted
6. Keyed lever shall not have exposed "keeper" hole
7. Each lever to have independent spring mechanism controlling it
8. 2-3/4-inch (70 mm) backset
9. 9/16-inch (14 mm) throw latchbolt
10. Provide sufficient curved strike lip to protect door trim
11. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
12. Keyed lever to be removable only after core is removed, by authorized control key
13. Provide locksets with 7-pin removable and interchangeable core cylinders
14. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
15. Locksets outside locked lever must withstand minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
16. Core face must be the same finish as the lockset.
17. Functions and design as indicated in the hardware groups.

D. Exit Devices:

1. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
2. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
3. Exit devices chassis to be investment cast steel, zinc dichromate.
4. Exit devices to have stainless steel deadlocking  $\frac{3}{4}$ " through latch bolt.
5. Exit devices to be equipped with sound dampening on touchbar.
6. Non-fire rated exit devices to have cylinder dogging.
7. Non-fire rated exit devices to have  $\frac{1}{4}$ " minimum turn hex key dogging.
8. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
9. Touchbar assembly on wide style exit devices to have a  $\frac{1}{4}$ " clearance to allow for vision frames.
10. All exposed exit device components to be of architectural metals and "true" architectural finishes.
11. Provide strikes as required by application.
12. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
13. The strike is to be black powder coated finish.
14. Exit devices to have field reversible handing.
15. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
16. Provide 9001-Quality Management and 14001-Environmental Management.
17. Vertical Latch Assemblies to have gravity operation, no springs.
18. Approved Manufacturers
  - a. The following manufacturers will be approved contingent on meeting or exceeding the above performance criteria:
    - 1) Precision Manufactured by Stanley Security Solutions

E. Cylinders:

1. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
2. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
3. Coordinate and provide as required for related sections.

F. Door Closers shall:

1. Tested and approved by BHMA for ANSI 156.4, Grade 1

2. UL10C certified
  3. Provide 9001-Quality Management and 14001-Environmental Management.
  4. Closer shall have extra-duty arms and knuckles
  5. Conform to ANSI 117.1
  6. Maximum 2 7/16-inch case projection with non-ferrous cover
  7. Separate adjusting valves for closing and latching speed, and backcheck
  8. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
  9. Full rack and pinion type closer with 1-1/2-inch minimum bore
  10. Mount closers on non-public side of door, unless otherwise noted in specification
  11. Closers shall be non-handed, non-sized and multi-sized.
- G. Door Stops: Provide a dome floor or wall stop for every opening as listed in the hardware sets.
1. Wall stops shall be wrought bronze, brass or stainless steel.
  2. Floor stops shall be cast bronze, brass, or stainless steel.
  3. Provide fastener suitable for wall construction.
  4. Coordinate reinforcement of walls where wall stop is specified.
  5. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
- H. Over Head Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
1. Concealed overhead stops shall be heavy duty bronze or stainless steel.
  2. Surface overhead stops shall be heavy duty bronze or stainless steel.
- I. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
- J. Pulls with plates: Provide with four beveled edges ANSI J301, .050 thickness Plate s with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
- K. Push Pull Bars: Provide ANSI J504, .1" Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
- L. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- M. Mop plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
- N. Electromagnetic Locks: Certified by BHMA for A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door
1. Type: Full exterior or full interior, as required by application indicated.
  2. Strength Ranking: **[1500 lbf] [1000 lbf] [500 lbf]**.
  3. Inductive Kickback Peak Voltage: Not more than **[53] [0]** V.
  4. Residual Magnetism: Not more than **[4 lbf] [0 lbf]** to separate door from magnet.
- O. Power Supply: UL Listed, Field Selectable 12VDC or 24VDC output. The power supply will specifically designed to support electric locks and access controls. The power supply uses 115 VAC at 800mA input. The power shall be able to be expanded to four station controls. The filtered and regulated output power is field selectable for 12 or 24 VDC.
1. Fire Alarm/Life Safety emergency release included in power supply.
  2. Available options for multiple door options four or more control stations, Adjustable Time delay relay, Battery charging, Battery Backup.
- P. Electric Door Strike: Certified by ANSI/BHMA 156.31, Grade 1. and listed for Burglary Protection ANSI/UL1034 Grade 1.

1. For General use provide fail-secure electric strike and with fire-rated device.
  2. Listed UL10C for Fire Door assemblies
  3. Latchbolt monitor switch option when specified in hardware sets.
  4. Provide the electric strike in the appropriate model that will accept a 5/8" or 3/4" latchbolt.
- Q. Door Position Switch: Provide door position switch for door status monitoring as indicated in hardware sets.
1. At all fired rated doors the door and frames, position switch preparation will be provided by the door and frame manufacturer or by an authorized label service agent.
- R. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- S. Weatherstripping: Provide at head and jambs only those units where resilient or flexible seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
1. Weatherstrip shall be resilient seal of (Neoprene, Polyurethane, Vinyl, Pile, Nylon Brush, Silicone)
  2. UL10C Positive Pressure rated seal set when required.
- T. Door Bottoms/Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
1. Door seal shall be resilient seal of (Neoprene, Polyurethane, Nylon Brush, Silicone)
  2. UL10C Positive Pressure rated seal set when required.
- U. Thresholds: Thresholds shall be aluminum beveled type with maximum height of 1/2" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.

## 2.3 FINISH:

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

## 2.4 KEYS AND KEYING:

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.
- B. Cylinders, removable and interchangeable core system: Best CORMAX™ Patented 7-pin.
- C. Permanent keys and cores: Stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish keys in the following quantities:

1. 1 each Grand Masterkeys
  2. 4 each Masterkeys
  3. 2 each Change keys each keyed core
  4. 15 each Construction masterkeys
  5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
1. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 HARDWARE LOCATIONS:

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
  2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
  3. WDMA Industry Standard I.S.-1A-04, Industry Standard for Architectural wood flush doors.

#### 3.3 INSTALLATION:

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

#### 3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/Installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
1. Check and adjust closers to ensure proper operation.

2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
  - a. Verify levers are free from binding.
  - b. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE:

### Hardware Sets

#### SET #01 - 104

|              |                     |       |    |
|--------------|---------------------|-------|----|
| 3 Hinges     | CB179 4 1/2 X 4 1/2 | US26D | ST |
| 1 Lockset    | 9K3-7D15D PATD      | 626   | BE |
| 1 Closer     | TS9315 ST           | 689   | DM |
| 1 Kick Plate | K0050 10" x 34"     | 630   | TR |

#### SET #02 - 106

|               |                         |       |    |
|---------------|-------------------------|-------|----|
| 3 Hinges      | CB179 4 1/2 X 4 1/2 NRP | US26D | ST |
| 1 Lockset     | 9K3-7D15D PATD          | 626   | BE |
| 1 Door Closer | QDC119                  | 689   | SH |
| 1 Kick Plate  | K0050 10" x 34"         | 630   | TR |

#### SET #03 - 103, 102, 108

|                    |                         |       |    |
|--------------------|-------------------------|-------|----|
| 3 Hinges           | CB179 4 1/2 X 4 1/2 NRP | US26D | ST |
| 1 Exit Device      | 2103 X 4903A            | 626W  | PR |
| 1 Rim Cylinder     | 12E-72 PATD             | 626   | BE |
| 1 Door Closer      | QDC119                  | 689   | SH |
| 1 Kick Plate       | K0050 10" x 34"         | 630   | TR |
| 1 Drip Cap         | 16 A - 4" ODW           |       | NA |
| 1 Gasketing        | 600 A 36"               |       | NA |
| 1 Gasketing        | 700 NA 1 x 36" 2 x 84"  |       | NA |
| 1 Saddle Threshold | 426 40" 1/4-20 SSMS/EA  | AL    | NA |

#### SET #04 - 107

|               |                         |       |    |
|---------------|-------------------------|-------|----|
| 3 Hinges      | CB179 4 1/2 X 4 1/2 NRP | US26D | ST |
| 1 Privacy Set | 9K3-0L15D               | 626   | BE |
| 1 Door Closer | QDC119                  | 689   | SH |
| 1 Kick Plate  | K0050 10" x 34"         | 630   | TR |
| 1 Wall Bumper | 1270CV                  | 626   | TR |
| 1 Gasketing   | 5040 B-17 17'           |       | NA |

#### SET #05 - 101

|                    |                        |       |    |
|--------------------|------------------------|-------|----|
| 3 Hinges           | CB179 4 1/2 X 4 1/2    | US26D | ST |
| 1 Lockset          | 9K3-7AB15D PATD        | 626   | BE |
| 1 Closer           | TS9315 ST              | 689   | DM |
| 1 Gasketing        | 600 A 36"              |       | NA |
| 1 Gasketing        | 700 NA 1 x 36" 2 x 84" |       | NA |
| 1 Saddle Threshold | 426 40" 1/4-20 SSMS/EA | AL    | NA |

#### SET #06 - 201

|           |                |     |    |
|-----------|----------------|-----|----|
| 1 Lockset | 9K3-7D15D PATD | 626 | BE |
|-----------|----------------|-----|----|

NOTE: Remaining Hardware by door MANF.

**SECTION 088000**  
**GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

**1.02 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples 10 by 10 inch in size of glass units.
- E. Samples: Submit 10 inch long bead of glazing sealant, color as selected.
- F. Certificate: Certify that products of this section meet or exceed specified requirements.
- G. Manufacturer's Qualification Statement.
- H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.04 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

**1.05 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

**1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Glass Fabricators:
  - 1. GGI - General Glass International: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).
  - 2. JE Berkowitz, LP: [www.jeberkowitz.com/#sle](http://www.jeberkowitz.com/#sle).
  - 3. Standard Bent Glass Corp: [www.standardbent.com/#sle](http://www.standardbent.com/#sle).
  - 4. Trulite Glass & Aluminum Solutions, LLC: [www.trulite.com/#sle](http://www.trulite.com/#sle).

5. Viracon, Inc: [www.viracon.com/#sle](http://www.viracon.com/#sle).

## **2.02 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
  - 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
  - 2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
  - 3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

## **2.03 GLAZING UNITS**

- A. Monolithic Exterior Vision Glazing:
  - 1. Applications: Exterior glazing unless otherwise indicated.
  - 2. Glass Type: Annealed or Fully tempered float glass, as scheduled.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch, nominal.

## **2.04 GLAZING COMPOUNDS**

- A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

## **2.05 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

# **PART 3 EXECUTION**

## **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

## **3.02 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.



- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

### **3.03 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)**

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- C. Apply heel bead of silicone sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
  - 1. Place glazing tape on glazing pane of unit with tape flush with sight line.
- G. Fill gap between glazing and stop with silicone type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
- H. Apply cap bead of silicone type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.04 FIELD QUALITY CONTROL**

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

### **3.05 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.06 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 092116**  
**GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with acoustic seals.
- C. Product Data: Provide data on gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

**1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of documented experience.

**PART 2 PRODUCTS**

**2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

**2.02 BOARD MATERIALS (NO IMPORTED MATERIALS ALLOWED)**

- A. Manufacturers - Gypsum-Based Board:
  - 1. American Gypsum Company: [www.americangypsum.com](http://www.americangypsum.com).
  - 2. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 3. Continental Building Products: [www.continental-bp.com/#sle](http://www.continental-bp.com/#sle).
  - 4. Georgia-Pacific Gypsum: [www.gpgypsum.com](http://www.gpgypsum.com).
  - 5. National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - 6. PABCO Gypsum: [www.pabco gypsum.com](http://www.pabco gypsum.com).
  - 7. Temple-Inland Inc: [www.templeinland.com](http://www.templeinland.com).
  - 8. USG Corporation: [www.usg.com](http://www.usg.com).
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
    - b. Mold resistant board is required in toilet rooms on walls not tiled.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 1/2 inch.
- C. Backing Board For Wet Areas: One of the following products:
  - 1. Application: Surfaces behind tile in wet areas including areas receiving tile.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
    - a. Thickness: 1/2 inch.
    - b. Products:
      - 1) Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
      - 2) National Gypsum Company; PermaBase Cement Board: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
      - 3) USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  4. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
    - a. Thickness: 1/2 inch.
    - b. Products:
      - 1) James Hardie Building Products, Inc: [www.jameshardie.com](http://www.jameshardie.com).
  5. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
- D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
  2. Thickness: 1/2 inch.
  3. Edges: Tapered.
  4. Products:
    - a. Continental Building Products; Sagcheck.
    - b. American Gypsum; Interior Ceiling Board.
    - c. CertainTeed Corporation; ProRoc Interior Ceiling.
    - d. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
    - e. National Gypsum Company; High Strength Brand Ceiling Board.
    - f. Pacific Coast Building Products, Inc; PABCO Ceiling Board.
    - g. Temple-Inland Inc; Span24 Ceiling Board.
    - h. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.

## **2.03 GYPSUM WALLBOARD ACCESSORIES**

- A. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- B. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
  1. Types: As detailed or required for finished appearance.
  2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
- C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners.
  2. Joint Compound: Drying type, vinyl-based, ready-mixed.
- D. Nails for Attachment to Wood Members: ASTM C514.
- E. Staples For Attachment of Base Ply of Two-Ply Assembly to Wood Members: Flattened galvanized wire type as specified in ASTM C840.
- F. Anchorage to Substrate: Nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Cementitious Backing Board: Install over wood framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- F. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:
  - 1. Single-Layer Applications: Screw attachment.
  - 2. Double-Layer Application: Install base layer using screws. Install face layer using screws.
- G. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

### **3.03 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

### **3.04 JOINT TREATMENT**

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 3. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
  - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
  - 3. Taping, filling and sanding is not required at base layer of double layer applications.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.05 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION**

**SECTION 093000**  
**TILING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- G. Installer's Qualification Statement:
  - 1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
  - 2. Submit documentation of completion of apprenticeship and certification programs.
- H. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 1 percent of each size, color, and surface finish combination.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- B. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.
  - 2. Installer Certification:
    - a. Ceramic Tile Education Foundation (CTEF): Certified Tile Installer (CTI).
    - b. Apprenticeship Program: Installer has achieved Journeyworker status through an apprenticeship from the International Union of Bricklayers and Allied Craftworkers (IUBAC) or a U.S. Department of Labor (DOL)-recognized program.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

## **1.06 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

## **PART 2 PRODUCTS**

### **2.01 TILE: SEE FINISH SCHEDULE FOR TILE SELECTION**

- A. Manufacturers: All products by the same manufacturer.

### **2.02 TRIM AND ACCESSORIES**

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
  - 1. Applications:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: Coved.
    - c. Floor to Wall Joints: Cove base.
  - 2. Manufacturers: Same as for tile.
- B. Thresholds: Marble, white or gray, honed finish; 2 inches wide by full width of wall or frame opening; 1/2 inch thick; beveled one long edge with radiused corners on top side; without holes, cracks, or open seams.
  - 1. Applications:
    - a. At doorways where tile terminates.
    - b. At open edges of floor tile where adjacent finish is a different height.

### **2.03 SETTING MATERIALS**

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com](http://www.ardexamericas.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  - 4. LATICRETE International, Inc: [www.laticrete.com](http://www.laticrete.com).
  - 5. Merkrete, by Parex USA, Inc: [www.merkrete.com](http://www.merkrete.com).
  - 6. ProSpec, an Oldcastle brand: [www.prospec.com](http://www.prospec.com).
  - 7. TEC, an H.B. Fuller Construction Products Brand: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
- B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4 or ANSI A118.15.

### **2.04 GROUTS**

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com](http://www.ardexamericas.com).
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 3. Custom Building Products: [www.custombuildingproducts.com](http://www.custombuildingproducts.com).
  - 4. LATICRETE International, Inc: [www.laticrete.com](http://www.laticrete.com).
  - 5. Merkrete, by Parex USA, Inc; Merkrete Duracolor Non-Sanded Color Grout: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
  - 6. ProSpec, an Oldcastle brand: [www.prospec.com](http://www.prospec.com).
  - 7. TEC, an H.B. Fuller Construction Products Brand: [www.tecspecialty.com/#sle](http://www.tecspecialty.com/#sle).
- B. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As selected by Architect from manufacturer's full line.
- C. Tile Sealant: Gunnable, silicone sealant moisture and mildew resistant type.

## **2.05 MAINTENANCE MATERIALS**

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  - 1. Applications: Between tile and plumbing fixtures.
  - 2. Color(s): As selected by Architect from manufacturer's full line.

## **2.06 ACCESSORY MATERIALS**

- A. Concrete Floor Slab Crack Isolation Membrane at slab on grade only: Material complying with ANSI A118.12. For Slab on grade application only
  - 1. Type: Peel-and-stick sheet.
  - 2. Thickness: 20 mils, maximum.
  - 3. Crack Resistance: No failure at 1/8 inch gap, minimum.
  - 4. Products:
    - a. LATICRETE International, Inc: [www.laticrete.com](http://www.laticrete.com).
    - b. Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: [www.merkrete.com/#sle](http://www.merkrete.com/#sle).
    - c. Proflex Products, Inc: [www.proflex.us](http://www.proflex.us).
- B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
- C. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
  - 1. Standard Type: Thickness 1/2 inch.
  - 2. Fire Resistant Type: Type X core, thickness 5/8 inch.
- D. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- M. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- N. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

#### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.

#### **3.05 INSTALLATION - WALL TILE**

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- B. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

#### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

#### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**END OF SECTION**



**SECTION 096519**  
**RESILIENT TILE FLOORING**

**PART 2 PRODUCTS**

**1.01 RESILIENT TILE FLOORING**

**1.02 ACCESSORIES**

- A. Moldings, Transition and Edge Strips: Same material as flooring.
- B. Adhesives:
  - 1. As recommended by tile manufacturer.

**PART 3 EXECUTION**

**2.01 EXAMINATION .**

- A. Install flooring and accessories after other operations (including painting) have been completed.
- B. Acceptance of Conditions: Carefully examine all installation areas with installer/applicator present, for compliance with requirements affecting work performance.
  - 1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive work.
- C. Verify that substrate is contaminant-free, including old adhesives and abatement chemicals.
- D. Test substrates as required by manufacturer to verify proper conditions exist.
  - 1. Concrete:
    - a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
    - b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
    - c. Perform alkalinity testing per ASTM F710 to verify pH level is between 7 to 10.
    - d. Check substrate for absorbency per manufacturer's recommendations.
    - e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.
- E. Verify that required floor-mounted utilities are in correct location.

**2.02 PREPARATION**

- A. Flooring installation should not begin until all site conditions have been assessed, testing has been completed and subfloor conditions have been approved.
- B. Prepare per manufacturer's written instructions, Section 017000, and as follows:
  - 1. Prepare substrates to ensure proper adhesion of Luxury Vinyl Plank & Tile.
  - 2. Concrete Substrates: Prepare substrate per ASTM F710.
    - a. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.
    - b. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
      - 1) Do not use solvents or adhesive removers.
    - c. Expansion joints, isolation joints, or other moving joints must be honored and must not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer, and based upon intended usage and aesthetic considerations.
    - d. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high-quality Portland cement or

calcium aluminate based patching or underlayment compound for filling or smoothing, or both.

- 1) Do not skim-coat large areas with patching compound, especially slick power-troweled surfaces.
- 2) Sand smooth per manufacturer's instructions.
- e. Slick surfaces such as power-troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
- f. Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.
- g. Self-Leveling Underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have a minimum of 3,000 psi compressive strength per ASTM C109/C109M.
- h. Lightweight concrete shall have a compressive strength greater than 90 pounds per cubic foot with minimum compression strength of 2,500 psi or greater.

### **2.03 INSTALLATION**

- A. Installation per manufacturer's written instructions, Section 017000, and as follows:
  1. Layout shall be specified by Architect, Designer or End User.
  2. Follow layout and ensure installation reference lines are square.
  3. Field tiles shall be installed with directional arrows on back aligned in the same direction, or may be installed in quarter-turned fashion.
  4. Check cartons for and do not mix dye lots.
  5. Expansion Joints: Locate expansion, isolation, and other moving joints prior to installation.
    - a. Do not fill expansion, isolation, and other moving joints with patching compound nor cover with resilient flooring.
    - b. Install movement joint systems per manufacturer's instructions and per Section 079200 and Section 079513.
  6. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
    - a. Select appropriate adhesive, trowel and follow manufacturer's instructions.
    - b. Periodically spot-check transfer of adhesive to back of tile during installation.
    - c. Roll floor with a 100 pound roller to ensure proper transfer of adhesive and bonding.
    - d. Protect floor from traffic per manufacturer's instructions.
    - e. Do not wet mop floor until the adhesive has properly set per written instructions.

### **2.04 FIELD QUALITY CONTROL**

- A. Site tests and inspections per Section 014000 and as follows:
  1. Inspect flooring installation for non-conforming work including (but not limited to) the following:
    - a. Lack of adhesion.
    - b. Bubbles, loose tiles or raised edges.
    - c. Dirt and debris underneath flooring.
    - d. Excessive gaps.
    - e. Improper substrate preparation (as indicated by telegraphing).
    - f. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.
- B. Non-conforming work per General Conditions and as follows:
  1. Repair or replace damaged material if not acceptable to the Architect.

### **2.05 CLEANING**

- A. Provide progress cleaning per manufacturer's written instructions, Section 017000, and as follows:
  1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the work.

- a. Clean and protect completed construction until Date of Substantial Completion.
  - b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.
2. Site: Maintain project site free of waste materials and debris.
- B. Provide final cleaning immediately prior to Date of Substantial Completion inspection per manufacturer's written instructions and Section 017000.
  1. Protection: Remove manufacturer's and other installed protection immediately prior to Date of Substantial Completion inspection, unless required otherwise.
  2. Clean floor with a neutral 6-8 pH cleaner.

## **2.06 MAINTENANCE**

- A. Initial maintenance per flooring manufacturer's written instructions and as follows:
  1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.
  2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris. Do not use vacuums with a beater bar assembly.
  3. Remove any dried adhesive residue from the surface with mineral spirits applied to a clean, lint-free cloth.
  4. Damp mop the floor using a cleaner recommended by the flooring manufacturer.
  5. If necessary, scrub the floor using an auto scrubber or rotary machine (300 rpm or less) with a cleaner recommended by the flooring manufacturer. Maintain the proper dilution ratio and use the appropriate scrubbing brush or pad.
  6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a wet-vacuum or clean mop and allow the floor to dry completely.

## **2.07 PROTECTION**

- A. Protect materials from construction operations until Date of Substantial Completion or Owner occupancy, whichever occurs first.
  1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
  2. Light foot traffic on a newly installed floor can be permitted after 24 hours.
  3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours.
  4. Protect the floor from rolling loads by covering with protective boards.

**END OF SECTION**

**SECTION 099113**  
**EXTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, submit each color in each sheen available.
- D. Samples: Submit two paper chip samples, 3 x 3 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 1/2 x 11 inch in size.
- F. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- G. Manufacturer's Instructions: Indicate special surface preparation procedures.
- H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

**1.04 MOCK-UP**

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.

- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Approved mock-up may remain as part of the work.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
  - 2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 2. Benjamin Moore Paints; [www.benjaminmoore.com](http://www.benjaminmoore.com)
  - 3. Dunn Edwards Paint Co.; [www.dunnedwards.com](http://www.dunnedwards.com)
  - 4. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 5. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

- a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - b. SCAQMD 1113 Rule.
  - c. CARB (SCM).
  - d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; [www.otcair.org](http://www.otcair.org); specifically:
    - 1) Opaque, Flat: 50 g/L, maximum.
    - 2) Opaque, Nonflat: 150 g/L, maximum.
    - 3) Opaque, High Gloss: 250 g/L, maximum.
  - e. Architectural coatings VOC limits of California.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding, primed wood, and primed metal.
1. Two top coats and one coat primer.
  2. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.

### **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

### **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Exterior Plaster and Stucco: 12 percent.
  2. Fiber Cement Siding: 12 percent.
  3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- G. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
  - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- I. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- J. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- F. Apply each coat to uniform appearance.
- G. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- H. Sand wood and metal surfaces lightly between coats to achieve required finish.
- I. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

- B. Owner will provide field inspection.
- C. Inspect and test questionable coated areas in accordance with MPI Standards.

**3.05 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**



**SECTION 099123  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  - 4. Manufacturer's installation instructions.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
- D. Samples: Submit two paper chip samples, 3 x 3 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- E. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 1/2 x 11 inch in size.
- F. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- G. Manufacturer's Instructions: Indicate special surface preparation procedures.
- H. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

**1.04 MOCK-UP**

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.

- D. Locate where directed by Architect.
- E. Approved mock-up may remain as part of the work.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 2. Benjamin Moore Paints; [www.benjaminmoore.com](http://www.benjaminmoore.com)
  - 3. Dunn Edwards Paints; [www.dunnedwards.com](http://www.dunnedwards.com)
  - 4. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 5. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. SCAQMD 1113 Rule.
    - c. CARB (SCM).
    - d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; [www.otcair.org](http://www.otcair.org); specifically:
      - 1) Opaque, Flat: 50 g/L, maximum.
      - 2) Opaque, Nonflat: 150 g/L, maximum.
      - 3) Opaque, High Gloss: 250 g/L, maximum.
    - e. Architectural coatings VOC limits of California.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- E. Colors: To be selected from manufacturer's full range of available colors.
  - 1. Selection to be made by Architect after award of contract.

## **2.03 PAINT SYSTEMS - INTERIOR**

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, wood, uncoated steel, shop primed steel, and galvanized steel.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
- B. Paint I-OP-FL - Concrete Shower Floors.
  - 1. Two top coats and one coat primer.
    - a. Concrete Surface Preparation per ICRI CSP 2-3.
    - b. Primer: Sherwin-Williams GP3579 Clear Primer applied @10 mils DFT
    - c. Grout Coat: Sherwin-Williams GP4850 Clear @10-15 mils DFT with a broadcast to refusal of 46 mesh aluminum oxide
    - d. Seal Coat: Sherwin-Williams GP4850 Clear @10-15 mils DFT

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  - 3. Concrete Floors and Traffic Surfaces: 8 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- F. Galvanized Surfaces:
- G. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- I. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

### **3.03 APPLICATION**

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 FIELD QUALITY CONTROL**

- A. See Section 014000 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.
- C. Inspect and test questionable coated areas in accordance with MPI Standards.

**3.05 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.06 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

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## **SECTION 101400 SIGNAGE**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

#### **1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.
- G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- H. Manufacturer's Qualification Statement.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

#### **1.03 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

#### **1.05 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Flat Signs:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. Cosco Industries (ADA signs); ADA Series 1: [www.coscoarchitecturalsigns.com/#sle](http://www.coscoarchitecturalsigns.com/#sle).
  - 3. FASTSIGNS: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 4. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 5. Mohawk Sign Systems, Inc: [www.mohawksign.com/#sle](http://www.mohawksign.com/#sle).

6. Seton Identification Products: [www.seton.com/aec/#sle](http://www.seton.com/aec/#sle).

## **2.02 SIGNAGE APPLICATIONS**

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  - 1. Sign Type: Flat signs with engraved panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 1 inch.
  - 4. Sign Height: 2 inches, unless otherwise indicated.
  - 5. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
- C. Building Identification Signs:
  - 1. Use individual metal letters.
  - 2. Mount on outside wall in location indicated on drawings.

## **2.03 SIGN TYPES**

- A. Flat Signs: Signage media without frame.
  - 1. Edges: Bevelled.
  - 2. Corners: Square.
  - 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
  - 1. Character Font: Helvetica, Arial, or other sans serif font.
  - 2. Character Case: Upper case only.
  - 3. Background Color: Olive.
  - 4. Character Color: Cream color.

## **2.04 TACTILE SIGNAGE MEDIA**

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
  - 1. Total Thickness: 1/16 inch.

## **2.05 DIMENSIONAL LETTERS**

- A. Plastic Letters:
  - 1. Material: Injection molded plastic.
  - 2. Color: As selected.
  - 3. Mounting: Tape adhesive.

## **2.06 ACCESSORIES**

- A. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Substantial Completion; repair or replace damaged items.

**END OF SECTION**



**SECTION 102800**  
**TOILET ROOM ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Toilet Accessories:
  - 1. AJW Architectural Products: [www.ajw.com](http://www.ajw.com).
  - 2. ASI - American Specialties, Inc: [www.americanspecialties.com](http://www.americanspecialties.com).
  - 3. Bobrick Washroom Accessories; [www.bobrick.com](http://www.bobrick.com)
  - 4. Bradley Corporation: [www.bradleycorp.com](http://www.bradleycorp.com).
  - 5. Georgia-Pacific Professional: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
- B. Provide products of each category type by single manufacturer.

**2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide 2 keys for each accessory to Owner; master key all lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

## **2.03 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.
- C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.
- D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- F. Back paint components where contact is made with building finishes to prevent electrolysis.

## **2.04 BATH AND TOILET ROOM ACCESSORIES**

- A. See contract drawing for toilet accessories list and location.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.
- D. See Section Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls.

### **3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### **3.03 INSTALLATION**

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 104400**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.03 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Ansul, a Tyco Business: [www.ansul.com](http://www.ansul.com).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 3. Nystrom, Inc: [www.nystrom.com](http://www.nystrom.com).
  - 4. Potter-Roemer; [www.potterroemer.com](http://www.potterroemer.com).
  - 5. Pyro-Chem, a Tyco Business: [www.pyrochem.com](http://www.pyrochem.com).
  - 6. Strike First Corporation of America: [www.strikefirstusa.com](http://www.strikefirstusa.com).

**2.02 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. FE-36 Clean Agent Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
  - 1. Class: A:B:C type.
  - 2. Size: 10 pound.
  - 3. Size and classification as scheduled.
  - 4. Finish: Baked polyester powder coat, color as selected.
  - 5. Temperature Range: Minus 40 degrees F to 120 degrees F.

**2.03 FIRE EXTINGUISHER CABINETS**

- A. Cabinet Construction: Non-fire rated.
  - 1. Formed primed steel sheet; 0.036 inch thick base metal.
- B. Potter Roemer Loma Series#7320-BA
- C. Cabinet Configuration: Surface mounted type.
  - 1. Size to accommodate accessories.

- 2. Trimless type.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- H. Finish of Cabinet Interior: White colored enamel.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers in cabinets.

**END OF SECTION**

**SECTION 122400**  
**WINDOW SHADES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

**1.02 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.
- B. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
  - 2. Do not install shades until final surface finishes and painting are complete.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
- F. Selection Samples: Include fabric samples in full range of available colors and patterns.
- G. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- I. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum 3 years of documented experience with shading systems of similar size and type.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

**1.06 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
  - 1. Shade Hardware: One year.
  - 2. Fabric: One year.
  - 3. Aluminum and Steel Coatings: One year.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Interior Manually Operated Roller Shades:
  - 1. Draper, Inc: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
  - 2. J. Geiger Shading; [www.jgeigershading.com](http://www.jgeigershading.com)
  - 3. Hunter Douglas Architectural; RB500 Manual Roller Shades: [www.hunterdouglasarchitectural.com/#sle](http://www.hunterdouglasarchitectural.com/#sle).
  - 4. Levolor: [www.levolor.com/commercial/#sle](http://www.levolor.com/commercial/#sle).
  - 5. TimberBlindMetroShade; SolarVue Manual Roller Shade: [www.timberblinds.com/commercial-division/#sle](http://www.timberblinds.com/commercial-division/#sle).
  - 6. SWFcontract, a division of Springs Window Fashions, LLC.: [www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).

### **2.02 ROLLER SHADES**

- A. General:
  - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
  - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades:
  - 1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Drop Position: Regular roll.
    - b. Roll Direction: Roll down, closed position is at window sill.
    - c. Mounting: Window jamb mounted- inside, between jambs.
    - d. Fabric: As indicated under Shade Fabric article.
  - 2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
  - 3. Roller Tubes: As required for type of shade operation.
  - 4. Hembars: Designed to maintain bottom of shade straight and flat.
  - 5. Manual Operation for Interior Shades:
    - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    - b. Drive Chain: Continuous loop beaded ball chain, 95 pounds minimum breaking strength. Provide upper and lower limit stops.

### **2.03 SHADE FABRIC**

- A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
  - 1. Material Certificates and Product Disclosures:
    - a. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
    - b. Health Product Declaration (HPD): Complete, published declaration with full disclosure of known hazards.
    - c. Declare label.
  - 2. Performance Requirements:
    - a. Flammability: Pass NFPA 701 large and small tests.

- b. Fungal Resistance: No growth when tested according to ASTM G21.
- 3. Color: As selected by Architect from manufacturer's full range of colors.
- 4. Fabrication:
  - a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.

#### **2.04 ROLLER SHADE FABRICATION**

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
  - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  - 2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 1/2 inch total.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

#### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

#### **3.04 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

#### **3.05 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

### **END OF SECTION**

## **SECTION 123600 COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Work includes labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing operations in connection with furnishing, delivery and installation of the work of this Section, meeting current building codes and manufacturer's latest printed instructions, complete as shown on the drawings and/or specified herein.

#### **1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- H. Installation Instructions: Manufacturer's installation instructions and recommendations.
- I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

#### **1.03 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- B. Quality Certification: Provide WI Certified Compliance Program (CCP) inspection report and quality certification of completed work.
  - 1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  - 2. Provide designated labels on shop drawings as required by certification program.
  - 3. Provide designated labels on installed products as required by certification program.
  - 4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.05 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.



## **PART 2 PRODUCTS**

### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers:
      - 1) Avonite Surfaces: [www.avonitesurfaces.com](http://www.avonitesurfaces.com).
      - 2) Caesarstone; [www.caesarstoneus.com](http://www.caesarstoneus.com)
      - 3) Dupont: [www.corian.com](http://www.corian.com).
      - 4) Formica Corporation: [www.formica.com](http://www.formica.com).
      - 5) Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
    - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - c. NSF approved for food contact.
    - d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - e. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 1/2 inch, minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  - 6. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

### **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

### **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach epoxy resin countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

#### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

#### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

#### **3.06 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 220000**  
**GENERAL PLUMBING REQUIREMENTS**

**PART 1 GENERAL**

**1.01 GENERAL REQUIREMENTS**

- A. The General conditions, supplementary conditions, special Requirements, and applicable portions of Division 1 of the specification are a part of this Division and the requirements contained herein are supplementary to them.
- B. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

**1.02 ABBREVIATIONS AND DEFINITIONS (as used on Division 22 Drawings and herein)**

- A. This Division is abbreviated and includes incomplete sentences. Supply omitted words by inference.
- B. Symbols: "S" means submittals are required; "M/O" means Maintenance/Operating data is required; see paragraphs hereinafter.
- C. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- D. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- E. "Extend", "Submit", "Repair", "Abandon", "Replace", "Remove" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- F. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constructed authorities and public utility franchise holders having jurisdiction.
- G. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- H. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces which are not included in the utility areas definition.
- I. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- J. "Below Grade" means buried in the ground, unless noted otherwise.
- K. "Substantial Plumbing Completion" means all components of all systems are functioning but lacking in final adjustment.
- L. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid which the device will serve.

**1.03 DESCRIPTION**

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

**1.04 RELATED WORK**

- A. Coordination: Refer to Architectural, Civil, Structural, Mechanical and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work

will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of plumbing work in relation to the work of other Divisions.

- B. Examine other Divisions for work related to the work of this Division especially Division 22 – MECHANICAL and Division 26 - ELECTRICAL.

#### **1.05 EXISTING CONDITIONS**

- A. Visit the site prior to bidding and investigate the existing conditions which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.
- B. The location of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his bid to cover costs of connection regardless of their exact location.
- C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

#### **1.06 DRAWINGS AND SPECIFICATIONS**

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification.
- B. The Architect shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflict not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

#### **1.07 WATER (DOMESTIC AND FIRE), SANITARY (AND STORM) SEWERS SERVICE**

- A. Within 5 days after award of contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the Owner. Furnish pertinent load and location information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the Owner. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice.

#### **1.08 PERMITS AND INSPECTIONS**

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

#### **1.09 CODES AND REGULATIONS**

- A. By submitting a bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract documents and the Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specify references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
  - 1. All local codes; city and/or County as applicable
  - 2. OSHA requirements
  - 3. Uniform Building Code
  - 4. Uniform Mechanical Code
  - 5. Uniform Plumbing Code
  - 6. California Building Code
  - 7. California Mechanical Code
  - 8. California Plumbing Code
  - 9. California Code of Regulations (CCR) Titles
  - 10. Fire Marshal Regulations
  - 11. Regulations of all other authorities having jurisdiction.
- C. Where conflict or variation exists among codes, the most stringent shall govern.
- D. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- E. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- F. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- G. Permits and Certificates of Inspection: Furnish the originals.
- H. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- I. Other data required by other sections of this Division. Furnish 2 copies.

#### **1.10 RECORD AND DOCUMENTATION**

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work:
  - 1. Record (As-Built) Drawings:
    - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 22. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
    - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
    - c. Furnish the originals.

2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated plumbing systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent, shall be provided to the Architect in accordance with the Division 1 section on Maintenance and Operation Manuals. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

PROJECT TITLE.....

CONTRACTOR.....

Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:

- a. Updated approved materials list, shop drawings and catalog information of all items indicated by symbol "M/O" at titles or beginning of paragraphs.
  - b. System layout showing piping, valves and controls.
  - c. Wiring and control diagrams with data to explain detailed operation and control of each component.
  - d. A control sequence describing start-up, operation and shutdown.
  - e. Detailed description of the function of each principal component of the system.
  - f. Procedure for starting.
  - g. Procedure for operation.
  - h. Shut-down instruction.
  - i. Installation instructions.
  - j. Adjustments, maintenance and overhaul instructions.
  - k. Lubrication schedule including type, grade, temperature range and frequency.
  - l. Safety precautions, diagrams and illustrations.
  - m. Test procedures.
  - n. Performance data.
  - o. Parts lists, with manufacturer's names and catalog numbers.
  - p. Preventive maintenance schedule.
  - q. Service organization with name, address and telephone number.
  - r. Valve identification chart and schedule.
  - s. ASME certification
- B. Standard Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards (ANSI), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Underwriters Laboratories (UL), American Refrigeration Institute (ARI), American Gas Association (AGA), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.

- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

#### **1.11 TOOLS**

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

#### **1.12 CONSTRUCTION COST BREAKDOWN**

- A. To assist the Architect and Engineer in evaluation of the construction cost, the Contractor shall prepare and submit for review a construction cost breakdown for the major subdivisions of the plumbing work.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Cost breakdowns shall be submitted and approved prior to the first payment request. Send one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS AND EQUIPMENT**

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- B. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall meet quality and performance of a particular one specified by both name and catalog number.

#### **2.02 SUBSTITUTIONS**

- A. General: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the Architect's request. If in the Architect's opinion the products as presented in this first submittal are in variance with the specified products, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified products shall be furnished. By proposing a substitution, it is

deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution.

- B. Specific: Refer to other sections of this Division for additional requirements.

## 2.03 SUBMITTALS

- A. General:

1. Provide for all items indicated with the symbol "S" at titles or beginning of paragraphs in accordance with the Division 1 section covering submittals and as herein specified. Where warranty of longer than one year is specified, include such warranty with submittal. Architect's review of the submittal is only for general conformance with design compliance with the information given in the contract documents. The submittal procedure is required as an effort to minimize the problems which occur due to the discovery of Contractor non-compliance at the construction site. The Contractor is responsible for conformation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all Divisions of the work. Deviations, if any, from Contract documents shall be clearly and completely indicated (by a separate letter if deviations are extensive) in the submittals, and the lack of such is deemed complete compliance with Contract Documents without any deviations. Submittals favorably processed will not relieve the Contractor of responsibility for deviations not so reported nor for errors in the submittal.
2. In addition to the above, upon permission to proceed after review of submittal and prior to the installation of work, submit dimensioned and scaled drawings (not less than 1/4-inch equal to one foot) of all mechanical equipment rooms and areas. Such layouts shall indicate, but not be limited to, all plumbing equipment, control panels, piping, housekeeping pads, ductwork, tube pull, access and maintenance clearances, and other like items. The layout shall also indicate major equipment to be provided under other Sections of work.
3. Contractor Stamp: All submittals shall be stamped with the following text and signed by the Contractors representative:  
"IT IS HEREBY CERTIFIED THAT THE PRODUCTS SHOWN AND MARKED IN THIS SUBMITTAL ARE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND CAN BE INSTALLED IN THE ALLOCATED SPACES EXCEPT WHERE NOTED AS DEVIATIONS.  
CERTIFIED BY:----- DATE:-----"
4. All submittals shall be complete and with catalog data and information properly marked to show, among other things, equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities of performance as specified or indicated. Arrange the submittals in the same sequence as these specifications, and reference (at the upper right-hand corner) the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected.
5. For all work under Division 22, the notations by the Contractor or Supplier on submittal documents "Per Plans and Specifications", or "As Specified", or similar wording or phrasing is not acceptable and will be cause of rejection. Complete descriptive submittals are required for all Division 22 work.
6. Refer to the other sections of this Division for specific requirements.

- B. Material List: Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.



- C. Shop Drawings: Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the Owner's representative.
- D. Other Submittals: As required by other sections of this Division.

### **PART 3 EXECUTION**

#### **3.01 WORKMANSHIP AND INSTALLATION METHODS**

- A. Workmanship shall be in the best standard practice of the trade.
- B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned, and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

#### **3.02 TESTS**

- A. General:
  - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
  - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

#### **3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK**

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop fabricated ductwork.
- D. Keep cabinets and other openings closed to prevent entry of foreign matter.

#### **3.04 CLEANUP AND HOUSEKEEPING**

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the plumbing work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

#### **3.05 PROJECT CONDITIONS**

- A. Site Examinations and Conditions:
  - 1. Regard information relative to existing conditions, services and structure as approximate only. Verify dimensions and locations, and be knowledgeable of all working conditions before submitting Bid. Verify pressure, location, size, and elevation of existing services (to which points of connection are to be made or crossed) as soon as possible and prior to commencement of any new work.
  - 2. Make minor deviations necessary to conform to actual locations and conditions. Submission of Bid presumes proper examination of Site, locations, dimensions and conditions, and no additional cost will be honored for lack of such examinations.
- B. Existing Services: Examine the Contract Drawings and visit the project site to ascertain the extent of the existing services. Where existing equipment/services serving existing structures

and/or existing structures to be demolished are to remain in service, reroute, relocate, or extend such existing equipment and/or services to accommodate this project without additional cost.

- C. Interruption of Existing Services: Where it is necessary to reroute existing services or utilities, or to make connections of new work to existing services or utilities, give timely written notice of such intent to the Owner and secure written approval before proceeding. Make all such interruptions at such time as permitted by the Owner. Anticipate such interruptions to be made outside of normal working hours or normal working days; therefore, no additional cost will be permitted for such work. Except in a case of emergency involving life, limb or health, do not operate any existing equipment (including valves). Where such operations are necessary, they shall be performed by the Owner's personnel.
- D. Access and Placement of Work:
  - 1. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped, disassembled, or disassembly of equipment at Project Site and re-assembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
  - 2. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Plumbing Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.
- E. Verification and Coordination: Drawings indicating suggested distribution routes are diagrammatic only, and all scaled and figured dimensions are approximate and are indicated for estimating purposes only. The Drawings do not indicate necessary offsets and like items. Do not construe Contract Drawings as fabrication drawings. Prior to fabrication and installation of work, verify all dimensions, sizes and distribution routes with actual conditions, and prepare submittal and fabrication drawings. Coordinate to avoid possible conflicts and resolve same where such exist. Install work to conform to structure, avoid obstruction, preserve headroom, and keep openings and passageway clear. Changes necessary, resulting from such verification and coordination, shall not be a cause for additional cost.
- F. See Drawings for extent of demolition.

### **3.06 WARRANTY**

- A. Guarantee, in writing, all work against fault of any product or workmanship for a period of not less than one year after formal acceptance by the Owner; except, where longer periods are specified in the Specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components that are inactive because of said failure shall be suspended. The warranty period for such component shall resume running for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- B. Neither payments for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.

### **3.07 SAFETY REQUIREMENTS**

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts in accordance with the OSHA 1910.219. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

### **3.08 MANUFACTURER'S RECOMMENDATIONS**

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the installing Contractor and Architect prior to installation. Do not proceed with the installation of the item until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

**END OF SECTION**

## **SECTION 220500**

### **BASIC PLUMBING MECHANICAL MATERIALS AND METHODS**

#### **PART 1 GENERAL**

##### **1.01 GENERAL REQUIREMENTS**

- A. The contract documents shall apply in their entirety to the work specified herein.
- B. Submittals: Submit shop drawings and manufacturer's data on each item marked [S] in accordance with the Division 1 section on submittals and Section 220000, General Plumbing Requirements.
- C. Maintenance and Operation Manuals: Provide manufacturer's maintenance and operation manuals on each item marked [M/O] in accordance with the Division 1 section on maintenance and operation manuals and Section 220000, General Plumbing Requirements.

#### **PART 2 PRODUCTS**

##### **2.01 ELECTRICAL MOTORS [S] [M/O]**

- A. Provide all motors indicated on drawings necessary for equipment under the Mechanical Work. See electrical drawings for voltage and phase of electrical services.
- B. Unless otherwise specified, all motors 1/2 HP or larger: heavy duty, ball bearing, squirrel cage induction type in drip proof or splash proof enclosure, 1.15 service factor, and shall be suitable for the voltage system specified or indicated. Motor speed shall not exceed 1750 rpm unless otherwise indicated or specified. Motors exposed outdoors: either epoxy encapsulated winding or TEFC enclosure.
- C. Each motor shall have sufficient starting torque to start the apparatus driven.
- D. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives. All motors shall have a nameplate voltage rating of the specified operating voltage.
- E. Provide overload protection on single phase motors.
- F. Motors rated 1 HP and larger shall have shaft, bearings, and etc. capable of operating with multiple grooved sheaves and two or more belts.
- G. Provide with nameplates permanently attached to exterior housing with manufacturer's name and all electrical characteristics specified thereon.
- H. Motors shall be Lincoln, Westinghouse, General Electric, or approved equivalent.
- I. Brake horsepower shall not exceed 90% of rated motor horsepower.

##### **2.02 MOTOR STARTERS [S] [M/O]**

- A. See Electrical Drawings for voltage and phase of electrical services.
- B. Starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- C. Enclosure: NEMA 1 (unless location of starters dictates otherwise) of sufficient size to contain all accessories specified.

##### **2.03 DIELECTRIC UNIONS [S]**

- A. Dielectric unions or flanged unions: constructed so that two pipes being connected are completely insulated (including bolt sleeves and washers) from each other with no metal-to-metal contact; EPCO or approved equivalent.
- B. Unions shall have a water-impervious insulation barrier capable of limiting galvanic current to 1 percent of the short-circuit current in a corresponding bimetallic joint and, when dry, shall also be able to withstand a 600-volt breakdown test.

## 2.04 PRESSURE AND TEMPERATURE TEST PLUGS [S]

- A. Brass body and gasketed cap, 1/4-inch mpt fitting to receive either a temperature or pressure probe 1/8-inch O.D. with neoprene (max. 200 degrees F) at 500 psi or norden (max. 275 degrees F) at 500 psi valve core; "Pete's Plug" or approved equivalent.

## 2.05 PIPING SUPPORTS [S]

- A. See Section 220548, Vibration, and Seismic Controls for Plumbing Piping and Equipment regarding structural supports in compliance with seismic requirements; supports shall be as specified therein. Unless otherwise indicated or superseded by cited seismic requirements, pipe hangers and supports as follows:
  - 1. See Section 220548, Vibration, and Seismic Controls for Plumbing Piping and Equipment for resilient support of pipes.
- B. Pipe Hangers: Carbon steel hanger with plain (black) or galvanized finish.
  - 1. Piping 5-inches or smaller: Conforms to Manufacturer's Standardization Society (MSS) SP-58, Type 5 hangers; Kin-Line 450 or approved equivalent.
  - 2. Hangers for copper piping shall be furnished with a processed felt lining; Kin-Line 450F or approved equivalent.
- C. Pipe Clamps: Carbon steel with plain (black) or galvanized finish. Provide with copper finish for use on copper piping.
  - 1. For Vertical Piping: Conforms to MSS SP-58, Type 8; Kin-Line 470 or approved equivalent.
  - 2. For Horizontal Piping and Framing Channels: Short clamp (strap) for channel mounting; Kin-Line 477 or approved equivalent.
- D. U-Bolts: Carbon steel U-bolt with plain (black) or galvanized finish and four finished hex nuts; conforms to MSS SP-58 type 24; Kin-Line 438 or approved equivalent.
- E. Pipe Anchor Chair: Unit consisting of a carbon steel, notched, HR channel; U-bolt; and hex nuts; Kin-Line 438, or approved equivalent. (no known equivalent).
- F. Pipe Anchors:
  - 1. Welded Tee Pipe Anchor, for piping 3-inches to 6-inches: Steel, welded, tee-shaped anchor; Pipe Shields Model C1000, or approved equivalent (no known equivalent).
- G. Trapeze Hangers: Trapeze hangers for piping shall be used where indicated or required and shall be fabricated in accordance with SMACNA Seismic Restraint Guide, latest edition.
- H. Support Channels: 1-5/8-inch by 1-5/8-inch, 12 gauge steel channel. Single channel: Superstrut A-1200, or approved equivalent. Double channel: Superstrut A-1202, or approved equivalent.
- I. Hanger Rods: Solid mild steel, sizes as specified below.

| Pipe Size                         | Rod Diameter |
|-----------------------------------|--------------|
| 1/2-inch through 2-inches         | 3/8-inch     |
| 2-1/2-inches through 3-1/2 inches | 1/2-inch     |
| 4-inches and 5-inches             | 5/8-inch     |
- J. Sound and Electrolysis Isolators: Provide sound and electrolysis isolators at all hangers and supports for un-insulated piping and on other piping where incompatible metals would contact each other. Isolators shall be factory fabricated, hinged, cadmium plated steel shell with processed, non-conducting hair felt isolating pad permanently attached with adhesive; Stoneman "Trisolators", or approved equivalent.
  - 1. Option: Piping isolators for bare un-insulated piping can be integral part of the pipe hanger.
- K. Connection of Hangers to Structure: Factory fabricated steel devices or other equal suitable steel inserts, clamps, and brackets as required, Devices shall comply to MSS-SP-58.

## **2.06 PIPE INSULATION INSERTS [S]**

- A. All insulated piping 2-inches and larger shall be provided with pipe insulation inserts with steel jackets at all pipe hangers and supports.
- B. Pipe Insulation Inserts: Insert shall consist of a galvanized steel jacket, minimum of 26 gauge to 16 gauge thickness depending on pipe size, and a waterproofed calcium silicate insulation insert impregnated with a fire resistive vapor barrier compound; insert thickness shall match the thickness of the specified insulation and shall extend a maximum of 1-inch beyond sheet metal; pipe Shields Model A2000, Kin-Line #463CW or approved equivalent.

## **2.07 ACCESS DOORS [S]**

- A. Flush-mounted sheet metal access doors with lock and concealed hinge; stainless steel door; Milcore, or approved equivalent.
  - 1. Access doors through fire-rated separations shall have like fire rating.

## **2.08 EQUIPMENT IDENTIFICATION [S]**

- A. General: Identify all equipment using brass discs or laminated plastics. Install as specified below in readily visible locations not interfering with insulation or equipment operation.
  - 1. Brass Discs: Provide minimum 0.040-inch in thickness and 2-inches in diameter or square. Top line of each tag shall have 1/4-inch high black filled letters to indicate designation of service. Bottom line shall have 7/16-inch high black filled numbers to indicate equipment or valve number.
  - 2. Laminated Plastic: Provide white on black with engraved black letters. The equipment identifying name and number lettering size shall be a minimum of 1/4-inch in height, nameplate data 3/16-inch in height and the manufacturer's name and location 1/8-inch in height. Provide laminated plastic tags either 2-1/2-inches by 3-1/2-inches or 3-1/2-inches by 5-inches, as required.

## **2.09 PIPING IDENTIFICATION [S]**

- A. Piping identification shall be by semi-rigid plastic markers or vinyl coated cloth; minimum information: base color, flow direction arrow, and fluid being conveyed.
  - 1. Service Markers, Interior Locations: W.H. Brady Co. Type B-500 vinyl coated cloth tape or Type B-350 Perma-Code Thin Film, or approved equivalent.
  - 2. Service Markers, Exterior Locations: W.H. Brady Co. Type B-946G, Brady B-915 Snap-on, or approved equivalent. Apply mechanically affixed with coated wire straps or approved equivalent.
- B. Base color coding and size of letters and arrows shall conform to ANSI A 13.1, "Scheme for the Identification of Piping Systems."

## **2.10 PRIMERS AND PAINTS [S]**

- A. All equipment furnished under Division 22, unless otherwise noted, shall be furnished with a factory applied prime coat. All ductwork exposed to weather shall be painted. See Division 9 section on painting.
- B. Where field priming or touch-up priming is required, primer shall be as follows for ferrous metal surfaces:
  - 1. Metal Surfaces, Not Galvanized: Latex, corrosion resistant primer suitable for metal surfaces or Epoxy-polyamide, green primer paint, formula 150, type I (QPL).
  - 2. Metal Surfaces, Galvanized: Galvanized repair compound with high zinc dust content; ZRC Cold Galvanizing Compound, or approved equivalent (no known equivalent).
- C. Finish painting of Mechanical equipment furnished under Division 23: See Division 9 section on painting.
  - 1. Non-metallic surfaces: Latex (Acrylic Emulsion, Exterior Wood and Masonry) Paint.

## **2.11 SEALANTS [S]**

- A. Non-fireproof Penetrations: Silicone rubber sealant; DowCorning 785/4, or approved equivalent.
- B. Fireproof Penetrations: Sealant shall comply with ASTM-E-814 (UL 1479 or UL 94); 3M Brand Fire Barrier Penetration Sealing System with CP-25 caulk, or approved equivalent.

## **2.12 SEALANTS, WATERSTOP**

- A. Cold applied, pre-formed, plasticized, waterstop sealing compound consisting of blends of refined hydrocarbon resins and plasticizing compounds; Synko-Flex Waterstop and Primer, or approved equivalent (no known equivalent).

## **2.13 BOLTED MECHANICAL SEALS [S]**

- A. Seals shall be modular, bolted, mechanical link type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Tightening of the bolts shall cause the rubber sealing elements to expand to form a water-tight seal between the pipe and the sleeve; Thunderline "Link-Seal" Model LS, or approved equivalent.

## **2.14 PIPE SLEEVES**

- A. Sleeves in Concrete Floor Slabs: Schedule 40 black steel pipe.
- B. Sleeves in all Fire Walls (regardless of Construction), Concrete or Masonry Walls: Schedule 40 black steel pipe.
- C. Sleeves in all Walls and Partitions (except Fire Walls, Concrete or Masonry Walls): 18-gauge galvanized steel.

## **2.15 NON-SHRINK GROUT**

- A. Non-shrink, non-metallic, non-corrosive cementitious grout; 5000 psi compressive strength at 28 days; Sika SilkaGrout 212, or approved equivalent.

## **2.16 VENT STACK FLASHING**

- A. Factory-fabricated, caulk type flashing for piping up to 8-inches; Josam 26450, or approved equivalent.

# **PART 3 EXECUTION**

## **3.01 GENERAL**

- A. Install products in accordance with product manufacturer's recommendations. After installation of systems and until formal acceptance of systems by the Owner, be responsible for operation and maintenance of systems.

## **3.02 FORMING, CUTTING, AND PATCHING**

- A. Provide Forming, recesses, chases, blocking and grounds necessary for Plumbing Work.
- B. Provide cutting (including core drilling and saw cutting), patching and repairing existing structures to accommodate the Plumbing Work. Such work shall include voids, holes, and the like resulting from removal of existing or addition of new Plumbing Work. Restoration shall match existing work.
- C. Core drill all holes through existing concrete structures. Before drilling through any structural members, obtain written permissions from the Architect. Before coring, check all proposed hole locations with electronic device to assure clearance of obstruction (i.e., reinforcement bars, piping, conduits, etc.).
- D. Saw cut all existing concrete and masonry openings and slabs.

### **3.03 ELECTRICAL WORK**

- A. Coordinate with Division 26. See Division 26 Contract Documents for voltage and phase of electrical services.
- B. All power wiring and conduits for same serving motors, and where indicated on Division 26 Contract Drawings, to mechanical control panels, separate or equipment mounted, shall be provided under Division 26.
- C. The following shall be provided under Division 23:
  - 1. Pre-wired mechanical control panels.
  - 2. All automatic or temperature control and interlock wiring, regardless of voltage, and conduits for same necessary for proper operation of equipment under Division 23. This includes interlock wiring between motor starter coils, interlocking relays, contactors, mechanical equipment control panels, temperature control devices, and temperature control panels.
  - 3. Power wiring and conduits for same not indicated on the Division 26 Contract Drawings to mechanical control panels (separate or equipment mounted).
- D. Install all wiring under Division 23 in rigid conduit or electrical metallic tubing indoors and in rigid conduit outdoors. All such wiring shall be concealed.

### **3.04 DIELECTRIC UNIONS**

- A. Install dielectric unions in acceptable locations and provide devices for all piping and equipment connections where ferrous and copper metal is joined.
- B. Where piping is buried, provide additional protection in the following manner. Thoroughly clean device and piping surfaces 5-feet upstream and downstream of connection point. Prime piping surface to be covered. Wrap connection point and piping with double wrapping of identified pressure-sensitive tape.

### **3.05 FLASHING**

- A. Flash and counter flash with metal to make waterproof all penetrations through roofs or exterior walls. Roof flashing shall have a minimum 8-inch skirt. The metal flashing and counterflashing shall be the same material as the equipment to which they are attached. Factory-fabricated flashing may be used for piping. Prior to any interior finish work, test the integrity of all flashing with water hose.

### **3.06 WELDING**

- A. All welding shall comply with provisions of applicable ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping, or other statutes or ordinances having jurisdiction. All welders shall be certified for all welding positions under the qualification tests prescribed by the National Certified Welding Bureau; National Association of Plumbing, Heating, Cooling Contractors; or by other reputable testing laboratories, using procedures covered in the ASME Boiler and Pressure Vessel Code (BPVC), Section IX, Qualification standards for Welding and Brazing Procedures, Welders, Brazers and Welding and Brazing Operators; and shall hold a current certification of his qualifications obtained within 12 months prior to date of contract. Prior to welding operation, submit for review evidence of such certification.
- B. Welded joints, fabrication, assembly and erection shall conform to the requirements of ANSI B 31.1 "Power Piping" of the American National Standard Code for Pressure Piping. Perform all welding by the metal-arc welding process, either manual, semi-automatic or automatic.

### **3.07 EXCAVATION AND BACKFILL**

- A. Excavation and backfill shall be in accordance with the requirements of the Division 2 section on the excavation and backfilling, as specified in other Division 22 sections, and as herein described. Where depths or invert elevations are not indicated, provide minimum coverage (above top of pipes) as follows:
  - 1. Any piping under slab (top of pipe to underside of slab): 18-inches.



2. Steel, cast iron, and copper in other locations: 18-inches.
- B. Excavate to undisturbed earth; cut level and form true. Remove debris, rubbish and soft material (such as mud). Where rock is encountered, undercut trenches 6-inches and fill with well tamped neutral sand and pea gravel to proper elevation. During installation of piping, maintain excavation free of standing water. Undercut trench 6-inches and install piping in a 6-inch neutral sand envelope.
- C. Do not backfill until piping has been successfully tested.
- D. Backfill to a point 12-inches above top of piping with earth (excavated material may be used) free of clay, debris, rubbish, rocks, or clods over 4-inches in the greatest dimensions. Backfill above 12-inches from top of piping may be with excavated material. Apply backfill by hand in 6-inch deep layers the full width of the trench. Moisten each layer (do not flood or puddle), and hand tamp to a minimum 90 percent compaction before proceeding with the next layer of backfill.
- E. Do not excavate under foundations or footings except in manner permitted. Do not backfill until installed piping has been successfully tested.
- F. Provide a 12-inch neutral sand envelope all around buried tanks.
- G. Dewatering:
  1. Lay pipe in dry trenches and keep trenches completely dry until piping system has been tested, cleaned, insulated, sealed, inspected and accepted by the Owner and completely backfilled before dewatering function ceases.
  2. Furnish and operate pumps, well points, siphons or other equipment as may be required to provide complete dewatering of trenches and disposal of excess water.

### **3.08 PIPE SUPPORT INSTALLATION**

- A. Support all piping, horizontal and vertical, with clamps or brackets. Independently support all line-mounted equipment. Provide at least one hanger for each branch piping and at each change of direction. Secure all hanger rods with double nuts and lock washers. Do not use perforated (plumber's) tape. Support vertical multiple-story piping at each floor with pipe clamps.
- B. Maximum Hanger Spacing:
  1. Cast Iron Soil, Waste, or vent Piping: Hangers at 5-feet and at each joint or fitting.
  2. Steel Piping: 1-inch and smaller, hangers at 8-feet; 1-1/4-inches and larger, hangers at 10-feet.
  3. Copper Piping: 1-1/2-inches and smaller, hangers at 6-feet; 2-inches and larger, hangers at 10-feet.
  4. In all cases, space pipe supports to provide adequate support for the pipes, the medium in the pipes, insulation, valves, and fittings to prevent any sagging or separation of joints.

### **3.09 PIPING INSTALLATION**

- A. Layout of work:
  1. Perform all dimensional layout of the Work and establish all lines and grades as set forth on the Drawings.
  2. Be responsible for conformity of the finished work with drawings and specifications.
- B. Installation:
  1. Inspect all piping prior to installation. Pipe found unsatisfactory on inspection or damaged by handling shall be promptly removed from the job site.
  2. All piping systems shall be graded and valved to provide complete drainage, venting, and control of all systems.
  3. Install all buried non-metallic piping with a continuous number 14 plastic-coated copper wire paralleling piping.

4. Use reducing fittings for pipe size changes; do not use brushings. Make all changes in pipe material with pipe adapters.
5. Prior to installation of piping to or at mechanical equipment, verify with the equipment manufacturers as to the clearance required for maintenance, repair, inspection, and part replacement for the respective equipment. Install piping to provide such clearance so that an absolute minimum of piping is required to be disturbed. Provide means for removal of such piping. Provide unions, flanges, and mechanical couplings at connections to equipment.
6. Where equipment connection sizes are smaller than piping sizes indicated, make size reduction immediately adjacent to the equipment connections. Flanges or unions at such equipment connection points may be the same size as the equipment connections.
7. Install horizontal sanitary piping to uniform grades conforming to the applicable Code for this installation.
8. Conceal all piping in finished portions of the building unless noted otherwise on the Drawings.
9. Coupled short sections of pipe, bushings, close nipples, long screws, bullhead tees and crosses are prohibited. Bullhead tees and crosses are permitted only in fire sprinkler systems.
10. Install all piping in such a manner as to prevent any undue noise from the flow of water under normal conditions.
11. Branch tees in piping, provided that the branch size is two pipe sizes or smaller than the main size, may be made with factory-manufactured outlet fittings with funneled inlet and with socket or threaded outlet as required. The fittings schedule shall be the same as the piping to which they are connected. For copper tubing fittings shall be joined to main by silver brazing. The use of extruded tees for branch takeoffs that are fabricated from the piping material being installed is expressly prohibited and will be rejected.
12. Install piping to permit free expansion and contraction, except where the Drawings specifically indicate an anchor or guide. Do not connect stiffening structural members to bends or elbows.
13. Use offsets necessary to prevent undue strain on piping. The springing of piping into place is prohibited.
14. Select and install pipe supports and hangers in such a manner as to impose only negligible restraint on the free movement of piping and not deform piping. No anchors shall be employed, except as indicated on Drawings.
15. Locate pipe supports as close as possible to valves or other heavy piping specialties.
16. Carefully locate supports and hangers so they do not hinder free movement of adjoining piping or occupy open space in a pipe rack.
17. Mark all stub-outs below grade with monuments identifying the services.
18. Provide shut-off valves at each division of main piping and at each branch serving one room or a group of adjoining rooms to enable isolation of fluid carrying piping systems for each portion of the building (buried piping excepted).
19. Valves shall be full size of the line in which they are installed (automatic control valves excepted). Prior to installation of control valves, verify with control manufacturer as to sizes, piping hookup, and the like for same.
20. Install valves with stems straight up wherever possible; do not install valves with stems below the horizontal position.
21. Provide spool between two adjacent valves.
22. Properly grade all water piping to provide flow, air elimination, and drainage. Do not install piping so as to create noise or flow impairment.

23. Separately pipe, with shut-off valve, equipment drains to nearest floor drain, or as noted on Contract Drawings.
24. Do not permit the use of any mechanical piping system under this Division of Work to be used as electrical grounding.
25. Buried Piping:
  - a. Carefully handle and lower pipe in such a manner as to avoid damage to the pipe.
  - b. Excavate a socket hole under the joint so that pipe will be supported on its body. Provide socket holes large enough (but not excessive) to allow adequate space for workmen to "make" the joints.
26. Thrust Blocks:
  - a. Provide concrete thrust blocks at all changes in direction of buried piping of non-restrained mechanical joined pressure systems and other systems as required.
  - b. Provide thrust blocks for buried restrained mechanical jointed piping systems where indicated.
  - c. Provide thrust blocks of 3000 psi concrete mix conforming to the requirements of the Division 3 section on concrete.
  - d. Provide thrust blocks of the required size and shape necessary for the specific system pressure and soil bearing capacity at the particular locations.
  - e. Exercise care to avoid encasing fittings, bends, valves, etc., in concrete to the extent that it will hamper maintenance.

### **3.10 PIPE JOINTS**

- A. Threaded Steel or Brass Pipe:
  1. Cut square and remove all burrs. Ream for full flow.
  2. Cut threads with clean dies. Apply thread compound to male threads only. Refer to specific piping system for type of thread compound.
  3. After joining, not more than three full threads shall remain exposed. Coat exposed threads of steel pipe with appropriate type red paint.
  4. Make-up brass, chrome plated pipe, or stainless steel pipe with strap wrenches.
- B. Copper Tubing:
  1. Cut square and remove all burrs. Ream for full flow.
  2. Clean outside ends of tubing and male fittings and sockets of female fittings to bright finish. Clean with emery cloth.
  3. Properly apply flux to surfaces being jointed. Application and type of flux shall be as recommended by the specific brazing or solder manufacturer.
  4. Remove stems, washers and internal parts of valves prior to brazing or soldering.
  5. Refer to specific piping system for type of brazing metal and solder.
- C. Ductile Iron Pipe and Fitting Mechanical Joints: Install mechanical joints in accordance with AWWA C 600.
- D. Grooved Pipe and Fitting Mechanical Joints: Install joints including grooving of pipe, in accordance with the coupling and fittings manufacturer's recommendations and printed instructions. Before couplings are assembled, pipe ends and gasket exterior surfaces shall be lightly coated with a lubricant manufactured especially for this application and recommended by the coupling and fitting manufacturer. Grooved mechanical joints shall not be used for hot water service.
- E. Flanged Joints: Use flanged joints for making piping connections to flanged valves, fixtures, and equipment, and to other flanged piping components. Install joints so that flange faces bear

uniformly on gaskets. Engage bolts so that there is complete threading through the nuts and tighten so that bolts are uniformly stressed (equally torqued).

F. Cast Iron Soil Pipe:

1. Hub-and-Spigot Compression Joints: Install rubber or neoprene gasket compression joints in accordance with the recommendations and printed instructions of the pipe and fitting manufacturer. Joints shall be installed with hub ends pointing upgrade. Pipe with cracked hubs shall be replaced.
2. Hubless Joints: Install clamp assemblies with bolts alternately and incrementally tightened to manufacturer's recommended torque. Use a single set-point torque wrench manufactured specifically for this purpose. The use of screwdrivers or other types of wrenches will not be permitted. After a period of at least 24 hours, re-torque each bolt.

G. Solvent-Weld Joints in Plastic Piping: Install solvent welded joints for CPVC, PVC or ABS plastic piping in accordance with the recommendations and printed instructions of each respective pipe and fitting manufacturers and with requirements of pertinent ASTM standards.

### 3.11 PIPE SLEEVES AND PLATES

A. Sleeves:

1. Provide sleeves for all pipes passing through walls, partitions of floor slabs unless specified otherwise.
2. Sleeves in concrete floor slabs: Sleeves shall project 2-inches above finished floors, unless specified otherwise.
3. Sleeves in all Fire Walls (regardless of construction), Concrete or Masonry Walls: Finished flush with wall finish, unless specified otherwise.
4. Sleeves in all Walls and Partitions (except Fire Walls, Concrete or Masonry Walls): Finished flush with wall or partition finish.
5. Provide 1/2-inch clearance completely around pipe between sleeve and non-insulated piping, except where pipes pass through exterior walls below grade, provide full 1-inch clearance between pipe and sleeve.
6. Sleeves for insulated piping shall be sized for insulation, pipe and clearance specified for non-insulated pipes.
7. Caulk sleeves set in fire rated construction with sealant specified for fireproof penetrations and caulk sleeves set in non-fireproof construction with sealant specified for non-fireproof penetrations.
8. Seal sleeves watertight when they are installed in outside walls, walls below grade and in floor slabs with waterproof epoxy grout, except as specified otherwise.

B. Plates: Provide chrome-plated hinged escutcheon plates with locking devices where pipes pierce finished surfaces. Plates shall fit outside of pipe insulation.

### 3.12 EQUIPMENT INSTALLATION

- A. Install equipment where shown, as indicated, and in accordance with the manufacturer's recommendations for the specific service.
- B. Provide anchor bolts, setting Drawings and templates for setting equipment.
- C. Assure correct alignment of equipment after setting.
- D. Where grouting is necessary, use non-shrink type.
- E. Before bolting any equipment coat threads with an anti-seize and lubricating compound. Do not use powder driven anchors unless written permission has been obtained from the Architect.
- F. Provide all exposed moving or rotating parts of machines with guards in compliance with OSHA requirements. Install all guards in removable sections, if necessary, and with studs and wing nuts

for removal of same in maintenance. Make provision for RPM readings on guards covering end of shafts; enclose fan belts at both sides of belts.

### **3.13 MAINTENANCE AND ACCESS TO EQUIPMENT**

- A. Where valves, dampers, control devices, coils, or other like devices (i.e, plumbing P-trap, water hammer arresters, gauges, thermometers) requiring maintenance, checking or readings are inaccessibly concealed in walls or ceilings, and where indicated, provide square or rectangular access doors. Where space permits, doors for ceiling installation shall not be less than 18-inches by 18-inches. Prior to installation, verify all access locations.
- B. Where there are lubrications within equipment, extend such to exterior of equipment.

### **3.14 REVIEW OF WORK**

- A. Do not allow or cause any mechanical work to be covered, concealed or enclosed until such work has been tested and reviewed. Should such work be covered, concealed or enclosed before being tested and reviewed, such shall be uncovered and thereafter restored at no additional cost.

### **3.15 EQUIPMENT IDENTIFICATION**

- A. Manufacturer's Nameplates: Provide all equipment with manufacturer's nameplates secured to the respective equipment and indicating, but not being limited to, the manufacturer's name, model, size, serial number, capacity and electrical characteristics. Clean, polish and protect all such nameplates with a coat of clear protective finish.
- B. Equipment Tags: Identify all equipment (such as machinery, motor starters, control panels, pushbuttons and other like devices) exposed to view with identification tags. Secure tags to equipment surface. Where size or surface curvature does not permit such, secure with No. 16 brass jack chain.
- C. Valve Tags:
  - 1. Identify each valve with a tag with distinguishing number. Secure tags to valves with No. 16 brass jack chain.
  - 2. Provide valve chart and schedule in aluminum frame with clear heavy plastic shield, and mount same at location directed. Indicate on the Record Drawings the location of valves with numbers corresponding to the valve schedule. Valve chart and schedule shall include, but not be limited to, tag number, location, usage/function, valve manufacturer's name and valve model number. Numbers for new valves shall continue from existing valve numbering system.
- D. Piping Identification:
  - 1. Identify each pipe, whether concealed or exposed, as to the content and character of material it carries (piping buried excepted).
  - 2. Location of Markers: Not to exceed 20-feet on straight run of pipe (including risers and drops) and so located as to be conspicuously visible from any reasonable vantage point; adjacent each valve; adjacent each tee; at each side of penetration of the structure or enclosure; at each obstruction.

### **3.16 PRIMING, PAINTING, AND COATING**

- A. Properly clean surfaces to be touched up of rust, dirt, scale, wax and other deleterious materials. Prime surfaces. Touch up with like material all damaged galvanized or factory-primed metal surfaces. Do not prime over manufacturer's nameplates on equipment.
- B. Coat all bare steel parts of piping accessories below grade with coats of coal-tar based bituminous mastic.
- C. Except for factory priming, factory finish painting and otherwise specified under this Article, all field priming (except touch up) and finish painting shall be under other Divisions.

- D. Paint flat black interior surfaces of all concealed unlined galvanized sheet metal ductwork behind air outlets and inlets.
- E. All exposed insulation surfaces in finished areas shall be ready for finish painting; glue size if necessary.

### **3.17 CLEANING AND DE-GREASING OF PIPING**

- A. General:
  - 1. Clean all piping systems to remove all dirt, grease, scale, foreign substances, etc., as specified in each separate section of the Specifications.
  - 2. Prior to commencing work, submit for approval a complete procedure for cleaning and flushing for each separate piping system. Include flushing source, system inlet flushing pressure and size of inlet and outlet flushing connections with their locations for each system. Install flushing connections at all low points of each piping system to ensure complete flushing of the system.
  - 3. Use air and/or gas blown through the lines of gas and air systems, unless specified otherwise, to prove the piping clean. All other piping systems shall be thoroughly flushed out with water unless specified otherwise.

### **3.18 TESTING OF PIPING**

- A. Provide notification of test at least three working days prior to tests on all part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed.
- B. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue full test pressure is achieved.
- C. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges, threaded joints and all welds shall be left unpainted and un-insulated until the piping systems have been approved.
- D. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.
- E. Equipment such as safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.
- F. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.
- G. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.
- H. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.
- I. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.
- J. Do not apply test pressure until the piping system and its contents approach the same temperature.
- K. While piping is under test, exercise care so that excessive pressure does not occur due to increase in ambient temperature.

- L. Piping test pressure shall be as noted in tabulation. If test pressures are not specified, they shall be 150 percent of design pressure for the specific system being tested.

| SYSTEM             | TEST MEDIUM | TEST PRESSURE (PSIG) | DURATION (HOURS) | ACCEPTANCE TOLERANCE     |
|--------------------|-------------|----------------------|------------------|--------------------------|
| Sewer & Vent       | Water       | Top of highest vent  | 4                | No joint sweat           |
| Water              | Water       | 150                  | 4                | None except temp. change |
| Pumped Storm Water | Water       | 150                  | 4                | None except temp. change |
| Fire Sprinkler     | Water       | 200                  | 4                | None except temp. change |

- M. Conduct Hydrostatic tests with water at a temperature below 100 degrees F.
1. Fill the system slowly with water and vent at highest points to expel the air before pressurizing.
  2. Carefully examine all joints for leaks or defects.
  3. Provide connections as required to accomplish the above.
- N. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:
1. Identification of piping system and test number.
  2. Testing medium.
  3. Test pressure.
  4. Date of test acceptance.

### 3.19 TESTS AND ADJUSTMENTS

- A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

**END OF SECTION**

**SECTION 220519**  
**METERS AND GAGES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Thermowells.
  - 4. Dial-type pressure gages.
  - 5. Gage attachments.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Operation and maintenance data.

**PART 2 PRODUCTS**

**2.01 BIMETALLIC-ACTUATED THERMOMETERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Terice, H. O. Co.
  - 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 3. Weiss Instruments, Inc.
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F.Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.
- H. Window: Plain glass or plastic.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

**2.02 LIQUID-IN-GLASS THERMOMETERS**

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Terice, H. O. Co.
    - b. Weiss Instruments, Inc.
    - c. Winters Instruments - U.S.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle unless otherwise indicated.



5. Tube: Glass with magnifying lens and blue or red organic liquid.
  6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  7. Window: Glass or plastic.
  8. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
  10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - b. Weiss Instruments, Inc.
    - c. WIKA Instrument Corporation - USA.
  2. Standard: ASME B40.200.
  3. Case: Plastic; 7-inch (178-mm) nominal size unless otherwise indicated.
  4. Case Form: Adjustable angle unless otherwise indicated.
  5. Tube: Glass with magnifying lens and blue[ or red] organic liquid.
  6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
  7. Window: Glass or plastic.
  8. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
  10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.03 THERMOWELLS

- A. Thermowells:
1. Standard: ASME B40.200.
  2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  3. Material for Use with Copper Tubing: CNR or CUNI.
  4. Material for Use with Steel Piping: CRES.
  5. Type: Stepped shank unless straight or tapered shank is indicated.
  6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
  7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
  8. Bore: Diameter required to match thermometer bulb or stem.
  9. Insertion Length: Length required to match thermometer bulb or stem.
  10. Lagging Extension: Include on thermowells for insulated piping and tubing.
  11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## **2.04 PRESSURE GAGES**

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Terice, H. O. Co.
    - b. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - c. Weiss Instruments, Inc.
    - d. WIKA Instrument Corporation - USA.
  - 2. Standard: ASME B40.100.
  - 3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass or plastic.
  - 10. Ring: Metal.
  - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Tel-Tru Manufacturing Company.
    - b. Terice, H. O. Co.
    - c. Weiss Instruments, Inc.
    - d. WIKA Instrument Corporation - USA.
  - 2. Standard: ASME B40.100.
  - 3. Case: Sealed type; plastic; 4-1/2-inch (114-mm) 4-inch (114-mm) nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
  - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
  - 8. Pointer: Dark-colored metal.
  - 9. Window: Glass or plastic.
  - 10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## **2.05 GAGE ATTACHMENTS**

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15) ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15)] [NPS 1/2 (DN 15), ASME B1.20.1 pipe threads.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
- K. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.
- L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- M. Adjust faces of meters and gages to proper angle for best visibility.

### **3.02 THERMOMETER SCHEDULE**

- A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
  - 1. Liquid-filled, bimetallic-actuated type.
  - 2. Industrial-style, liquid-in-glass type.

### **3.03 PRESSURE-GAGE SCHEDULE**

- A. Pressure gages at discharge of each water service into building shall be one of the following:
  - 1. Liquid-filled, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
  - 1. Liquid-filled, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
  - 1. Liquid-filled, direct-mounted, metal case.

### **3.04 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

**END OF SECTION**

**SECTION 220523**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Bronze swing check valves.
  - 3. Bronze gate valves.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.

**1.02 SUBMITTALS**

- A. Product Data: For each type of valve indicated.

**1.03 QUALITY ASSURANCE**

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

**PART 2 PRODUCTS**

**2.01 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. Handlever: For quarter-turn valves NPS 6 and smaller.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.

**2.02 BRASS BALL VALVES**

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
  - 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. Crane Co.; Crane Valve Group; Crane Valves.
    - b. DynaQuip Controls.
    - c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: 150 psig.
    - c. CWP Rating: 600 psig.
    - d. Body Design: Two piece.
    - e. Body Material: Forged brass.

- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Brass.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

### **2.03 BRONZE SWING CHECK VALVES**

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products from one of the following:
    - a. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. Powell Valves.
    - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 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 125, Bronze Swing Check Valves with Nonmetallic Disc:
  - 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. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Hammond Valve.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Red-White Valve Corporation.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.

### **2.04 BRONZE GATE VALVES**

- A. Class 125, NRS Bronze Gate Valves:
  - 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. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Hammond Valve.
    - f. Kitz Corporation.

- g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Powell Valves.
    - j. Red-White Valve Corporation.
    - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - l. Zy-Tech Global Industries, Inc.
  - 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: Solder joint.
    - e. Stem: Bronze.
    - f. Disc: Solid wedge; bronze.
    - g. Packing: Asbestos free.
    - h. Handwheel: Bronze.
- B. Class 125, RS Bronze Gate Valves:
- 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. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Hammond Valve.
    - f. Kitz Corporation.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Powell Valves.
    - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 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: Solder joint.
    - e. Stem: Bronze.
    - f. Disc: Solid wedge; bronze.
    - g. Packing: Asbestos free.
    - h. Handwheel: Bronze.

### **PART 3 EXECUTION**

#### **3.01 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.

#### **3.02 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.

#### **3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.
2. Throttling Service: Ball valves.
3. Pump-Discharge Check Valves:
  - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
  - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. 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.

#### **3.04 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE**

- A. Pipe NPS 2 and Smaller:
  1. Brass Valves: May be provided with solder-joint ends instead of threaded ends.
  2. Bronze Angle Valves: Class 125, bronze disc.
  3. Ball Valves: One piece, full port, brass with brass trim.
  4. Bronze Swing Check Valves: Class 125, bronze disc.
  5. Bronze Gate Valves: Class 125, NRS.
- 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 Gate Valves: Class 125, NRS.
  3. Iron Globe Valves: Class 125.

**END OF SECTION**

## **SECTION 22 05 29**

### **HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.
  - 6. Equipment supports.

##### **1.02 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 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.

##### **1.03 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. Equipment supports.
- C. Welding certificates.

##### **1.04 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**

##### **2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.



## **2.02 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.

## **2.03 THERMAL-HANGER SHIELD INSERTS**

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## **2.04 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 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.

## **2.05 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.

## **2.06 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

# **PART 3 EXECUTION**

## **3.01 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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.
- 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 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- 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 (DN 100) and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
    - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - 5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.02 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.

### **3.03 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- 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.

### **3.04 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

### **3.05 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 (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### **3.06 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use 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 (DN 15 to DN 750).
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  5. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  6. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 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 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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-joint 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 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. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  3. 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.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

**END OF SECTION**

## **SECTION 22 05 53**

### **IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.

##### **1.02 SUBMITTAL**

- A. Product Data: For each type of product indicated.

#### **PART 2 PRODUCTS**

##### **2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  - 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

##### **2.02 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

#### **PART 3 EXECUTION**

##### **3.01 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

##### **3.02 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.03 PIPE LABEL INSTALLATION**

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: White.
    - b. Letter Color: Black.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: White.
    - b. Letter Color: Black.

**END OF SECTION**

**SECTION 220719**  
**PLUMBING PIPING INSULATION**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic hot-water piping.
  - 2. Domestic recirculating hot-water piping.
  - 3. Roof drains and rainwater leaders.
  - 4. Supplies and drains for handicap-accessible lavatories and sinks.
- B. Related Sections:
  - 1. Division 22 Section "Domestic Water Piping."

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. 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.
- C. Field quality-control reports.

**1.03 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 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.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

**2. PART 2 PRODUCTS**

**2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," and "Indoor 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, provide products by one of 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, Preformed Pipe Insulation:
  1. Products: Subject to compliance with requirements, provide products by 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.
  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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.02 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
  1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 2.03 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 products by one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
  2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Use adhesive that complies 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," including 2004 Addenda.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  1. Products: Subject to compliance with requirements, provide products by 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products: Subject to compliance with requirements, provide products from 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 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 products by 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
  1. Products: Subject to compliance with requirements, provide products from one of 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.04 SEALANTS

- A. Joint Sealants:
  1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide products by 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, use sealants that 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 products by 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 (Minus 40 to plus 121 deg C).
  5. Color: Aluminum.
  6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.05 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.

## **2.06 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) 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, 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; Mast-A-Fab.
    - b. Vimasco Corporation; Elastafab 894.

## **2.07 FIELD-APPLIED JACKETS**

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto 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. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - 1. Products: Subject to compliance with requirements, provide products by 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. Finish and thickness are indicated in field-applied jacket schedules.
  - 3. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
  - 4. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
  - 5. Factory-Fabricated Fitting Covers:
    - a. Same material, finish, and thickness as jacket.
    - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - c. Tee covers.
    - d. Flange and union covers.
    - e. End caps.
    - f. Beveled collars.
    - g. Valve covers.
    - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## **2.08 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 products by 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. 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, provide products by one of 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.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. Products: Subject to compliance with requirements, provide products by 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.

## **2.09 SECUREMENTS**

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
  - 1. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

## **2.10 PROTECTIVE SHIELDING GUARDS**

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Engineered Brass Company.
    - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    - c. McGuire Manufacturing.
    - d. Plumberex.

- e. Truebro; a brand of IPS Corporation.
- f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
- 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Truebro; a brand of IPS Corporation.
    - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
  - 2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

### **3. PART 3 EXECUTION**

#### **3.01 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

#### **3.02 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.

### 3.03 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 (50 mm) 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 (50 mm).
  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.

### 3.04 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 (50 mm) 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.

### **3.05 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 (150 mm) 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 (25 mm), 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.

### **3.06 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.

### **3.07 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE 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 (150 mm) 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 (25 mm), 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.

### **3.08 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.

### **3.09 FIELD-APPLIED JACKET INSTALLATION**

- A. 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.
- B. 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.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### **3.10 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. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### **3.11 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, 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.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### **3.12 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.

### **3.13 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:
1. Flexible Elastomeric: 1 inch thick.
- B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:
1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 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.
- C. Piping, Concealed:
1. PVC, Color-Coded by System: 20 mils thick.
- D. Piping, Exposed:
1. PVC, Color-Coded by System: 20 mils thick.

### **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, Concealed:
1. PVC, Color-Coded by System: 20 mils thick.
- D. Piping, Exposed:
1. PVC: 20 mils thick.

**END OF SECTION**

**SECTION 22 11 16**  
**DOMESTIC WATER PIPING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Specialty valves.
  - 3. Flexible connectors.
  - 4. Water meters furnished by utility company for installation by Contractor.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

**1.04 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

**PART 2 PRODUCTS**

**2.01 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.

**2.02 PEX TUBE AND FITTINGS**

- A. Pex Distribution System: ASTM F 877, SDR 9 tubing.
  - 1. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
  - 2. Manifold: Multiple-outlet, plastic or corrosion resistant metal assembly complying with ASTM F877 with plastic or corrosion resistant metal valve for each outlet.

**2.03 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. 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.

**2.04 PIPING JOINING MATERIALS**

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

**2.05 SPECIALTY VALVES**

- A. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

**2.06 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Description:
    - a. Pressure Rating: 250 psig at 180 deg F.
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Factory-fabricated, bolted, companion-flange assembly.
    - b. Pressure Rating: 300 psig.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
  - 1. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
  - 1. Description:
    - a. Electroplated steel nipple.
    - b. Pressure Rating: 300 psig at 225 deg F.
    - c. End Connections: Male threaded or grooved.
    - d. Lining: Inert and noncorrosive, propylene.

## **2.07 FLEXIBLE CONNECTORS**

- A. 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 250 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
  - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## **PART 3 EXECUTION**

### **3.01 EARTHWORK**

- A. Comply with requirements in Division 32 Section "Sitework Concrete" for excavating, trenching, and backfilling.

### **3.02 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, and test tee with valve, inside the building at each domestic water service entrance. Comply with Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- 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 "General-Duty Valves for Plumbing Piping" for pressure-reducing valves.
- G. Install domestic water piping level without pitch and plumb.
- H. Install PEX piping with loop at each change in direction of more than 90 degrees.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- 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.

### **3.03 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. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### **3.04 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 ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate 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.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

### **3.05 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 unions.

### **3.06 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 Use dielectric nipples.

### **3.07 FLEXIBLE CONNECTOR INSTALLATION**

- A. Install stainless-steel-hose flexible connectors in steel domestic water piping.

### **3.08 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.

### **3.09 HANGER AND SUPPORT INSTALLATION**

- A. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1 and smaller: 32 inches and 3/8 inch rod.
- B. Install hangers for vertical PEX piping every 48 inches.

### **3.10 IDENTIFICATION**

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. 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 CLEANING**

- A. Clean and disinfect potable 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:
    - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
    - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.13 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. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
  1. Hard copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints.
- D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
  1. Hard copper tube, ASTM B 88, Type L cast-copper solder-joint fittings; and soldered joints.
  2. PEX Tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.

### **3.14 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 ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
  3. Hot-Water Circulation Piping, Balancing Duty: 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**

## **SECTION 22 1119**

### **DOMESTIC WATER PIPING SPECIALTIES**

#### **PART 1 - GENERAL**

##### **1.01 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.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.

##### **1.02 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 60 psig, unless otherwise indicated.

##### **1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

##### **1.04 QUALITY ASSURANCE**

- A. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

#### **PART 2 - PRODUCTS**

##### **2.01 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Zurn Plumbing Products Group; Wilkins Div.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Conbraco Industries, Inc.
  - 2. Standard: ASSE 1001.
  - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: Threaded.
  - 6. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Zurn Plumbing Products Group; Light Commercial Operation.
    - b. Watts Industries, Inc.; Water Products Div.

- c. Conbraco Industries, Inc.
- d. MIFAB, Inc.
- e. Woodford Manufacturing Company.
- 2. Standard: ASSE 1001.
- 3. Body: Bronze, nonremovable, with manual drain.
- 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
- 5. Finish: **Rough bronze.**

## 2.02 BACKFLOW PREVENTERS

- A. Intermediate Atmospheric-Vent Backflow Preventers:
  - 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. Conbraco Industries, Inc.
    - d. Honeywell Water Controls.
  - 2. Standard: ASSE 1012.
  - 3. Operation: Continuous-pressure applications.
  - 4. Size: NPS 3/4.
  - 5. Body: Bronze.
  - 6. End Connections: Solder joint.
  - 7. Finish: Rough bronze.
- B. Reduced-Pressure-Principle Backflow Preventers:
  - 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. Conbraco Industries, Inc.
  - 2. Standard: ASSE 1013.
  - 3. Operation: Continuous-pressure applications.
  - 4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
  - 5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
  - 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 7. Configuration: Designed for horizontal, straight through flow.
  - 8. 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.

## 2.03 WATER PRESSURE-REDUCING VALVES

- A. Water Regulators:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Zurn Plumbing Products Group; Wilkins Div.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Conbraco Industries, Inc.
  - 2. Standard: ASSE 1003.
  - 3. Pressure Rating: Initial working pressure of 150 psig.
  - 4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
  - 5. Valves for Booster Heater Water Supply: Include integral bypass.
  - 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

## 2.04 BALANCING VALVES

- A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Bell and Gossett
  - b. Conbraco Industries, Inc.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
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: Standard or 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.

## **2.05 TEMPERATURE-ACTUATED WATER MIXING VALVES**

- A. Water-Temperature Limiting Devices:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Powers; a Watts Industries Co.
    - b. Conbraco Industries, Inc.
    - c. Honeywell Water Controls.
    - d. Leonard Valve Company.
    - e. Symmons Industries, Inc.
    - f. Taco, Inc.
    - g. Watts Industries, Inc.; Water Products Div.
    - h. Zurn Plumbing Products Group; Wilkins Div.
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig.
  4. Type: Thermostatically controlled water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded union inlets and outlet.
  7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Tempered-Water Setting: 105 deg F.
  9. Valve Finish: Chrome plated.
- B. Primary, Thermostatic, Water Mixing Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Powers; a Watts Industries Co.
    - b. Leonard Valve Company.
    - c. Symmons Industries, Inc.
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig.
  4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
  5. Material: Bronze body with corrosion-resistant interior components.
  6. Connections: Threaded union inlets and outlet.
  7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
  8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
  9. Tempered-Water Setting: 120 deg F.
  10. Valve Finish: Rough bronze.
  11. Piping Finish: Copper.
  12. Cabinet: Factory-fabricated, stainless steel, for surface mounting and with hinged, stainless-steel door.

## **2.06 STRAINERS FOR DOMESTIC WATER PIPING**

- A. Y-Pattern Strainers:
  - 1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
  - 2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and 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: 0.020 inch.
  - 6. Drain: Factory-installed, hose-end drain valve.

## **2.07 OUTLET BOXES**

- A. Clothes Washer Outlet Boxes:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Guy Gray Manufacturing Co., Inc.
    - b. Oatey.
    - c. Symmons Industries, Inc.
    - d. Watts Industries, Inc.
    - e. Zurn Plumbing Products Group.
  - 2. Mounting: Recessed.
  - 3. Material and Finish: Enameled steel or epoxy painted steel box and faceplate.
  - 4. Faucet: Combination, valved fitting or separate hot and cold water, valved fittings complying with ASME A112.18.1. Include garden hose thread complying with ASME B1.20.7 on outlets.
  - 5. Supply Shutoff Fittings: NPS 1/2 gate, globe or ball valves and NPS 1/2 copper, water tubing.
  - 6. Drain: 2" standpipe and P-trap for direct waste connection to drainage piping.
  - 7. Inlet hoses: Two 60 inch long rubber household clothes washer inlet hoses with female, garden hose thread couplings. Include rubber washers.
  - 8. Drain Hose: One 48 inch long rubber household clothes washer drain hose with hooked end.
- B. Icemaker Outlet Boxes:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. IPS Corporation.
    - b. Oatey.
  - 2. Mounting: Recessed.
  - 3. Material and Finish: Enameled steel or epoxy painted steel box and faceplate.
  - 4. Faucet: Valved fittings complying with ASME A112.18.1. Include 1/2 inch or smaller tube outlet.
  - 5. Supply shut off fitting: 1/2 inch ball valve.

## **2.08 HOSE BIBBS**

- A. Hose Bibbs:
  - 1. Standard: ASME A112.18.1 for sediment faucets.
  - 2. Body Material: Bronze.
  - 3. Seat: Bronze, replaceable.
  - 4. Supply Connections: 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 or field-installation, 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: Chrome or nickel plated.
  - 10. Finish for Finished Rooms: Chrome or nickel plated.
  - 11. Operation for Equipment Rooms: Wheel handle or operating key.

12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.09 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Zurn Plumbing Products Group; Light Commercial Operation.Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Watts Drainage Products Inc.
  - e. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed and exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

### B. Moderate-Climate Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Zurn Plumbing Products Group; Light Commercial Operation.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Watts Drainage Products Inc.
  - f. Woodford Manufacturing Company.
2. Standard: ASME A112.21.3M for concealed and exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4.
6. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Chrome plated.
9. Outlet: Exposed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

### C. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Zurn Plumbing Products Group; Light Commercial Operation.

- b. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Watts Industries, Inc.; Water Products Div.
- d. Woodford Manufacturing Company.
- 2. Standard: ASSE 1019, Type A or Type B.
- 3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
- 4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
- 5. Pressure Rating: 125 psig.
- 6. Operation: Loose key.
- 7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
- 8. Inlet: NPS 3/4.
- 9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

## **2.10 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.

## **2.11 WATER HAMMER ARRESTERS**

- A. Water Hammer Arresters:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. MIFAB, Inc.
    - b. PPP Inc.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. AMTROL, Inc.
    - e. Josam Company.
    - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - g. Watts Drainage Products Inc.
    - h. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASSE 1010 or PDI-WH 201.
  - 3. Type: Copper tube with piston.
  - 4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## **2.12 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. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Watts Industries, Inc.; Water Products Div.
  - 2. Standard: ASSE 1018.
  - 3. Pressure Rating: 125 psig minimum.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: NPS 1/2 threaded, union, 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.

### **PART 3 - EXECUTION**

#### **3.01 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. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. 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.
- F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve.
- G. Install water hammer arresters in water piping according to PDI-WH 201.
- H. 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.
- I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  1. Intermediate atmospheric-vent backflow preventers.
  2. Reduced-pressure-principle backflow preventers.
  3. Double-check backflow-prevention assemblies.
  4. Water pressure-reducing valves.
  5. Primary, thermostatic, water mixing valves.
  6. Supply-type, trap-seal primer valves.
- K. 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. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

#### **3.02 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.

#### **3.03 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

**END OF SECTION**



**SECTION 22 13 16**  
**SANITARY WASTE AND VENT PIPING**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.
  - 3. Encasement for underground metal piping.
- B. Related Sections:
  - 1. Division 22 Section "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

**1.03 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 (30 kPa).
- 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.

**1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. 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.
- C. Field quality-control reports.

**1.05 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.
- C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.

- D. All couplings for hubless cast iron soil pipe and fittings shall meet the latest requirements of CISPI 310 including Annex A1 and be certified by NSF International.

## **2. PART 2 PRODUCTS**

### **2.01 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.

### **2.02 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 and CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe.
    - b. MIFAB, Inc.
    - c. Tyler Pipe.
  - 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.
- C. Cast-Iron, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. MG Piping Products Company.
  - 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.

### **2.03 COPPER TUBE AND FITTINGS**

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M (ASTM B 88M, Type B and Type C), water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.
- E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

### **2.04 ABS PIPE AND FITTINGS**

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

C. Solvent Cement: ASTM D 2235.

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.05 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Nonpressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Dallas Specialty & Mfg. Co.
    - 2) Fernco Inc.
    - 3) Mission Rubber Company; a division of MCP Industries, Inc.
    - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
  - b. Standard: ASTM C 1173.
  - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - d. Sleeve Materials:
    - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Nonpressure Transition Couplings:
  - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - b. Cascade Waterworks Mfg. Co.
    - 1) Mission Rubber Company; a division of MCP Industries, Inc.
  - c. Standard: ASTM C 1460.
  - d. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Capitol Manufacturing Company.
    - 2) Central Plastics Company.
    - 3) Jomar International Ltd.
    - 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - 5) Wilkins; a Zurn company.
  - b. Description:
    - 1) Standard: ASSE 1079.
    - 2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C)
    - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
3. Dielectric Flanges:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Capitol Manufacturing Company.
  - 2) Central Plastics Company.
  - 3) Matco-Norca, Inc.
  - 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 5) Wilkins; a Zurn company.
- b. Description:
  - 1) Standard: ASSE 1079.
  - 2) Factory-fabricated, bolted, companion-flange assembly.
  - 3) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
  - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
4. Dielectric-Flange Insulating Kits:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Advance Products & Systems, Inc.
    - 2) Calpico, Inc.
    - 3) Central Plastics Company.
    - 4) Pipeline Seal and Insulator, Inc.
  - b. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig (1035 kPa).
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Grinnell Mechanical Products.
    - 2) Matco-Norca, Inc.
    - 3) Precision Plumbing Products, Inc.
    - 4) Victaulic Company.
  - b. Description:
    - 1) Standard: IAPMO PS 66
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

### **3. PART 3 EXECUTION**

#### **3.01 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

#### **3.02 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. Comply with requirements for seismic-restraint devices specified in Division 23.
- 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 (DN 80) and smaller; 2 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- 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."
- O. Install steel piping according to applicable plumbing code.
- P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- Q. Install aboveground ABS piping according to ASTM D 2661.
- R. Install underground ABS piping according to ASTM D 2321.
- S. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
  2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
  3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- U. Install sleeve seals for piping penetrations of concrete walls and slabs.
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22.

### **3.03 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. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- C. 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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

### **3.04 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
  2. In Drainage Piping: Shielded, nonpressure transition couplings.
- B. Dielectric Fittings:
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric nipples.
  3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric nipples.
  4. Dielectric Fittings for [NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### **3.05 VALVE INSTALLATION**

- A. General valve installation requirements are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Backwater Valves: Install backwater valves in piping subject to backflow.
1. Horizontal Piping: Horizontal backwater valves.
  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 Division 22 Section "Sanitary Waste Piping Specialties."

### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 23.
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  6. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
  2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
  3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
  4. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).
- G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
  2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
  3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
  4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
  5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
  6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
- I. Install supports for vertical steel piping every 15 feet (4.5 m).
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
  2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.

- K. Install supports for vertical copper tubing every 10 feet (3 m).
- L. Install hangers for ABS piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
  - 3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
- M. Install supports for vertical ABS piping every 48 inches (1200 mm).
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### **3.07 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 Division 22 Section "Sanitary Waste Piping Specialties."
- 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 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment

### **3.08 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

### **3.09 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 (30 kPa). 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 (250 Pa). 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.

### **3.10 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 ABS Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

### **3.11 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:
  1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
  2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:
  1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:
1. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  2. Dissimilar Pipe- Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION**

**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Roof flashing assemblies.
  - 4. Through-penetration firestop assemblies.
  - 5. Miscellaneous sanitary drainage piping specialties.
  - 6. Flashing materials.

**1.03 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

**1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

**1.05 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.

**1.06 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.

**2. PART 2 PRODUCTS**

**2.01 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. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
    - g. Josam Company; Blucher-Josam Div.
  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: Countersunk or raised-head 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. Sioux Chief Manufacturing Company, Inc.
    - 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.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
    - g. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  2. Standard: ASME A112.36.2M for adjustable housing cleanout.
  3. Size: Same as connected branch.
  4. Type: Adjustable housing
  5. Body or Ferrule: Cast iron
  6. Clamping Device: Required.
  7. Outlet Connection: Inside callk
  8. Closure: Brass plug with tapered threads
  9. Adjustable Housing Material: Cast iron with set-screws or other device.
  10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy
  11. Frame and Cover Shape: Round
  12. Top Loading Classification: Medium Duty.
  13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
  14. Standard: ASME A112.3.1.
  15. Size: Same as connected branch.

16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
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: Countersunk or raised-head 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.

2.02 **FLOOR DRAINS**

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products Inc.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Cast iron
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: 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 of Body and Strainer Finish: Nickel bronze
14. Top Shape: Round
15. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
16. Trap Material: Cast iron
17. Trap Pattern: Standard P-trap.
18. Trap Features: Trap-seal primer valve drain connection.

## **2.03 ROOF FLASHING ASSEMBLIES**

### **A. Roof Flashing Assemblies:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-) 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.

## **2.04 THROUGH-PENETRATION FIRESTOP ASSEMBLIES**

### **A. Through-Penetration Firestop Assemblies:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. ProSet Systems Inc.
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.
6. Special Coating: Corrosion resistant on interior of fittings.

## **2.05 FLOOR SINK**

### **A. Cast-Iron Floor Sink FS-1:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. MIFAB, Inc.
  - b. Prier Products, Inc.

- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Tyler Pipe; Wade Div.
- e. Watts Drainage Products Inc.
- f. Zurn Plumbing Products Group; Light Commercial Operation.
- g. Zurn Plumbing Products Group; Specifications Drainage Operation.
- 2. Standard: ASME A112.6.3.
- 3. Pattern: Sanitary drain.
- 4. Body Material: Gray iron.
- 5. Seepage Flange: Required.
- 6. Anchor Flange: Not required.
- 7. Clamping Device: Not required.
- 8. Outlet: Bottom.
- 9. Backwater Valve: Not required.
- 10. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
- 11. Sediment Bucket: Aluminum Dome.
- 12. Top or Strainer Material: Nickel bronze.
- 13. Top of Body and Strainer Finish: Nickel bronze.
- 14. Top Shape: Square.
- 15. Dimensions of Top or Strainer: 8 ½ x 6.
- 16. Top Loading Classification: Light Duty
- 17. Funnel: Not required.

## **2.06 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES**

### **A. Open Drains:**

- 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
- 2. Size: Same as connected waste piping.

### **B. 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 (DN 50): 4-inch- (100-mm-) minimum water seal.
  - b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.

### **C. 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 (DN 15) side inlet.

### **D. 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.
- E. 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 **2 inches (51 mm)** 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.
- F. Stack Flashing Fittings:
1. Description: Counterflashing-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.
- G. 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.

## **2.07 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. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
  2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
  3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Refer to Division 22 Section "Basic Plumbing Methods and Materials" for piping joining materials, joint construction, and basic installation requirements.
- B. 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 (DN 100). Use NPS 4 (DN 100) 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 (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. 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 (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) 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.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- H. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. 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.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch (25-mm) 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 frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
- Q. Install wood-blocking reinforcement for wall-mounting-type specialties.
- R. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.02 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.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.03 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 (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) 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. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

### **3.04 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**

**SECTION 22 34 00**  
**FUEL-FIRED, DOMESTIC-WATER HEATERS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Commercial, gas-fired, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 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."

**1.03 SUBMITTALS**

- A. Product Data: For each type and size of domestic-water heater indicated.
- B. Shop Drawings:
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.
- D. Product certificates.
- E. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Operation and maintenance data.
- I. Warranty: Sample of special warranty.

**1.04 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/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Five years.

- 2) Controls and Other Components: One year(s).
- b. Compression Tanks: Five years.

## **PART 2 PRODUCTS**

### **2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS**

- A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Water Heaters.
    - b. Bradford White Corporation.
    - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    - d. State Industries.
  - 2. Standard: ANSI Z21.10.3/CSA 4.3.
  - 3. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.
    - a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
      - 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
      - 2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.
    - b) Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c) Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
  - 4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    - e. Jacket: Steel with enameled finish.
    - f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
    - g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    - h. Temperature Control: Adjustable thermostat.
    - i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    - j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
  - 5. Special Requirements: NSF 5 construction.
  - 6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

## 2.02 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL Inc.
    - b. Flexcon Industries.
    - c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    - d. Taco, Inc.
  - 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  - 3. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.
- E. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig (3.5-kPa) pressure rating as required to match gas supply.
- F. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.
- G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- H. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.
  - 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- J. Propane conversion kit.

## 2.03 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## **PART 3 EXECUTION**

### **3.01 DOMESTIC-WATER HEATER INSTALLATION**

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."
  - 1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
  - 2. Maintain manufacturer's recommended clearances.
  - 3. Arrange units so controls and devices that require servicing are accessible.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 8. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
  - 4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Division 23.
- D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Division 23.
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- G. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."

- H. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- I. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- J. Fill domestic-water heaters with water.
- K. Charge domestic-water compression tanks with air.

### **3.02 CONNECTIONS**

- A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Division 23 Section "Facility Liquefied Petroleum Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### **3.03 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

### **3.04 FIELD QUALITY CONTROL**

- A. 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.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

### **3.05 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

**END OF SECTION**

**SECTION 22 4213.13**  
**COMMERCIAL WATER CLOSETS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Water closets.
  - 2. Toilet seats.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.01 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS**

- A. Water Closets: Floor mounted, bottom outlet, top spud.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard America.
    - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
    - c. Kohler Co.
  - 2. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Siphon jet.
    - d. Style: Close-coupled tank type.
    - e. Height: Disabled/elderly, complying with CBC Section 1115B.
    - f. Rim Contour: Elongated.
    - g. Water Consumption: 1.28 gal. per flush.
    - h. Spud Size and Location: NPS 1-1/2; top.
    - i. Color: White.
  - 3. Bowl-to-Drain Connecting Fitting: ASME A112.4.3.

**2.02 TOILET SEATS**

- A. Toilet Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Olsonite Seat Co.
    - b. Centoco Manufacturing Corporation.
    - c. Bemis Manufacturing Company.
    - d. Church Seats.
    - e. Kohler Co.
    - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
  - 2. Standard: IAPMO/ANSI Z124.5.
  - 3. Material: Plastic.
  - 4. Type: Commercial (Heavy duty).
  - 5. Shape: Elongated rim, open front.
  - 6. Hinge: Self-sustaining, check.
  - 7. Hinge Material: Noncorroding metal.
  - 8. Seat Cover: Not required.
  - 9. Color: White.



**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Water-Closet Installation:
  - 1. Install level and plumb according to roughing-in drawings.
  - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- B. Support Installation:
  - 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- C. Install toilet seats on water closets.
- D. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
  - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to water-closet color.
  - 3. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

**3.02 CONNECTIONS**

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

**3.03 ADJUSTING**

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

**3.04 CLEANING AND PROTECTION**

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

**SECTION 22 4216.13**  
**COMMERCIAL LAVATORIES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Lavatories.
  - 2. Faucets.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

**PART 2 PRODUCTS**

**2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES**

- A. Lavatory: Oval, self rimming, vitreous china, counter mounted.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard America.
    - b. Zurn Industries, LLC; Commercial Brass and Fixtures.
    - c. Kohler Co.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: Self-rimming for above-counter mounting.
    - c. Nominal Size: Round, 19 inches.
    - d. Faucet-Hole Punching: Three holes, 2-inch centers.
    - e. Faucet-Hole Location: Top.
    - f. Color: White.
    - g. Mounting Material: Sealant.

**2.02 SOLID-BRASS, MANUALLY OPERATED FAUCETS**

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, single-control mixing, solid-brass valve.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Delta Faucet Company.
    - b. Chicago Faucets.

- c. Kohler Co.
- 2. Standard: ASME A112.18.1/CSA B125.1.
- 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
- 4. Body Type: Centerset.
- 5. Body Material: Commercial, solid brass.
- 6. Finish: Polished chrome plate.
- 7. Maximum Flow Rate: 0.4 gpm.
- 8. Mounting Type: Deck, exposed.
- 9. Valve Handle(s): Single lever.
- 10. Spout: Rigid type.
- 11. Spout Outlet: Aerator.
- 12. Operation: Compression, manual.
- 13. Drain: Not part of faucet.

### **2.03 SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2.
  - 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

### **2.04 WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
  - 3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install lavatories level and plumb according to roughing-in drawings.

- B. 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 Division 22.
- C. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

### **3.03 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 Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

### **3.04 ADJUSTING**

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.05 CLEANING AND PROTECTION**

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

**SECTION 22 42 16.16**  
**COMMERCIAL SINKS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Kitchen sinks.
  - 2. Service sinks
  - 3. Sink faucets.
  - 4. Supply fittings.
  - 5. Waste fittings.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

**1.04 CLOSEOUT SUBMITTALS**

- A. Maintenance data.

**PART 2 PRODUCTS**

**2.01 UTILITY SINKS**

- A. Utility sink KS-1 stainless steel counter mounted.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Just Manufacturing.
    - b. Elkay Manufacturing Company.
  - 2. Fixture:
    - a. Standard: ASME A112.19.1/CSA B45.4.
    - b. Type" Ledge back.
    - c. Number of compartments: One.
    - d. Overall dimension: 17-1/2" x 19" x 6-1/2"
    - e. Metal Thickness 18 gauge stainless steel.
    - f. Each Compartment
      - 1) Dimension 11-1/2" x 16" x 6-1/2" deep.
      - 2) Drains: NPS 1-1/2" (DN 40) tailpiece with stopper.
      - 3) Drain Location: Near back of compartment.
    - g. Supply fittings:
      - 1) Standard ASME A112.18.1/CSA B125.1
      - 2) Supplies: Chrome-plated brass compression stop with inlet connection matching water supply piping type and size.
        - a) Operation: Wheel handle
        - b) Risers: NPS 1/2 (DN 15), ASME A112.18.6, braided or corrugated stainless steel flexible hose.
    - h. Waste Fittings:
      - 1) Standard: ASME A112.18.2/CSA B125.2.
      - 2) Trap(s):

- a) Size: NPS 1-1/2" (DN 40).
- b) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032 inch thick tube to wall.
- i. Mounting: On counter with sealant.

## **2.02 SINK FAUCETS**

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucet KS-1.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Delta Faucet Company.
    - b. Chicago Faucets.
    - c. Just Manufacturing.
  - 2. Standard: ASME A112.18.1/CSA B125.1.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  - 4. Body Type: Single.
  - 5. Body Material: Commercial solid brass.
  - 6. Finish: Chrome plated.
  - 7. Maximum Flowrate: 1.8 GPM.
  - 8. Handles: Single lever with pull out spray hose
  - 9. Mounting Type: Deck, concealed.
  - 10. Spout Type: Pull out sprayer
  - 11. Vacuum Breaker: Not Required for hose outlet.
  - 12. Spout End: Sprayer.

## **2.03 SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2
  - 2. ASME A112.18.6, braided flexible hose.

## **2.04 WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  - 1. Size: NPS 1-1/2.

2. Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- thick brass tube to wall; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Install water-supply piping with stop on each supply to each sink faucet.
  1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  2. Install stops in locations where they can be easily reached for operation.
- E. 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 Division 22 Section "Escutcheons for Plumbing Piping."
- F. Seal joints between sinks and 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 Division 07 Section "Joint Sealants."
- G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

#### **3.03 CONNECTIONS**

- A. Connect sinks 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 Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

#### **3.04 ADJUSTING**

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

#### **3.05 CLEANING AND PROTECTION**

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

#### **END OF SECTION**





## **SECTION 22 42 23**

### **COMMERCIAL SHOWERS, RECEPTORS, AND BASINS**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Shower faucets.

##### **1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.03 CLOSEOUT SUBMITTALS**

- A. Maintenance data.

#### **PART 2 - PRODUCTS**

##### **2.01 SHOWER FAUCETS**

- A. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.
- B. Shower Faucets:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Delta Faucet Company.
    - b. Symmons.
    - c. Moen Incorporated.
  - 2. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
  - 3. Faucet:
    - a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
    - b. Body Material: Solid brass.
    - c. Finish: Polished chrome plate.
    - d. Maximum Flow Rate: 1.5 gpm unless otherwise indicated.
    - e. Mounting: Concealed.
    - f. Operation: Single-handle, twist or rotate control.
    - g. Antiscald Device: Integral with mixing valve.
    - h. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
  - 4. Supply Connections: NPS 1/2 (DN 15).
  - 5. Shower Head:
    - a. Standard: ASME A112.18.1/CSA B125.1.
    - b. Type: Ball joint with arm and flange.
    - c. Shower Head Material: Metallic with chrome-plated finish.
    - d. Spray Pattern: Adjustable.
    - e. Integral Volume Control: Not required.
    - f. Shower-Arm, Flow-Control Fitting: Single push button.
    - g. Handheld Spray Wand with metal flexible hose.
    - h. Temperature Indicator: Not required.

#### **PART 3 - EXECUTION**

##### **3.01 INSTALLATION**

- A. Assemble shower components according to manufacturers' written instructions.
- B. Install showers level and plumb according to roughing-in drawings.
- C. Install water-supply piping with stop on each supply to each shower faucet.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with shower. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

- 2. Install stops in locations where they can be easily reached for operation.
- D. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- E. Set shower receptors in leveling bed of cement grout.
- F. 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 escutcheons requirements specified in Division 22.
- G. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

### **3.02 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 Division 22 Section "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

### **3.03 ADJUSTING**

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

### **3.04 CLEANING AND PROTECTION**

- A. After completing installation of showers, inspect and repair damaged finishes.
- B. Clean showers, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

**SECTION 22 47 13**  
**DRINKING FOUNTAINS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes drinking fountains and related components.

**1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of drinking fountains.

**1.03 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For drinking fountains to include in maintenance manuals.

**PART 2 PRODUCTS**

**2.01 DRINKING FOUNTAINS**

- A. Drinking Fountains: Stainless steel, wall mounted, vandal-proof with water cooler and bottle filler.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Haws Corporation.
    - b. Elkay.
  - 2. Standards:
    - a. Comply with ASME A112.19.3/CSA B45.4.
    - b. Comply with NSF 61.
  - 3. Type Receptor: With back, On horizontal support.
  - 4. Receptor Shape: Rectangular.
  - 5. Back Panel: Stainless-steel wall plate behind drinking fountain.
  - 6. Bubblers: Two, with adjustable stream regulator, located on deck.
  - 7. Control: Push button.
  - 8. Bottle Filler: Sensor with mechanical front bubbler button activation.
  - 9. Drain: Grid type with NPS 1-1/4 tailpiece.
  - 10. Supply Piping: NPS 3/8 with shutoff valve.
  - 11. Drain Piping: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
  - 12. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.
  - 13. Cooling system: Electric, with hermetically sealed compressor, cooling coil, air cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant metal storage tank and adjustable thermostat.
    - 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.
  - 14. Support: ASME A112.6.1M, Type III lavatory carrier.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22.
- F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- G. Adjust fixture flow regulators for proper flow and stream height.

### **3.03 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 Division 22 Section "Domestic Water Piping."
- C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

### **3.04 CLEANING**

- A. After installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

SECTION 221113  
FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes water-distribution piping and related components outside the building for water service and fire-service mains.
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 REFERENCED STANDARDS:

- A. The editions, specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
- B. Standard Specifications:
  - 1. Standard Specifications for Public Works Construction (current edition).
  - 2. San Diego Water Agencies' Standard Specifications
  - 3. Standard Special Provisions of the Regional Standards Committee.
  - 4. California Department of Transportation, "Manual of Traffic Controls, for Construction and Maintenance Work Zones", (current edition), Document No. PITS070112-04.
  - 5. California Department of Transportation U.S. Customary Standard Specification, Document No. PITS070112-06.
- C. Standard Drawings:
  - 1. San Diego Regional Standard Drawings (current edition).
  - 2. San Diego Water Agencies' Standards (WAS).
  - 3. California Department of Transportation U.S. Customary Standard Plans, Document No. PITS070112-05 (current edition).
  - 4. ANSI: American National Standards Institute.
  - 5. ASTM: American Society of Testing and Materials International.
  - 6. AWWA: American Water Works Association.
  - 7. SSPC: The Society for Protective Coatings.

1.4 DEFINITIONS

- A. EPDM: Ethylene propylene diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PA: Polyamide (nylon) plastic.
- D. PE: Polyethylene plastic.

- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.
- H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. Submit manufactures catalog data on pipe to be supplied.
  - 2. Gate valves.
  - 3. Check valves
  - 4. Detector check valves

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control test reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

#### 1.8 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
  - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
  - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
  - 1. Legibly label pipe, with blue markings, at 5 foot intervals and each coupling. Identify the following:
    - a. Pipe size.
    - b. Nominal OD base, PVC, dimension ratio number or pressure class.
    - c. AWWA C900.

- d. Seal of the testing agency that verified the suitability of the material for potable water service.
- 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 ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- G. NSF Compliance:
  - 1. Comply with NSF 14 for plastic potable-water-service piping.
  - 2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - 1. Ensure that valves are dry and internally protected against rust and corrosion.
  - 2. Protect valves against damage to threaded ends and flange faces.
  - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
  - 1. Hoist pipe with mechanical equipment using a cloth belt sling or a continuous fiber rope to avoid scratching pipe. Do not use chains.
  - 2. Pipes may be lowered by rolling on two ropes controlled by snubbing.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
  - 1. Do not stack higher than 4 feet.
  - 2. Do not stack with weight on bells.
  - 3. Avoid scratching the pipe surface.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

## 1.10 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution 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 water-distribution service according to requirements indicated:
  - 1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of water-distribution service without Owner's Representative's written permission.

## 1.11 COORDINATION

- A. Coordinate connection to water main with Owner's Representative.

## PART 2 - PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.
  - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
  - 2. Copper, Pressure-Seal Fittings:
    - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
    - b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.
  - 1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
  - 2. Copper, Pressure-Seal Fittings:
    - a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
    - b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- 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.

### 2.2 PVC PIPE AND FITTINGS

- A. PVC, Schedule 40 Pipe: ASTM D 1785.
  - 1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.



- B. PVC, Schedule 80 Pipe: ASTM D 1785.
  - 1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
  - 2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.
- C. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, and with spigot end.
  - 1. Comply with UL 1285 for fire-service mains if indicated.
  - 2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
  - 3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
  - 4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    - a. Gaskets: AWWA C111, rubber.
  - 5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
    - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

## 2.3 JOINING MATERIALS

- A. Refer to Section 330500 "Common Work Results for Utilities" for commonly used joining materials.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.
- D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

## 2.4 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Flexible Connectors:
  - 1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
  - 2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

## 2.5 GATE VALVES

- A. Gate valves, unless otherwise indicated, shall be the same size as the main in which they are installed. Gate valves shall be non-rising stem, counterclockwise opening and provided with a 2-inch square operating nut with the word open and an arrow cast in the metal to indicate direction to open. Valves shall be marked with raised lettering cast on the body indicating

manufacturer and working pressure. Working pressure rating shall equal or exceed that of the pressure class of the adjoining pipe unless otherwise indicated. Gaskets shall conform to AWWA C111 and be full faced 0.0625-inch cloth inserted rubber with bolt holes pre-punched.

- B. Four-inch pipe size and larger valves shall conform to AWWA C509 and the following:
1. Valves shall be iron body with flanged ends, fully-encapsulated resilient wedge type, with solid bronze stem and disc nut. Minimum designated water working pressure shall be 200 psi for valves 4 inches through 12 inches and 150 psi for larger valves.
  2. Bronze for stems and disc nuts shall not contain more than 2 percent aluminum nor more than 5 percent zinc. Bronze shall be ASTM B62 (85-5-5-5) copper alloy 836, except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi and a minimum of 15 percent elongation in 2 inches. Valves shall be equipped with operating nuts unless otherwise indicated. Valves shall be furnished with O-ring seals.
  3. Sealing mechanism shall provide zero leakage at the water working pressure against line flow from either direction and be designed such that no exposed metal seams, edges, screws, etc., are within the waterway in the closed position (all rubber surfaces). Rubber-covered gate shall not be wedged into a pocket nor slide across the seating surface to obtain tight closure. Wedge shall be of cast iron completely encapsulated with urethane rubber. Urethane sealing rubber shall be permanently bonded to the cast iron wedge to meet ASTM tests for rubber metal bond ASTM D 429.
  4. There shall be two low torque thrust bearings located above and below the stem collar. Stem nut shall be independent of wedge and shall be made of solid bronze. There shall be a smooth, unobstructed waterway free of pockets, cavities and depressions in the seat area.
  5. Body and bonnet shall be coated with fusion bonded epoxy both interior and exterior having a minimum thickness of 8 mils. Coating to be applied to castings prior to assembly to ensure all exposed areas, including bolt holes and flange face surfaces, shall be covered. Prior to shipment from factory, each valve shall be tested by hydrostatic pressure equal to requirement for both AWWA (twice the specified working pressure) and 400 psi UL/FM requirements.
  6. Acceptable Product: Mueller Style A-2360-6 with 2-inch square wrench nut (P-2360-6 for use as sprinkler system post indicator valves) to match Owner standard.
- C. Three-inch and smaller pipe size valves shall have a body and all interior working parts constructed of ASTM B62 (85-5-5-5) copper alloy 836. Stem bronze shall not contain more than 2 percent aluminum nor more than 5 percent zinc and shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi and a minimum of 15 percent elongation in 2 inches.
1. Handwheels: Brass or bronze.
  2. Valves: Provide one of the following, or equal:
- D. AWWA, Cast-Iron Gate Valves:
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. Mueller Co.
    - b. Per Padre Dam Approved Materials List.
  2. Nonrising-Stem, Metal-Seated Gate Valves:

- a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
  - 1) Standard: AWWA C500.
  - 2) Minimum Pressure Rating: 200 psig.
  - 3) End Connections: Mechanical joint.
  - 4) Interior Coating: Complying with AWWA C550.
- 3. Nonrising-Stem, Resilient-Seated Gate Valves:
  - a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
    - 1) Standard: AWWA C509.
    - 2) Minimum Pressure Rating: 200 psig.
    - 3) End Connections: Mechanical joint.
    - 4) Interior Coating: Complying with AWWA C550.
- 4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
  - a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
    - 1) Standard: AWWA C509.
    - 2) Minimum Pressure Rating: 250 psig.
    - 3) End Connections: Push on or mechanical joint.
    - 4) Interior Coating: Complying with AWWA C550.
- 5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
  - a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
    - 1) Standard: AWWA C500.
    - 2) Minimum Pressure Rating: 200 psig.
    - 3) End Connections: Flanged.
- 6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
  - a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
    - 1) Standard: AWWA C509.
    - 2) Minimum Pressure Rating: 200 psig.
    - 3) End Connections: Flanged.
- E. UL/FMG, Cast-Iron Gate Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Cast Iron Pipe Company.
    - b. Clow Valve Company; a subsidiary of McWane, Inc.
    - c. Crane; Crane Energy Flow Solutions.
    - d. Kennedy Valve Company; a division of McWane, Inc.
    - e. M & H Valve Company; a division of McWane, Inc.
    - f. McWane, Inc.

- g. Mueller Co.
    - h. NIBCO INC.
    - i. Stockham; Crane Energy Flow Solutions.
    - j. U.S. Pipe and Foundry Company.
    - k. Per approved materials list.
  - 2. UL/FMG, Nonrising-Stem Gate Valves:
    - a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
      - 1) Standards: UL 262 and FMG approved.
      - 2) Minimum Pressure Rating: 175 psig.
      - 3) End Connections: Flanged.
  - 3. OS&Y, Rising-Stem Gate Valves:
    - a. Description: Iron body and bonnet and bronze seating material.
      - 1) Standards: UL 262 and FMG approved.
      - 2) Minimum Pressure Rating: 175 psig.
      - 3) End Connections: Flanged.
- F. Bronze Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane; Crane Energy Flow Solutions.
    - b. Hammond Valve.
    - c. Jenkins Valves; Crane Energy Flow Solutions.
    - d. Milwaukee Valve Company.
    - e. Red-White Valve Corporation.
    - f. Stockham; Crane Energy Flow Solutions.
    - g. Per approved materials list
  - 2. OS&Y, Rising-Stem Gate Valves:
    - a. Description: Bronze body and bonnet and bronze stem.
      - 1) Standards: UL 262 and FMG approved.
      - 2) Minimum Pressure Rating: 175 psig.
      - 3) End Connections: Threaded.
  - 3. Nonrising-Stem Gate Valves:
    - a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
      - 1) Standard: MSS SP-80.

## 2.6 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Cast Iron Pipe Company.
    - b. Clow Valve Company; a subsidiary of McWane, Inc.
    - c. EJ.
    - d. Flowserve Corporation.
    - e. Kennedy Valve Company; a division of McWane, Inc.
    - f. M & H Valve Company; a division of McWane, Inc.
    - g. McWane, Inc.
    - h. Mueller Co.
    - i. Per approved materials list
  2. Description: Sleeve and valve compatible with drilling machine.
    - a. Standard: MSS SP-60.
    - b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
    - c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.
- B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.
1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.7 CHECK VALVES

### A. AWWA Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American AVK Co.
  - b. American Cast Iron Pipe Company.
  - c. APCO Willamette Valve and Primer Corporation.
  - d. Clow Valve Company; a subsidiary of McWane, Inc.
  - e. Crane; Crane Energy Flow Solutions.
  - f. Flomatic Corporation.
  - g. Kennedy Valve Company; a division of McWane, Inc.
  - h. M & H Valve Company; a division of McWane, Inc.
  - i. McWane, Inc.
  - j. Mueller Co.
  - k. NIBCO INC.
  - l. Stockham; Crane Energy Flow Solutions.
  - m. Per approved materials list.
2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.

- a. Standard: AWWA C508.
- b. Pressure Rating: 175 psig.

B. UL/FMG, Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Cast Iron Pipe Company.
  - b. Clow Valve Company; a subsidiary of McWane, Inc.
  - c. Crane; Crane Energy Flow Solutions.
  - d. Globe Fire Sprinkler Corporation.
  - e. Kennedy Valve Company; a division of McWane, Inc.
  - f. Kidde Fire Fighting; A UTC Business Unit.
  - g. Matco-Norca.
  - h. McWane, Inc.
  - i. Mueller Co.
  - j. NIBCO INC.
  - k. Reliable Automatic Sprinkler Co., Inc. (The).
  - l. Stockham; Crane Energy Flow Solutions.
  - m. Tyco Fire & Building Products LP.
  - n. United Brass Works, Inc.
  - o. Victaulic Company.
  - p. Viking Corporation.
  - q. Per approved material list.
2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
  - a. Standards: UL 312 and FMG approved.
  - b. Pressure Rating: Verify with Padre Dam Municipal Water District.

2.8 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks.
  - b. Badger Meter, Inc.
  - c. FEBCO.
  - d. Globe Fire Sprinkler Corporation.
  - e. Kennedy Valve Company; a division of McWane, Inc.
  - f. McWane, Inc.
  - g. Mueller Co.
  - h. Victaulic Company.
  - i. Viking Corporation.
  - j. Watts; a Watts Water Technologies company.
  - k. Per approved materials list.
2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

- a. Standards: UL 312 and FMG approved.
- b. Pressure Rating: 175 psig.
- c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

## 2.9 BUTTERFLY VALVES

### A. AWWA Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. DeZURIK/Copes-Vulcan.
  - b. Flomatic Corporation.
  - c. Milliken Valve Company.
  - d. Milwaukee Valve Company.
  - e. Mosser Valve.
  - f. Mueller Co.
  - g. Pratt, Henry Company.
  - h. Per approved materials list
- 2. Description: Rubber seated.
  - a. Standard: AWWA C504.
  - b. Body: Cast or ductile iron.
  - c. Body Type: per approved materials list.
  - d. Pressure Rating: Verify with Padre Dam Municipal Water District.

### B. UL Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Kennedy Valve Company; a division of McWane, Inc.
  - b. McWane, Inc.
  - c. Milwaukee Valve Company.
  - d. Mueller Co.
  - e. NIBCO INC.
  - f. Per approved materials list.
- 2. Description: Metal on resilient material seating.
  - a. Standards: UL 1091 and FMG approved.
  - b. Body: Cast or ductile iron.
  - c. Body Type: per approved materials list.
  - d. Pressure Rating: Verify with Padre Dam Municipal Water District.

## 2.10 WATER METERS

- A. Water meters are existing to remain.

## 2.11 BACKFLOW PREVENTERS

### A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks.
  - b. Conbraco Industries, Inc.
  - c. FEBCO.
  - d. Flowmatic Corporation.
  - e. Watts; a Watts Water Technologies company.
  - f. Wilkins.
  - g. Padre Dam Approved Materials list.

### B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks.
  - b. Conbraco Industries, Inc.
  - c. FEBCO.
  - d. Flowmatic Corporation.
  - e. Watts; a Watts Water Technologies company.
  - f. Wilkins.
  - g. Padre Dam Approved Materials List

### C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks.
  - b. Conbraco Industries, Inc.
  - c. FEBCO.
  - d. Watts; a Watts Water Technologies company.
  - e. Wilkins.
  - f. Padre Dam Approved Materials List

### D. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Ames Fire & Waterworks.
  - b. Conbraco Industries, Inc.
  - c. FEBCO.
  - d. Watts; a Watts Water Technologies company.
  - e. Wilkins.
  - f. Padre Dam Approved Materials List

## 2.12 WATER METER BOXES

- A. Description: 2-inch meter box, precast concrete meter box 9-1/2 in. x 16 in., with #9 gauge welded wire loop.



1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or equal:
  - a. Associated Concrete Products, Inc.
  - b. Brooks Products, Inc.
  - c. Padre Dam Approved Materials List

## 2.13 PROTECTIVE ENCLOSURES

### A. Expanded-Metal Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Backflow Prevention Device InnClosures, Inc.
  - b. BF Products Inc.
  - c. Cross Brothers Inc.
  - d. Per approved materials list.
2. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
  - a. Material: ASTM F 1267, expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
  - b. Finish: Manufacturer's enamel paint.
  - c. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
  - d. Locking device.
  - e. Lugs or devices for securing enclosure to base.

### B. Enclosure Bases:

1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

## 2.14 FIRE HYDRANTS

### A. Wet-Barrel Fire Hydrants:

- a. N/A

## 2.15 FIRE DEPARTMENT CONNECTIONS

- A. Fire Department Connections: Per Fire Department approved materials list.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Refer to Section 310000 "Earthwork" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping shall be per Padre Dam Approved Materials List and San Diego Water Agencies' Standards.

### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, reference Padre Dam Approved Materials List and San Diego Water Agencies' Standards.

### 3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Section 330500 "Common Work Results for Utilities" for piping-system common requirements.
- B. Do not install pipe that is gouged, scratched or forming a clear depression. Remove damaged pipe from the site.
- C. Do not install pipe contaminated with petroleum products or other toxic materials whether inside or outside of pipe.

### 3.5 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
  - 1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
  - 2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- B. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
- C. Install PE pipe according to ASTM D 2774 and ASTM F 645.
- D. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- E. Install fiberglass AWWA pipe according to AWWA M45.
- F. Bury piping with depth of cover over top at least 36 inches.

- G. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
  - 1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.
- I. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- J. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- K. See Section 211300 "Fire-Suppression System"
- L. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

### 3.6 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks, concrete thrust blocks shall be Class 470-C-2000, conforming to Section 201 of the Standard Specifications.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
  - 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
  - 4. Fire-Service-Main Piping: According to NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.
- D. Install Thrust Blocks and Anchor Blocks in accordance with San Diego Regional Standard Drawings.

### 3.7 VALVE INSTALLATION

- A. Check operation of all valves before installing. Wrap all buried, ferrous metal valves with polyethylene film.
- B. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

- C. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- D. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- E. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.
- F. MSS Valves: Install as component of connected piping system.
- G. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- H. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves
- I. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

### 3.8 DETECTOR-CHECK VALVE INSTALLATION

- A. Install in vault or aboveground.
- B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.
- C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

### 3.9 ROUGHING-IN FOR WATER METERS

- A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

### 3.10 VACUUM BREAKER ASSEMBLY INSTALLATION

- A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

### 3.11 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.

### 3.12 WATER METER BOX INSTALLATION

- A. Install water meter boxes in paved areas flush with surface.

### 3.13 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install concrete base level and with top approximately 2 inches above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

### 3.14 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.
- C. AWWA Fire Hydrants: Comply with AWWA M17.
- D. UL/FMG Fire Hydrants: Comply with NFPA 24.

### 3.15 FLUSHING HYDRANT INSTALLATION

- A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.
- B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.
- C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

### 3.16 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.
- B. Install protective pipe bollards if adjacent to vehicular way.

### 3.17 CONNECTIONS

- A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.
- B. Connect water-distribution piping to existing water main per Water Agencies' Standards.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.18 FIELD QUALITY CONTROL

- A. Pressure Testing: The pipe shall be tested twice as described below. Plan joint completion to accommodate temporary test bulkheads for pressure testing.
  - 1. For both tests, fill line with potable water for at least 72 hours prior to testing and placed under a slight pressure for that period. While filling and immediately prior to testing, all air shall be expelled from the pipeline. Where air valves are not available for releasing air or applying the test taps and fittings approved by the Owner's Representative shall be installed and later securely plugged.
    - a. First Test: As specified in NFPA 24 Section 8-9 and conducted prior to backfilling. All joints shall be visible and pipe shall be center-loaded only.
      - 1) All joints shall be exposed. The trench shall be backfilled between joints to prevent movement.
      - 2) Test pressure shall be a minimum of 200 psi or 50 psi in excess of the pressure rating of pipe, whichever is greater.
      - 3) Test pressure shall be maintained for two hours.
      - 4) Amount of leakage shall be measured at the specified test pressure by pumping from a calibrated container. Amount of leakage at joints shall not exceed two quarts per hour per 100 gaskets or joints irrespective of pipe diameter.
      - 5) Amount of allowable leakage may be increased by one fluid ounce per inch valve diameter per hour for each metal seated valve isolating the test section.
    - b. Second Test: Conducted after the system has been completely backfilled and per UNI-B-3-88, Section 5.4.4.
- B. Obtain Owner's Representative's written approval prior to backfilling.
- C. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- D. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
  - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- E. Prepare reports of testing activities.

### 3.19 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 310000 "Earthwork."

### 3.20 CLEANING

- A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651.
    - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
- B. Prepare reports of purging and disinfecting activities.

END SECTION

**SECTION 230000**  
**GENERAL MECHANICAL REQUIREMENTS**

**PART 1 GENERAL**

**1.01 GENERAL REQUIREMENTS**

- A. The General conditions, supplementary conditions, special Requirements, and applicable portions of Division 1 of the specification are a part of this Division and the requirements contained herein are supplementary to them.
- B. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
- C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

**1.02 ABBREVIATIONS AND DEFINITIONS (as used on Division 23 Drawings and herein)**

- A. This Division is abbreviated and includes incomplete sentences. Supply omitted words by inference.
- B. Symbols: "[S]" means submittals are required; "[M/O]" means Maintenance/Operating data is required; see paragraphs hereinafter.
- C. "Provide" means furnish, install and connect unless otherwise described in specific instances.
- D. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.
- E. "Ductwork" means ducts, plenums, compartments, casings or any like devices, including the building structure, which are used to convey or contain air.
- F. "Extend", "Submit", "Repair", "Abandon", "Replace", "Remove" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.
- G. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constructed authorities and public utility franchise holders having jurisdiction.
- H. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.
- I. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces which are not included in the utility areas definition.
- J. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.
- K. "Below Grade" means buried in the ground.
- L. "Substantial Mechanical Completion" means all components of all systems are functioning but lacking in final adjustment.
- M. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid which the device will serve.

**1.03 DESCRIPTION**

- A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

**1.04 RELATED WORK**

- A. Coordination: Refer to Architectural, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order



the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of mechanical work in relation to the work of other Divisions.

- B. Examine other Divisions for work related to the work of this Division especially Division 26 - ELECTRICAL.

#### **1.05 DRAWINGS AND SPECIFICATIONS**

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or the specifications, request clarification.
- B. The Architect shall interpret the drawings and the specifications, and his decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflict not clarified prior to Bidding deadline, use the most costly alternative (better quality ,greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

#### **1.06 PERMITS AND INSPECTIONS**

- A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
- B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

#### **1.07 WATER (DOMESTIC AND FIRE), SANITARY (AND STORM) SEWERS AND NATURAL GAS SERVICE**

- A. Within 5 days after award of contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the Owner. Furnish pertinent load and location information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the Owner. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice.

#### **1.08 CODES AND REGULATIONS**

- A. By submitting a bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract documents and the Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specify references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options which are permitted by Codes.
- B. Applicable Codes: (Current editions unless otherwise noted)
  - 1. All local codes; city and/or County as applicable
  - 2. OSHA requirements
  - 3. California Building Code with California Amendments

4. California Mechanical Code with California Amendments
  5. California Plumbing Code with California Amendments
  6. California Code of Regulations (CCR) Titles
  7. Fire Marshal Regulations
  8. Regulations of all other authorities having jurisdiction.
- C. Where conflict or variation exists among codes, the most stringent shall govern.
- D. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- E. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- F. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.
- G. Permits and Certificates of Inspection: Furnish the originals.
- H. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- I. Other data required by other sections of this Division. Furnish 2 copies.

#### **1.09 RECORD AND DOCUMENTATION**

- A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work:
1. Record (As-Built) Drawings:
    - a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
    - b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
    - c. Furnish the originals.
  2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent, shall be provided to the Architect in accordance with the Division 1 section on Maintenance and Operation Manuals. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:

##### **OPERATION AND MAINTENANCE MANUAL**

PROJECT TITLE.....

CONTRACTOR.....

Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all materials, piping, valves, devices

- and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
- a. Updated approved materials list, shop drawings and catalog information of all items indicated by symbol "[M/O]" at titles or beginning of paragraphs.
  - b. System layout showing piping, valves and controls.
  - c. Wiring and control diagrams with data to explain detailed operation and control of each component.
  - d. A control sequence describing start-up, operation and shutdown.
  - e. Detailed description of the function of each principal component of the system.
  - f. Procedure for starting.
  - g. Procedure for operation.
  - h. Shut-down instruction.
  - i. Installation instructions.
  - j. Adjustments, maintenance and overhaul instructions.
  - k. Lubrication schedule including type, grade, temperature range and frequency.
  - l. Safety precautions, diagrams and illustrations.
  - m. Test procedures.
  - n. Performance data.
  - o. Parts lists, with manufacturer's names and catalog numbers.
  - p. Preventive maintenance schedule.
  - q. Service organization with name, address and telephone number.
  - r. Valve identification chart and schedule.
  - s. ASME certification
  - t. Air Balance report.
- B. Standard Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards (ANSI), American Society of Mechanical Engineers (ASME), American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Underwriters Laboratories (UL), American Refrigeration Institute (ARI), American Gas Association (AGA), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.
- C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements specified, such as "as good as", "achieve the same end use and results as materials formulated in accordance with the referenced publications", "equal or exceed the services and performance of the specified material". Simply state that the product conforms to the requirements specified.
- D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.
- E. Factory Tests: Factory tests are tests which are required to be performed on the actual materials or equipment proposed for use. Submit results of the tests in accordance with the

requirements for laboratory test results of this Contract.

- F. Permits and Certificates of Inspection: Furnish the originals.
- G. Testing procedures and test results required in this and other sections. Furnish 2 copies.
- H. Other data required by other sections of this Division. Furnish 2 copies.

#### **1.10 TOOLS**

- A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

#### **1.11 CONSTRUCTION COST BREAKDOWN**

- A. To assist the Architect and Engineer in evaluation of the construction cost, the Contractor shall prepare and submit for review a construction cost breakdown for the major subdivisions of the mechanical work.
- B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.
- C. Cost breakdowns shall be submitted and approved prior to the first payment request. Send one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

### **2. PART 2 PRODUCTS**

#### **2.01 MATERIALS AND EQUIPMENT**

- A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.
- B. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall meet quality and performance of a particular one specified by both name and catalog number.

#### **2.02 SUBSTITUTIONS**

- A. General: Should the Contractor desire to substitute for specified products, he shall submit with the Material List a complete list of the requested substitutions. The request shall contain complete descriptive information of the products. Samples for evaluation shall also be submitted upon the Architect's request. If in the Architect's opinion the products as presented in this first submittal are in variance with the specified products, or if the information submitted is not sufficiently complete to allow proper evaluation, the substitution will be disallowed from consideration and the specified products shall be furnished. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution.
- B. Specific: Refer to other sections of this Division for additional requirements.

## 2.03 SUBMITTALS

### A. General:

1. Provide for all items indicated with the symbol "[S]" at titles or beginning of paragraphs in accordance with the Division 1 section covering submittals and as herein specified. Where warranty of longer than one year is specified, include such warranty with submittal. Architect's review of the submittal is only for general conformance with design compliance with the information given in the contract documents. The submittal procedure is required as an effort to minimize the problems which occur due to the discovery of Contractor non-compliance at the construction site. The Contractor is responsible for conformation and correlation of the dimensions, quantities and sizes, for information that pertains to fabrication methods or construction techniques, and for coordination of work of all Divisions of the work. Deviations, if any, from Contract documents shall be clearly and completely indicated (by a separate letter if deviations are extensive) in the submittals, and the lack of such is deemed complete compliance with Contract Documents without any deviations. Submittals favorably processed will not relieve the Contractor of responsibility for deviations not so reported nor for errors in the submittal.
2. In addition to the above, upon permission to proceed after review of submittal and prior to the installation of work, submit dimensioned and scaled drawings (not less than 1/4-inch equal to one foot) of all mechanical equipment rooms and areas. Such layouts shall indicate, but not be limited to, all mechanical equipment, control panels, piping, housekeeping pads, ductwork, tube pull, access and maintenance clearances, and other like items. The layout shall also indicate major equipment to be provided under other Sections of work.
3. Contractor Stamp: All submittals shall be stamped with the following text and signed by the Contractors representative:

"IT IS HEREBY CERTIFIED THAT THE PRODUCTS SHOWN AND MARKED IN THIS SUBMITTAL ARE IN COMPLIANCE WITH THE CONTRACT DOCUMENTS AND CAN BE INSTALLED IN THE ALLOCATED SPACES EXCEPT WHERE NOTED AS DEVIATIONS.

CERTIFIED BY:----- DATE:-----

4. All submittals shall be complete and with catalog data and information properly marked to show, among other things, equality of material (where substitution is allowed and desired), adequacy in capacity and performance to meet minimum capacities of performance as specified or indicated. Arrange the submittals in the same sequence as these specifications, and reference (at the upper right-hand corner) the particular specification provision for which each submittal is intended. Incomplete submittals will be rejected.
  5. For all work under Division 23, the notations by the Contractor or Supplier on submittal documents "Per Plans and Specifications", or "As Specified", or similar wording or phrasing is not acceptable and will be cause of rejection. Complete descriptive submittals are required for all Division 23 work.
  6. Refer to the other sections of this Division for specific requirements.
- B. Material List: Within 15 days after award of Contract, submit for approval a complete list of materials proposed for use. Furnish names and addresses of manufacturers, catalog numbers (where applicable) types and trade names. For purposes of uniformity, only one manufacturer will be accepted for each class or type of material. This list is in addition to Shop Drawings.
- C. Shop Drawings: Submit shop drawings with such promptness as to cause no delay in the work. Do not commence fabrication of the equipment until the approved drawings are received from the Owner's representative.
- D. Other Submittals: As required by other sections of this Division.

## **PART 3 EXECUTION**

### **3.01 WORKMANSHIP AND INSTALLATION METHODS**

- A. Workmanship shall be in the best standard practice of the trade.
- B. Execute the work so as to contribute to ease of operation and maintenance, maximum accessibility and best appearance. Execute it so that the installation will conform and adjust itself to the building structure, its equipment and its usage. The work shall be symmetrical, plumb, uniform, properly aligned, and firmly secured in place.
- C. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

### **3.02 TESTS**

- A. General:
  - 1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
  - 2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.
- B. Specific: Refer to the other sections of this Division for test requirements.

### **3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK**

- A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.
- B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint. and all moving parts will be kept clean and dry.
- C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop fabricated ductwork.
- D. Keep cabinets and other openings closed to prevent entry of foreign matter.

### **3.04 CLEANUP AND HOUSEKEEPING**

- A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.
- B. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

### **3.05 PROJECT CONDITIONS**

- A. Site Examinations and Conditions:
  - 1. Regard information relative to existing conditions, services and structure as approximate only. Verify dimensions and locations, and be knowledgeable of all working conditions before submitting Bid. Verify pressure, location, size, and elevation of existing services (to which points of connection are to be made or crossed) as soon as possible and prior to commencement of any new work.
  - 2. Make minor deviations necessary to conform with actual locations and conditions. Submission of Bid presumes proper examination of Site, locations, dimensions and conditions, and no additional cost will be honored for lack of such examinations.
- B. Existing Services: Examine the Contract Drawings and visit the project site to ascertain the extent of the existing services. Where existing equipment/services serving existing structures and/or existing structures to be demolished are to remain in service, reroute, relocate, or extend such existing equipment and/or services to accommodate this project without additional cost.
- C. Interruption of Existing Services: Where it is necessary to reroute existing services or utilities,

or to make connections of new work to existing services or utilities, give timely written notice of such intent to the Owner and secure written approval before proceeding. Make all such interruptions at such time as permitted by the Owner. Anticipate such interruptions to be made outside of normal working hours or normal working days; therefore, no additional cost will be permitted for such work. Except in a case of emergency involving life, limb or health, do not operate any existing equipment (including valves). Where such operations are necessary, they shall be performed by the Owner's personnel.

**D. Access and Placement of Work:**

1. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped, disassembled, or disassembly of equipment at Project Site and re-assembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.
2. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Mechanical Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

- E. Verification and Coordination:** Drawings indicating suggested distribution routes are diagrammatic only, and all scaled and figured dimensions are approximate and are indicated for estimating purposes only. The Drawings do not indicate necessary offsets and like items. Do not construe Contract Drawings as fabrication drawings. Prior to fabrication and installation of work, verify all dimensions, sizes and distribution routes with actual conditions, and prepare submittal and fabrication drawings. Coordinate to avoid possible conflicts and resolve same where such exist. Install work to conform to structure, avoid obstruction, preserve headroom, and keep openings and passageway clear. Changes necessary, resulting from such verification and coordination, shall not be a cause for additional cost.

**3.06 WARRANTY**

- A. Guarantee, in writing, all work against fault of any product or workmanship for a period of not less than one year after formal acceptance by the Owner; except, where longer periods are specified in the Specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components that are inactive because of said failure shall be suspended. The warranty period for such component shall resume to run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
- B. Neither payments for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.

**3.07 SAFETY REQUIREMENTS**

- A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts in accordance with the OSHA 1910.219. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

**3.08 MANUFACTURER'S RECOMMENDATIONS**

- A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish

printed copies of these recommendations to the installing Contractor and Architect prior to installation. Do not proceed with the installation of the item until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

**END OF SECTION**



## **SECTION 230500**

### **BASIC MECHANICAL MATERIALS AND METHODS**

#### **PART 1 GENERAL**

##### **1.01 GENERAL REQUIREMENTS**

- A. The contract documents shall apply in their entirety to the work specified herein.
- B. Submittals: Submit shop drawings and manufacturer's data on each item marked [S] in accordance with the Division 01 section on submittals and Section 23 00 00, Basic Mechanical Requirements.
- C. Maintenance and Operation Manuals: Provide manufacturer's maintenance and operation manuals on each item marked [M/O] in accordance with the Division 01 section on maintenance and operation manuals and Section 23 00 00, Basic Mechanical Requirements.

#### **PART 2 PRODUCTS**

##### **2.01 ELECTRICAL MOTORS [S] [M/O]**

- A. Provide all motors indicated on drawings necessary for equipment under the Mechanical Work. See electrical drawings for voltage and phase of electrical services.
- B. Unless otherwise specified, all motors 1/2 HP or larger: heavy duty, ball bearing, squirrel cage induction type in drip proof or splash proof enclosure, 1.15 service factor, and shall be suitable for the voltage system specified or indicated. Motor speed shall not exceed 1750 rpm unless otherwise indicated or specified. Motors exposed outdoors: either epoxy encapsulated winding or TEFC enclosure.
- C. Each motor shall have sufficient starting torque to start the apparatus driven.
- D. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives. All motors shall have a nameplate voltage rating of the specified operating voltage.
- E. Provide overload protection on single phase motors.
- F. Motors rated 1 HP and larger shall have shaft, bearings, etc. capable of operating with multiple grooved sheaves and two or more belts.
- G. Provide with nameplates permanently attached to exterior housing with manufacturer's name and all electrical characteristics specified thereon.
- H. Brake horsepower shall not exceed 90% of rated motor horsepower.
- I. Motors shall be Lincoln, Westinghouse, General Electric, or approved equivalent.

##### **2.2 MOTOR STARTERS [S] [M/O]**

- A. See Electrical Drawings for voltage and phase of electrical services.
- B. Starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.
- C. Enclosure: NEMA 1 (unless location of starters dictates otherwise) of sufficient size to contain all accessories specified.

##### **2.03 BELT DRIVES [S] [M/O]**

- A. V Type. Drives requiring not more than 2 belts: variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts: nonadjustable constant speed type. Provide belts in matched sets.
- B. All belt drives shall have a minimum rating of 1.5 times the motor nameplate horsepower rating.

##### **2.04 BELT AND DRIVE GUARDS [S]**

- A. Provide all rotating equipment drives and couplings with suitable guards.
- B. Drive guards shall be as standard by the equipment manufacturer.
- C. Belt guards shall be as standard by the equipment manufacturer.

#### **2.05 DIELECTRIC UNIONS [S]**

- A. Dielectric unions or flanged unions: constructed so that two pipes being connected are completely insulated (including bolt sleeves and washers) from each other with no metal-to-metal contact; EPCO or approved equivalent.
- B. Unions shall have a water-impervious insulation barrier capable of limiting galvanic current to 1 percent of the short-circuit current in a corresponding bimetallic joint and, when dry, shall also be able to withstand a 600-volt breakdown test.

#### **2.06 PRESSURE AND TEMPERATURE TEST PLUGS [S]**

- A. Brass body and gasketed cap, 1/4-inch mpt fitting to receive either a temperature or pressure probe 1/8-inch O.D. with neoprene (max. 200 degrees F) at 500 psi or norel (max. 275 degrees F) at 500 psi valve core; "Pete's Plug" or approved equivalent.

#### **2.07 PIPING SUPPORTS [S]**

- A. See Section 23 05 48 Vibration and Seismic Controls for HVAC Piping and Equipment regarding structural supports in compliance with seismic requirements; supports shall be as specified therein. Unless otherwise indicated or superseded by cited seismic requirements, pipe hangers and supports as follows:
- B. Pipe Hangers: Carbon steel hanger with plain (black) or galvanized finish.
  - 1. Piping 5-inches or smaller: Conforms to Manufacturer's Standardization Society (MSS) SP-58, Type 5 hangers; Kin-Line 450 or approved equivalent.
  - 2. Hangers for copper piping shall be furnished with a processed felt lining; Kin-Line 450F or approved equivalent.
- C. Pipe Clamps: Carbon steel with plain (black) or galvanized finish. Provide with copper finish for use on copper piping.
  - 1. For Vertical Piping: Conforms to MSS SP-58, Type 8; Kin-Line 470 or approved equivalent.
  - 2. For Horizontal Piping and Framing Channels: Short clamp (strap) for channel mounting; Kin-Line 477 or approved equivalent.
- D. U-Bolts: Carbon steel U-bolt with plain (black) or galvanized finish and four finished hex nuts; conforms to MSS SP-58 type 24; Kin-Line 438 or approved equivalent.
- E. Pipe Anchor Chair: Unit consisting of a carbon steel, notched, HR channel; U-bolt; and hex nuts; Kin-Line 438, or approved equivalent. (no known equivalent)
- F. Pipe Anchors:
  - 1. Welded Tee Pipe Anchor, for piping 3-inches to 6-inches: Steel, welded, tee-shaped anchor; Pipe Shields Model C1000, or approved equivalent (no known equivalent).
- G. Trapeze Hangers: Trapeze hangers for piping shall be used where indicated or required and shall be fabricated in accordance with SMACNA Seismic Restraint Guide, latest edition.
- H. Support Channels: 1-5/8-inch by 1-5/8-inch, 12 gauge steel channel. Single channel: Superstrut A-1200, or approved equivalent. Double channel: Superstrut A-1202, or approved equivalent.
- I. Hanger Rods: Solid mild steel, sizes as specified below.

| Pipe Size                 | Rod Diameter |
|---------------------------|--------------|
| 1/2-inch through 2-inches | 3/8-inch     |

2-1/2-inches through 3-1/2 inches    1/2-inch  
4-inches and 5-inches                    5/8-inch

- J. Sound and Electrolysis Isolators: Provide sound and electrolysis isolators at all hangers and supports for un-insulated piping and on other piping where incompatible metals would contact each other. Isolators shall be factory fabricated, hinged, cadmium plated steel shell with processed, non-conducting hair felt isolating pad permanently attached with adhesive; Stoneman "Trisolators", or approved equivalent.
1. Option: Piping isolators for bare un-insulated piping can be integral part of the pipe hanger.
- K. Connection of Hangers to Structure: Factory fabricated steel devices or other equal suitable steel inserts, clamps, and brackets as required, Devices shall comply to MSS-SP-58.

## **2.08 PIPE INSULATION INSERTS    [S]**

- A. All insulated piping 2-inches and larger shall be provided with pipe insulation inserts with steel jackets at all pipe hangers and supports.
- B. Pipe Insulation Inserts: Insert shall consist of a galvanized steel jacket, minimum of 26 gauge to 16 gauge thickness depending on pipe size, and a waterproofed calcium silicate insulation insert impregnated with a fire resistive vapor barrier compound; insert thickness shall match the thickness of the specified insulation and shall extend a maximum of 1-inch beyond sheet metal; pipe Shields Model A2000, Kin-Line #463CW or approved equivalent.

## **2.09 ACCESS DOORS            [S]**

- A. Flush-mounted sheet metal access doors with lock and concealed hinge; stainless steel door; Milcore, or approved equivalent.
1. Access doors through fire-rated separations shall have like fire rating.

## **2.10 EQUIPMENT IDENTIFICATION    [S]**

- A. General: Identify all equipment using brass discs or laminated plastics. Install as specified below in readily visible locations not interfering with insulation or equipment operation.
1. Brass Discs: Provide minimum 0.040-inch in thickness and 2-inches in diameter or square. Top line of each tag shall have 1/4-inch high black filled letters to indicate designation of service. Bottom line shall have 7/16-inch high black filled numbers to indicate equipment or valve number.
2. Laminated Plastic: Provide white on black with engraved black letters. The equipment identifying name and number lettering size shall be a minimum of 1/4-inch in height, nameplate data 3/16-inch in height and the manufacturer's name and location 1/8-inch in height. Provide laminated plastic tags either 2-1/2-inches by 3-1/2-inches or 3-1/2-inches by 5-inches, as required.

## **2.11 PIPING IDENTIFICATION[S]**

- A. Piping identification shall be by semi-rigid plastic markers or vinyl coated cloth; minimum information: base color, flow direction arrow, and fluid being conveyed.
1. Service Markers, Interior Locations: W.H. Brady Co. Type B-500 vinyl coated cloth tape or Type B-350 Perma-Code Thin Film, or approved equivalent.
2. Service Markers, Exterior Locations: W.H. Brady Co. Type B-946G, Brady B-915 Snap-on, or approved equivalent. Apply mechanically affixed with coated wire straps or approved equivalent.
- B. Base color coding and size of letters and arrows shall conform to ANSI A 13.1, "Scheme for the Identification of Piping Systems."

## **2.12 PRIMERS AND PAINTS    [S]**

- A. All equipment furnished under Division 23, unless otherwise noted, shall be furnished with a factory applied prime coat.

- B. Where field priming or touch-up priming is required, primer shall be as follows for ferrous metal surfaces:
  - 1. Metal Surfaces, Not Galvanized: Latex, corrosion resistant primer suitable for metal surfaces or Epoxy-polyamide, green primer paint, formula 150, type I (QPL).
  - 2. Metal Surfaces, Galvanized: Galvanized repair compound with high zinc dust content; ZRC Cold Galvanizing Compound, or approved equivalent (no known equivalent).
- C. Finish painting of Mechanical equipment furnished under Division 23: See Section 09 90 00 - Paints and Coatings.
  - 1. Non-metallic surfaces: Latex (Acrylic Emulsion, Exterior Wood and Masonry) Paint.
- D. All exterior exposed ductwork shall be provided with salt air corrosion protective coating.

#### **2.13 SEALANTS [S]**

- A. Non-fireproof Penetrations: Silicone rubber sealant; DowCorning 785/4, or approved equivalent.
- B. Fireproof Penetrations: Sealant shall comply with ASTM-E-814 (UL 1479 or UL 94); 3M Brand Fire Barrier Penetration Sealing System with CP-25 caulk, or approved equivalent.

#### **2.14 SEALANTS, WATERSTOP**

- A. Cold applied, pre-formed, plasticized, waterstop sealing compound consisting of blends of refined hydrocarbon resins and plasticizing compounds; Synko-Flex Waterstop and Primer, or approved equivalent (no known equivalent).

#### **2.15 BOLTED MECHANICAL SEALS [S]**

- A. Seals shall be modular, bolted, mechanical link type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. Tightening of the bolts shall cause the rubber sealing elements to expand to form a water-tight seal between the pipe and the sleeve; Thunderline "Link-Seal" Model LS, or approved equivalent.

#### **2.16 PIPE SLEEVES**

- A. Sleeves in Concrete Floor Slabs: Schedule 40 black steel pipe.
- B. Sleeves in all Fire Walls (regardless of Construction), Concrete or Masonry Walls: Schedule 40 black steel pipe.
- C. Sleeves in all Walls and Partitions (except Fire Walls, Concrete or Masonry Walls): 18-gauge galvanized steel.

#### **2.17 NON-SHRINK GROUT**

- A. Non-shrink, non-metallic, non-corrosive cementitious grout; 5000 psi compressive strength at 28 days; Sika SilkaGrout 212, or approved equivalent.

#### **2.18 VENT STACK FLASHING**

- A. Factory-fabricated, caulk type flashing for piping up to 8-inches; Josam 26450, or approved equivalent.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Install products in accordance with product manufacturer's recommendations. After installation of systems and until formal acceptance of systems by the Owner, be responsible for operation and maintenance of systems.

#### **3.02 FORMING, CUTTING, AND PATCHING**

- A. Provide Forming, recesses, chases, blocking and grounds necessary for Mechanical Work.

- B. Provide Cutting (including core drilling and saw cutting), patching and repairing existing structures to accommodate the Mechanical Work. Such work shall include voids, holes, and the like resulting from removal of existing or addition of new Mechanical Work. Restoration shall match existing work.
- C. Core drill all holes through existing concrete structures. Before drilling through any structural members, obtain written permissions from the Architect. Before coring, check all proposed hole locations with electronic device to assure clearance of obstruction (i.e., reinforcement bars, piping, conduits, etc.).
- D. Saw cut all existing concrete and masonry openings and slabs.

### **3.03 ELECTRICAL WORK**

- A. Coordinate with Division 26. See Division 26 Contract Documents for voltage and phase of electrical services.
- B. All power wiring and conduits for same serving motors, and where indicated on Division 26 Contract Drawings, to mechanical control panels, separate or equipment mounted, shall be provided under Division 26.
- C. The following shall be provided under Division 23:
  - 1. Pre-wired mechanical control panels.
  - 2. All automatic or temperature control and interlock wiring, regardless of voltage, and conduits for same necessary for proper operation of equipment under Division 23. This includes interlock wiring between motor starter coils, interlocking relays, contactors, mechanical equipment control panels, temperature control devices, and temperature control panels.
  - 3. Power wiring and conduits for same not indicated on the Division 26 Contract Drawings to mechanical control panels (separate or equipment mounted).
- D. Install all wiring under Division 23 in rigid conduit or electrical metallic tubing indoors and in rigid conduit outdoors. All such wiring shall be concealed.

### **3.04 BELT DRIVES**

- A. Select drives for proper speed required for conditions indicated. Conditions indicated are estimated conditions and may vary under actual operating conditions. To adjust speed for actual operating conditions, change drive as often as necessary, at no additional cost.

### **3.05 DIELECTRIC UNIONS**

- A. Install dielectric unions in acceptable locations and provide devices for all piping and equipment connections where ferrous and copper metal is joined.
- B. Where piping is buried, provide additional protection in the following manner. Thoroughly clean device and piping surfaces 5-feet upstream and downstream of connection point. Prime piping surface to be covered. Wrap connection point and piping with double wrapping of identified pressure-sensitive tape.

### **3.06 FLASHING**

- A. Flash and counter flash with metal to make waterproof all penetrations through roofs or exterior walls. Roof flashing shall have a minimum 8-inch skirt. The metal flashing and counterflashing shall be the same material as the equipment to which they are attached. Factory-fabricated flashing may be used for piping. Prior to any interior finish work, test the integrity of all flashing with water hose.

### **3.07 WELDING**

- A. All welding shall comply with provisions of applicable ASME Boiler and Pressure Vessel Code, ANSI Code for Pressure Piping, or other statutes or ordinances having jurisdiction. All welders shall be certified for all welding positions under the qualification tests prescribed by the National Certified Welding Bureau; National Association of Plumbing, Heating, Cooling

Contractors; or by other reputable testing laboratories, using procedures covered in the ASME Boiler Construction Code, Section IX, Qualification standards for Welding and Brazing Procedures, Welders, Brazers and Welding and Brazing Operators; and shall hold a current certification of his qualifications obtained within 12 months prior to date of contract. Prior to welding operation, submit for review evidence of such certification.

- B. Welded joints, fabrication, assembly and erection shall conform to the requirements of ANSI B 31.1 "POWER PIPING" of the American National Standard Code for Pressure Piping. Perform all welding by the metal arc process, either manual, semi-automatic, or automatic.

### **3.08 PIPE SUPPORT INSTALLATION**

- A. Support all piping, horizontal and vertical, with clamps or brackets. Independently support all line-mounted equipment. Provide at least one hanger for each branch piping and at each change of direction. Secure all hanger rods with double nuts and lock washers. Do not use perforated (plumber's) tape. Support vertical multiple-story piping at each floor with pipe clamps.
- B. Maximum Hanger Spacing:
  - 1. Steel Piping: 1-inch and smaller, hangers at 8-feet; 1-1/4-inches and larger, hangers at 10-feet.
  - 2. Copper Piping: 1-1/2-inches and smaller, hangers at 6-feet; 2-inches and larger, hangers at 10-feet.
  - 3. In all cases, space pipe supports to provide adequate support for the pipes, the medium in the pipes, insulation, valves, and fittings to prevent any sagging or separation of joints.

### **3.09 PIPING INSTALLATION**

- A. Layout of work:
  - 1. Perform all dimensional layout of the Work and establish all lines and grades as set forth on the Drawings.
  - 2. Be responsible for conformity of the finished work with drawings and specifications.
- B. Installation:
  - 1. Inspect all piping prior to installation. Pipe found unsatisfactory on inspection or damaged by handling shall be promptly removed from the job site.
  - 2. All piping systems shall be graded and valved to provide complete drainage, venting, and control of all systems.
  - 3. Use reducing fittings for pipe size changes; do not use brushings. Make all changes in pipe material with pipe adapters.
  - 4. Prior to installation of piping to or at mechanical equipment, verify with the equipment manufacturers as to the clearance required for maintenance, repair, inspection, and part replacement for the respective equipment. Install piping to provide such clearance so that an absolute minimum of piping is required to be disturbed. Provide means for removal of such piping. Provide unions/ flanges/ mechanical couplings at connections to equipment.
  - 5. Where equipment connection sizes are smaller than piping sizes indicated, make size reduction immediately adjacent to the equipment connections. Flanges or unions at such equipment connection points may be the same size as the equipment connections.
  - 6. Conceal all piping in finished portions of the building unless noted otherwise on the Drawings.
  - 7. Coupled short sections of pipe, bushings, close nipples, long screws, bullhead tees and crosses are prohibited. Bullhead tees and crosses are permitted only in fire sprinkler systems.
  - 8. Install all piping in such a manner as to prevent any undue noise from the flow of water under normal conditions.
  - 9. Branch tees in piping, provided that the branch size is two pipe sizes or smaller than the main size, may be made with factory-manufactured outlet fittings with funneled inlet and with socket or threaded outlet as required. The fittings schedule shall be the same as the

piping to which they are connected. For copper tubing fittings shall be joined to main by silver brazing. The use of extruded tees for branch takeoffs that are fabricated from the piping material being installed is expressly prohibited and will be rejected.

12. Install piping to permit free expansion and contraction, except where the Drawings specifically indicate an anchor or guide. Do not connect stiffening structural members to bends or elbows.
13. Use offsets necessary to prevent undue strain on piping. The springing of piping into place is prohibited.
14. Select and install pipe supports and hangers in such a manner as to impose only negligible restraint on the free movement of piping and not deform piping. No anchors shall be employed, except as indicated on Drawings.
15. Locate pipe supports as close as possible to valves or other heavy piping specialties.
16. Carefully locate supports and hangers so they do not hinder free movement of adjoining piping or occupy open space in a pipe rack.
17. Mark all stub-outs below grade with monuments identifying the services.
18. Provide shut-off valves at each division of main piping and at each branch serving one room or a group of adjoining rooms to enable isolation of fluid carrying piping systems for each portion of the building (buried piping excepted).
19. Valves shall be full size of the line in which they are installed (automatic control valves excepted). Prior to installation of control valves, verify with control manufacturer as to sizes, piping hookup, and the like for same.
20. Install valves with stems straight up wherever possible; do not install valves with stems below the horizontal position.
21. Provide spool between two adjacent valves.
22. Properly grade all water piping to provide flow, air elimination, and drainage. Do not install piping so as to create noise or flow impairment.
23. Separately pipe, with shut-off valve, equipment drains to nearest floor drain, or as noted on Contract Drawings.
24. Do not permit the use of any mechanical piping system under this Division of Work to be used as electrical grounding.

### 3.10 PIPE JOINTS

- A. Threaded Steel or Brass Pipe:
  1. Cut square and remove all burrs. Ream for full flow.
  2. Cut threads with clean dies. Apply thread compound to male threads only. Refer to specific piping system for type of thread compound.
  3. After joining, not more than three full threads shall remain exposed. Coat exposed threads of steel pipe with appropriate type red paint.
  4. Make-up brass, chrome plated pipe, or stainless steel pipe with strap wrenches.
- B. Copper Tubing:
  1. Cut square and remove all burrs. Ream for full flow.
  2. Clean outside ends of tubing and male fittings and sockets of female fittings to bright finish. Clean with emery cloth.
  3. Properly apply flux to surfaces being jointed. Application and type of flux shall be as recommended by the specific brazing or solder manufacturer.
  4. Remove stems, washers and internal parts of valves prior to brazing or soldering.
  5. Refer to specific piping system for type of brazing metal and solder.
- C. Ductile Iron Pipe and Fitting Mechanical Joints: Install mechanical joints in accordance with AWWA C 600.
- D. Grooved Pipe and Fitting Mechanical Joints: Install joints including grooving of pipe, in accordance with the coupling and fittings manufacturer's recommendations and printed instructions. Before couplings are assembled, pipe ends and gasket exterior surfaces shall be

lightly coated with a lubricant manufactured especially for this application and recommended by the coupling and fitting manufacturer. Not for use with hot water systems.

- E. Flanged Joints: Use flanged joints for making piping connections to flanged valves, fixtures, and equipment, and to other flanged piping components. Install joints so that flange faces bear uniformly on gaskets. Engage bolts so that there is complete threading through the nuts and tighten so that bolts are uniformly stressed (equally torqued).

### **3.11 WELDING**

- A. Welded joints, fabrication, assembly and erection shall conform to the requirements of ANSI B 31.1 "Power Piping" of the American National Standard Code for Pressure Piping. Perform all welding by the metal-arc welding process, either manual, semi-automatic or automatic.
- B. Welding qualifications shall conform to the requirements of Section IX "Welding and Brazing Qualifications" of the ASME Boiler and Pressure Vessel Code. Proof of qualifications, issued within the previous twelve months, is required from a testing agency approved by the Owner.

### **3.12 PIPE SLEEVES AND PLATES**

- A. Sleeves:
  - 1. Provide sleeves for all pipes passing through walls, partitions of floor slabs unless specified otherwise.
  - 2. Sleeves in concrete floor slabs: Sleeves shall project 2-inches above finished floors, unless specified otherwise.
  - 3. Sleeves in all Fire Walls (regardless of construction), Concrete or Masonry Walls: Finished flush with wall finish, unless specified otherwise.
  - 4. Sleeves in all Walls and Partitions (except Fire Walls, Concrete or Masonry Walls): Finished flush with wall or partition finish.
  - 5. Provide 1/2-inch clearance completely around pipe between sleeve and non-insulated piping, except where pipes pass through exterior walls below grade, provide full 1-inch clearance between pipe and sleeve.
  - 6. Sleeves for insulated piping shall be sized for insulation, pipe and clearance specified for non-insulated pipes.
  - 7. Caulk sleeves set in fire rated construction with sealant specified for fireproof penetrations and caulk sleeves set in non-fireproof construction with sealant specified for non-fireproof penetrations.
  - 8. Seal sleeves watertight when they are installed in outside walls, walls below grade and in floor slabs with waterproof epoxy grout, except as specified otherwise.
- B. Plates: Provide chrome-plated hinged escutcheon plates with locking devices where pipes pierce finished surfaces. Plates shall fit outside of pipe insulation.

### **3.13 EQUIPMENT INSTALLATION**

- A. Install equipment where shown, as indicated, and in accordance with the manufacturer's recommendations for the specific service.
- B. Provide anchor bolts, setting Drawings and templates for setting equipment.
- C. Assure correct alignment of equipment after setting.
- D. Where grouting is necessary, use non-shrink type.
- E. Before bolting any equipment coat threads with an anti-seize and lubricating compound. Do not use powder driven anchors unless written permission has been obtained from the Architect.
- F. Provide all exposed moving or rotating parts of machines with guards in compliance with OSHA requirements. Install all guards in removable sections, if necessary, and with studs and wing nuts for removal of same in maintenance. Make provision for RPM readings on guards covering end of shafts; enclose fan belts at both sides of belts.



### **3.14 MAINTENANCE AND ACCESS TO EQUIPMENT**

- A. Where valves, dampers, control devices, coils, or other like devices (i.e, plumbing P-trap, water hammer arresters, gauges, thermometers) requiring maintenance, checking or readings are inaccessibly concealed in walls or ceilings, and where indicated, provide square or rectangular access doors. Where space permits, doors for ceiling installation shall not be less than 18-inches by 18-inches. Prior to installation, verify all access locations.
- B. Where there are lubrications within equipment, extend such to exterior of equipment.

### **3.15 REVIEW OF WORK**

- A. Do not allow or cause any mechanical work to be covered, concealed or enclosed until such work has been tested and reviewed. Should such work be covered, concealed or enclosed before being tested and reviewed, such shall be uncovered and thereafter restored at no additional cost.

### **3.16 EQUIPMENT IDENTIFICATION**

- A. Manufacturer's Nameplates: Provide all equipment with manufacturer's nameplates secured to the respective equipment and indicating, but not being limited to, the manufacturer's name, model, size, serial number, capacity and electrical characteristics. Clean, polish and protect all such nameplates with a coat of clear protective finish.
- B. Equipment Tags: Identify all equipment (such as machinery, motor starters, control panels, pushbuttons and other like devices) exposed to view with identification tags. Secure tags to equipment surface. Where size or surface curvature does not permit such, secure with No. 16 brass jack chain.
- C. Valve Tags:
  - 1. Identify each valve with a tag with distinguishing number. Secure tags to valves with No. 16 brass jack chain.
  - 2. Provide valve chart and schedule in aluminum frame with clear heavy plastic shield, and mount same at location directed. Indicate on the Record Drawings the location of valves with numbers corresponding to the valve schedule. Valve chart and schedule shall include, but not be limited to, tag number, location, usage/function, valve manufacturer's name and valve model number. Numbers for new valves shall continue from existing valve numbering system.
- D. Piping Identification:
  - 1. Identify each pipe, whether concealed or exposed, as to the content and character of material it carries (piping buried excepted).
  - 2. Location of Markers: Not to exceed 20-feet on straight run of pipe (including risers and drops) and so located as to be conspicuously visible from any reasonable vantage point; adjacent each valve; adjacent each tee; at each side of penetration of the structure or enclosure; at each obstruction.

### **3.17 PRIMING, PAINTING, AND COATING**

- A. Properly clean surfaces to be touched up of rust, dirt, scale, wax and other deleterious materials. Prime surfaces. Touch up with like material all damaged galvanized or factory-primed metal surfaces. Do not prime over manufacturer's nameplates on equipment.
- B. Coat all bare steel parts of piping accessories below grade with coats of coal-tar based bituminous mastic.
- C. Except for factory priming, factory finish painting and otherwise specified under this Article, all field priming (except touch up) and finish painting shall be under other Divisions.
- D. Paint flat black interior surfaces of all concealed unlined galvanized sheet metal ductwork behind air outlets and inlets.
- E. All exposed insulation surfaces in finished areas shall be ready for finish painting; glue size if

necessary.

### **3.18 CLEANING AND DE-GREASING OF PIPING**

#### **A. General:**

1. Clean all piping systems to remove all dirt, grease, scale, foreign substances, etc., as specified in each separate section of the Specifications.
2. Prior to commencing work, submit for approval a complete procedure for cleaning and flushing for each separate piping system. Include flushing source, system inlet flushing pressure and size of inlet and outlet flushing connections with their locations for each system. Install flushing connections at all low points of each piping system to ensure complete flushing of the system.
3. Use air and/or gas blown through the lines of gas and air systems, unless specified otherwise, to prove the piping clean. All other piping systems shall be thoroughly flushed out with water unless specified otherwise.

### **3.19 TESTING OF PIPING**

- A. Provide notification of test at least three working days prior to tests on all part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed.
- B. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue full test pressure is achieved.
- C. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges, threaded joints and all welds shall be left unpainted and un-insulated until the piping systems have been approved.
- D. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.
- E. Equipment such as safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.
- F. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.
- G. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.
- H. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.
- I. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.
- J. Do not apply test pressure until the piping system and its contents approach the same temperature.
- K. While piping is under test, exercise care so that excessive pressure does not occur due to increase in ambient temperature.
- L. Piping test pressure shall be as noted in tabulation. If test pressures are not specified, they shall be 150 percent of design pressure for the specific system being tested.
- M. Conduct hydrostatic tests with water at a temperature below 100 degrees F.
  1. Fill the system slowly with water and vent at highest points to expel the air before

- pressurizing.
- 2. Carefully examine all joints for leaks or defects.
- 3. Provide connections as required to accomplish the above.
- N. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:
  - 1. Identification of piping system and test number.
  - 2. Testing medium.
  - 3. Test pressure.
  - 4. Date of test acceptance.

### **3.20 TESTS AND ADJUSTMENTS**

- A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

**END OF SECTION**

## **SECTION 230529**

### **HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Equipment supports.

##### **1.02 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 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 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.

##### **1.03 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. 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.
- D. Welding certificates.

##### **1.04 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**

##### **2.01 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.

5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

## **2.02 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.

## **2.03 THERMAL-HANGER SHIELD INSERTS**

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

## **2.04 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, stainless- 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.

## **2.05 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## **2.06 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

# **PART 3 EXECUTION**

## **3.01 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) 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.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
  1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.02 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.

### **3.03 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.

### **3.04 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).
- C. 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 (0.05 mm).
- D. 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.
- E. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### **3.05 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers] and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.

- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 5. Single-Pipe Rolls: For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  - 2. 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. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.



- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

**END OF SECTION**

## **SECTION 230548**

### **VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Isolation pads.
  - 2. Isolation mounts.
  - 3. Freestanding and restrained spring isolators.
  - 4. Housed spring mounts.
  - 5. Spring hangers.
  - 6. Spring hangers with vertical-limit stops.
  - 7. Pipe Riser resilient supports.
  - 8. Resilient pipe guides.
  - 9. Restrained air-mounting system.
  - 10. Restrained vibration isolation roof-curb rails.
  - 11. Restraining braces and cables.

##### **1.02 TECHNICAL REQUIREMENTS**

- A. Structural steel bases shall be cleaned of welding slag and painted with a coat of red primer-finish.
- B. All mounts shall be selected to perform their function without undue stress or overloading. All isolators that are to be used with structural steel bases, as shown or specified shall be equipped with height saving brackets. When applicable these isolators shall have a method for leveling and the spring isolators shall sit in a neoprene cup of have two layers of ribbed neoprene pad with a steel separation plate bonded to the underside of the base.
- C. When neoprene connectors are not used, the first three support locations from isolated equipment require resilient hangers or mounts with deflections equal to the equipment isolation system. All other piping requires resilient hangers and mounts with 0.35-inch minimum static deflections or as scheduled.
- D. Vertical pipe risers shall be fully supported, guided and anchored. System shall be submitted for approval and include calculations for thermal expansion/contraction and seismic loads. Guides and anchors shall be selected to provide restraint of the full weight of the pipe.
- E. All equipment shall be restrained from displacements exceeding 1/4-inch due to thrust forces. Thrust restraint assemblies shall consist of a spring element in series with a neoprene cup and shall be factory preset to allow for a maximum of 1/4-inch movement at start and stop. The assembly shall be furnished with angle brackets for attachment to both the equipment and ductwork or the equipment and the structure. Brackets shall be attached at the centerline of thrust, symmetrically on both sides of the unit.
- F. Typical applicable codes and standards
  - 1. Seismic design shall be in accordance with 2016 California Building Code, Chapter 16A.
  - 2. Attachments of floor – or roof – mounted equipment weighing less than 400 lbs need not be designed to resist seismic loads. Attachments for vibration – isolated and suspended equipment weighing less than 20 lbs. needs not be designed to resist seismic loads. However, attachment of such equipment is still required.
  - 3. Seismic sway bracing of suspended piping and ductwork shall be installed in accordance with the 2011 Mason Industries Seismic Restraint Guidelines for Suspended Systems.

##### **1.03 SUBMITTALS**

- A. Product Data: For each product indicated.
- B. Delegated-Design Submittal: For vibration isolation and seismic-restraint calculations and details indicated to comply with performance requirements and design criteria, including

- analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
  - D. Qualification Data: For professional engineer.
  - E. Field quality-control test reports.

#### **1.04 QUALITY ASSURANCE**

- A. Comply with seismic-restraint requirements in the CBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

### **PART 2 PRODUCTS**

#### **2.01 VIBRATION ISOLATORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Mason Industries.
  - 2. M.W. Sausse & Co.
  - 3. Kinetics Noise Control.
- B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment. (Mason Type Super W or equal)
  - 1. Resilient Material: Oil- and water-resistant neoprene.
- C. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range. Mason Type HD or equal.
- D. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of ½-inch- (13-mm-) thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

#### **2.02 SEISMIC-RESTRAINT DEVICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. California Dynamics Corporation.
  - 2. Cooper B-Line, Inc., a division of Cooper Industries.
  - 3. Kinetics Noise Control.
  - 4. Mason Industries.
  - 5. TOLCO Incorporated; a brand of NIBCO INC.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- F. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.
- G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

### **PART 3 EXECUTION**

#### **3.01 APPLICATIONS**

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

#### **3.02 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION**

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
  1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
  2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction] providing required submittals for component.
- C. Piping Restraints:
  1. Comply with requirements in MSS SP-127.
  2. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  3. Brace a change of direction longer than 12 feet (3.7 m).
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

- G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- H. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### **3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

### **3.04 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

### **3.05 ADJUSTING**

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION**

## **SECTION 23 05 53**

### **IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Duct labels.

##### **1.02 SUBMITTAL**

- A. Product Data: For each type of product indicated.

#### **PART 2 PRODUCTS**

##### **2.01 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  - 3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

##### **2.02 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

### **2.03 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

### **2.04 DUCT LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### **3.02 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### **3.03 PIPE LABEL INSTALLATION**

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  - 1. Refrigerant Piping:
    - a. Background Color: Green.
    - b. Letter Color: Black.

### **3.04 DUCT LABEL INSTALLATION**

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Blue: For supply ducts.
  - 2. Yellow: Return and mixed air ducts.
  - 3. Green: For exhaust-, outside-, and relief ducts.
  - 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

**END OF SECTION**



**SECTION 23 05 93**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
- B. Related Section:
  - 1. Division 23 Section "Commissioning of HVAC"

**1.02 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TAB Specialist: An entity engaged to perform TAB Work.

**1.03 SUBMITTALS**

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- B. Certified TAB reports.

**1.04 QUALITY ASSURANCE**

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

**PART 2 PRODUCTS (Not Applicable)**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine control dampers and verify that they are accessible and their controls are connected and functioning.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.02 PREPARATION**

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare 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 indicated conditions for system operations can be met.

### **3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

### **3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 6. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  - 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
  - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
  - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### **3.06 PROCEDURES FOR MOTORS**

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer's name, model number, and serial number.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### **3.07 PROCEDURES FOR CONDENSING UNITS**

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

### **3.08 PROCEDURES FOR HEAT-TRANSFER COILS**

- A. Measure, adjust, and record the following data for each water coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Wet-bulb temperature of entering and leaving air for cooling coils.
  - 3. Airflow.
  - 4. Air pressure drop.
- B. Measure, adjust, and record the following data for each refrigerant coil:
  - 1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

### **3.09 TOLERANCES**

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.

### **3.10 COMMISSIONING COORDINATION**

- A. Coordinate all effects with commissioning agent as per requirements of section 230800.

### **3.11 REPORTING**

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress 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. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### **3.12 FINAL REPORT**

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  1. Title page.
  2. Name and address of the TAB contractor.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:
  - a. Indicated versus final performance.
  - b. Notable characteristics of systems.
  - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms including the following:
  - a. Settings for outdoor-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Fan drive settings including settings and percentage of maximum pitch diameter.
  - e. Variable frequency drive settings.
  - f. Settings for supply-air, static-pressure controller.
  - g. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Duct, outlet, and inlet sizes.
  3. Balancing stations.
  4. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
  1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches (mm), and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches (mm), and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
  3. Test Data (Indicated and Actual Values):

- a. Total air flow rate in cfm (L/s).
  - b. Total system static pressure in inches wg (Pa).
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg (Pa).
  - e. Filter static-pressure differential in inches wg (Pa).
  - f. Cooling-coil static-pressure differential in inches wg (Pa).
  - g. Outdoor airflow in cfm (L/s).
  - h. Return airflow in cfm (L/s).
  - i. Outdoor-air damper position.
  - j. Return-air damper position.
- F. Apparatus-Coil Test Reports:
- 1. Coil Data:
    - a. System identification.
    - b. Location.
    - c. Coil type.
    - d. Number of rows.
    - e. Fin spacing in fins per inch (mm) o.c.
    - f. Make and model number.
    - g. Face area in sq. ft. (sq. m).
    - h. Tube size in NPS (DN).
    - i. Tube and fin materials.
    - j. Circuiting arrangement.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm (L/s).
    - b. Average face velocity in fpm (m/s).
    - c. Air pressure drop in inches wg (Pa).
    - d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
    - e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
    - f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
    - g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
    - h. Refrigerant expansion valve and refrigerant types.
    - i. Refrigerant suction pressure in psig (kPa).
    - j. Refrigerant suction temperature in deg F (deg C).
- G. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
- 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Fuel type in input data.

- g. Output capacity in Btu/h (kW).
  - h. Ignition type.
  - i. Burner-control types.
  - j. Motor horsepower and rpm.
  - k. Motor volts, phase, and hertz.
  - l. Motor full-load amperage and service factor.
  - m. Sheave make, size in inches (mm), and bore.
  - n. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
2. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm (L/s).
  - b. Entering-air temperature in deg F (deg C).
  - c. Leaving-air temperature in deg F (deg C).
  - d. Air temperature differential in deg F (deg C).
  - e. Entering-air static pressure in inches wg (Pa).
  - f. Leaving-air static pressure in inches wg (Pa).
  - g. Air static-pressure differential in inches wg (Pa).
  - h. Low-fire fuel input in Btu/h (kW).
  - i. High-fire fuel input in Btu/h (kW).
  - j. Manifold pressure in psig (kPa).
  - k. High-temperature-limit setting in deg F (deg C).
  - l. Operating set point in Btu/h (kW).
  - m. Motor voltage at each connection.
  - n. Motor amperage for each phase.
  - o. Heating value of fuel in Btu/h (kW).
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches (mm), and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches (mm), and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).



- g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm (L/s).
  - b. Total system static pressure in inches wg (Pa).
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg (Pa).
  - e. Suction static pressure in inches wg (Pa).
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  - 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F (deg C).
    - d. Duct static pressure in inches wg (Pa).
    - e. Duct size in inches (mm).
    - f. Duct area in sq. ft. (sq. m).
    - g. Indicated air flow rate in cfm (L/s).
    - h. Indicated velocity in fpm (m/s).
    - i. Actual air flow rate in cfm (L/s).
    - j. Actual average velocity in fpm (m/s).
    - k. Barometric pressure in psig (Pa).
- J. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.13 INSPECTIONS

- A. Initial Inspection:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
  - 2. Check the following for each system:
    - a. Measure airflow of at least 10percent of air outlets.
    - b. Measure water flow of at least 5 percent of terminals.
    - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    - d. Verify that balancing devices are marked with final balance position.
    - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
  2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
  3. Architect shall randomly select measurements, documented in the final report, to be re-checked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
  4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

### **3.14 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

### **END OF SECTION**

**SECTION 23 07 13**  
**DUCT INSULATION**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed return located in unconditioned space.
  - 4. Indoor, exposed return located in unconditioned space.
  - 5. Outdoor, exposed supply and return.

**1.03 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. 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 insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. Field quality-control reports.

**1.04 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.

**1.05 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.

## **1.06 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork 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.

## **1.07 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.

# **2. PART 2 PRODUCTS**

## **2.01 INSULATION MATERIALS**

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum 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 II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armacell LLC; AP Armaflex.
    - b. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.
    - c. Degussa; Solcoustic.
- 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, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.

## **2.02 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, 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Use adhesive that complies 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," including 2004 Addenda.
- C. 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Use adhesive that complies 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," including 2004 Addenda.
- D. 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; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Use adhesive that complies 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," including 2004 Addenda.

## **2.03 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 (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  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 (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  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 (0.0033 metric perm) at 30-mil (0.8-mm) dry film thickness.
  3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
  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.
    - e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## **2.04 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 duct insulation.
  4. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
  5. Color: White.

## **2.05 SEALANTS**

- A. 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 (Minus 40 to plus 121 deg C).
  5. Color: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl 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 (Minus 40 to plus 121 deg C).
  5. Color: White.

## **2.06 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.

## **2.07 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. in. (2 strands by 2 strands/sq. mm) for covering ducts.
  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 No. 5.
- B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for ducts.
  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.

## **2.08 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. (271 g/sq. m).
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

## **2.09 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. 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.
- D. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) 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 stucco-embossed aluminum-foil facing.
  1. Products: Subject to compliance with requirements, provide the following:
    - a. Polyguard Products, Inc.; Alumaguard 60.

## **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 (75 mm).
  3. Thickness: 11.5 mils (0.29 mm).
  4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 (75 mm).
  3. Thickness: 6.5 mils (0.16 mm).
  4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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, provide one of 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 (50 mm).
  3. Thickness: 6 mils (0.15 mm).
  4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide products by 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 (50 mm).
  3. Thickness: 3.7 mils (0.093 mm).
  4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch (6.2 N/mm) 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, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Products: Subject to compliance with requirements, provide one of the following:
2. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
  - a. AGM Industries, Inc.; CWP-1.
  - b. GEMCO; CD.
  - c. Midwest Fasteners, Inc.; CD.
3. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.
4. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
  - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
  - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
  - b. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
  - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
6. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

- a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
- b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
- c. Adhesive-backed base with a peel-off protective cover.
- 7. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
  - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 8. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.
  - 1. Manufacturers: Subject to compliance with requirements, provide the following:
    - a. C & F Wire.

## **2.12 CORNER ANGLES**

- A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

## **3. PART 3 EXECUTION**

### **3.01 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.

### **3.02 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### **3.03 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.

- I. 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) 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 duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### **3.04 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 (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

**3.05 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.

**3.06 INSTALLATION OF MINERAL-FIBER INSULATION**

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 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 either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

### **3.07 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. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### **3.08 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### **3.09 DUCT INSULATION SCHEDULE, GENERAL**

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air located in unconditioned space.
  3. Indoor, concealed return located in unconditioned space.
  4. Indoor, exposed return located in unconditioned space.
  5. Outdoor, exposed supply and return.
- B. Items Not Insulated:
  1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  2. Factory-insulated flexible ducts.
  3. Factory-insulated plenums and casings.
  4. Flexible connectors.
  5. Vibration-control devices.
  6. Factory-insulated access panels and doors.

**3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. All supply and return and outside air duct insulation shall be mineral fiber blanket or board, 0.75 lb/cu. ft nominal density of thickness to achieve R-8.0.
- B. All exhaust ducts serving Type 1 hoods shall be insulated with two layers of 1-1/2 inch thick fire rated duct wrap.

**3.11 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.

**3.12 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Exposed, rectangular, supply-air duct insulation shall be one of the following:
  - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
  - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- B. Exposed, rectangular, return-air duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 3 inches (75mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- C. Exposed, supply-air plenum insulation shall be one of the following:
  - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
  - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.
- D. Exposed, return-air plenum insulation shall be one of the following:
  - 1. Mineral-Fiber Blanket: 3 inches (75 mm) and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
  - 2. Mineral-Fiber Board: 3 inches (75 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

**3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Ducts and Plenums, Exposed, up to 48 Inches (1200 mm) in Diameter or with Flat Surfaces up to 72 Inches (1800 mm):
  - 1. Aluminum, Smooth: 0.032 inch (0.81 mm) thick.
  - 2. Painted Aluminum, Smooth: 0.032 inch (0.81 mm) thick.
  - 3. Stainless Steel, Type 304 or Type 316, Smooth 2B Finish 0.020 inch (0.51 mm) thick.

**END OF SECTION**

**SECTION 23 07 19**  
**HVAC PIPING INSULATION**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
  - 1. Condensate drain piping, indoors and outdoors.
  - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.
  - 3. Dual-service heating and cooling piping, indoors and outdoors.
- B. Related Sections:
  - 1. Division 23 Section "Duct Insulation."

**1.03 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. Qualification Data: For qualified Installer.
- C. 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.
- D. Field quality-control reports.

**1.04 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 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.

**1.05 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.

**1.06 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. 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.

**1.07 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**

### **2.01 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, provide products by one of 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, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide products by 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.
    - e. 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### **2.02 INSULATING CEMENTS**

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. Ramco Insulation, Inc.; Super-Stik.

### **2.03 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 Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide products by one of 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.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide products by 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, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Use adhesive that complies 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," including 2004 Addenda.
- 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, provide products by 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; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide products by one of 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, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.04 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 products by 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 (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  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 products by 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 (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
  3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
  4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
  5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Products: Subject to compliance with requirements, provide products by 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.
    - e. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  4. Solids Content: 60 percent by volume and 66 percent by weight.
  5. Color: White.

## **2.05 SEALANTS**

- A. Joint Sealants:
- B. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide products by 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 (Minus 40 to plus 121 deg C).
  5. Color: Aluminum.
  6. For indoor applications, use sealants that 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 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 (Minus 40 to plus 121 deg C).
  5. Color: White.
  6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.06 FACTORY-APPLIED JACKETS**

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
  5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm (0.013 metric 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, provide the following:
      - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
  6. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm (0.007 metric 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, provide the following:
      - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
  7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
    - a. Products: Subject to compliance with requirements, provide the following:
      - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
  8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## **2.07 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.
  - 1. Products: Subject to compliance with requirements, provide products by 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.

## **2.08 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, provide products by 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.
- D. Metal Jacket:
  - 1. Products: Subject to compliance with requirements, provide products by 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.
- E. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - 1. Products: Subject to compliance with requirements, provide products by 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.

## **2.09 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 (75 mm).
- 3. Thickness: 11.5 mils (0.29 mm).
- 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 (75 mm).
  - 3. Thickness: 6.5 mils (0.16 mm).
  - 4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 (50 mm).
  - 3. Thickness: 6 mils (0.15 mm).
  - 4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch (3.3 N/mm) 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 (50 mm).
  - 3. Thickness: 3.7 mils (0.093 mm).

4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) 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. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.

### **B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.**

### **C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.**

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. C & F Wire.

## **PART 3 EXECUTION**

### **3.01 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.

### **3.02 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.03 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- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). 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 (50 mm) 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 (100 mm) 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.

### **3.04 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 insula-



tion 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 (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. 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.
- D. 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."

### **3.05 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 (50 mm) 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.

### **3.06 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.

### **3.07 INSTALLATION OF MINERAL-FIBER PREFORMED 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 (150 mm) 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 (25 mm), 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.

### **3.08 FIELD-APPLIED JACKET INSTALLATION**

- A. 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 (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch (25-mm) 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.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) 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 (300 mm) o.c. and at end joints.

### **3.09 FINISHES**

- A. Pipe 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. 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. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, 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.
- C. 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. Refrigerant Suction and Hot-Gas Piping:
  1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch (25 mm) thick.

- b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Refrigerant Suction and Hot-Gas Flexible Tubing:
  - 1. All Pipe Sizes: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1 inch (25 mm) thick.
    - b. Polyolefin: 1 inch (25 mm) thick.

### **3.13 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.
  - 2. PVC: 20 mils (0.5 mm) thick.
- D. Piping, Exposed:
  - 1. None.
  - 2. PVC: 20 mils (0.5 mm) thick.

### **3.14 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. Exposed:
  - 1. Aluminum, Corrugated: 0.020 inch (0.51 mm) thick.

**END OF SECTION**

**SECTION 231126**

**FACILITY LIQUEFIED-PETROLEUM GAS PIPING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Minimum Operating-Pressure Ratings:
  - 1. For Piping Containing Only Vapor:
    - a. Piping and Valves: 125 psig unless otherwise indicated.
  - 2. For Piping Containing Liquid:
    - a. Piping between Shutoff Valves: 350 psig unless otherwise indicated.
    - b. Piping Other Than Above: 250 psig unless otherwise indicated.
    - c. Valves and Fittings: 250 psig unless otherwise indicated.
- B. LPG System Pressure within Buildings: One pressure range. 0.5 psig or less.
- C. Seismic Performance: Vaporizers and storage container supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
  - 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."

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For facility LPG piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Seismic Qualification Certificates: Submit certification that vaporizer, storage container supports, accessories, and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Welding certificates.
- E. Field quality-control reports.
- F. Operation and maintenance data.

**1.04 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.

## **PART 2 - PRODUCTS**

### **2.01 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedules 40 and 80, 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. 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.
- B. PE Pipe: ASTM D 2513, SDR 11.
  - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  - 4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

### **2.02 PIPING SPECIALTIES**

- A. Flexible Piping Joints:
  - 1. Approved for LPG service.
  - 2. Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.

3. Minimum working pressure of 250 psig and 250 deg F operating temperature.
4. Threaded-end connections to match equipment connected and shall be capable of minimum 3/4-inch misalignment.
5. Maximum 36-inch length for liquid LPG lines.
- B. 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. Operating-Pressure Rating: 0.5 psig.
  6. End Fittings: Zinc-coated steel.
  7. Threaded Ends: Comply with ASME B1.20.1.
  8. Maximum Length: 72 inches.
- C. 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.
- D. Y-Pattern Strainers:
  1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
  2. End Connections: Threaded ends for NPS 2 and smaller.
  3. Strainer Screen: 40-mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
  4. CWP Rating: 125 psig.
- E. 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.

## **2.03 JOINING MATERIALS**

- A. Joint Compound and Tape: Suitable for LPG.
- 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 complying with AWS A5.8/A5.8M.

## **2.04 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. Metallic Valves, NPS 2 and Smaller for Liquid Service: Comply with ASME B16.33 and UL 842.
  1. CWP Rating: 250 psig.
  2. Threaded Ends: Comply with ASME B1.20.1.
  3. Socket ends for brazed joints.
  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 by CSA or agency acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  6. Valves 1-1/4 inch and larger shall be suitable for LPG service, with "WOG" indicated on valve body.
- C. General Requirements for Metallic Valves, NPS 2 and Smaller for Vapor Service: Comply with ASME B16.33.
1. CWP Rating: 125 psig.
  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 and smaller.
  6. Service Mark: Valves 1-1/4 inch to NPS 2 shall have initials "WOG" permanently marked on valve body.
- D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. McDonald, A. Y. Mfg. Co.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated brass.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Separate packnut with adjustable-stem packing threaded ends.
  7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  8. CWP Rating: 600 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for LPG service with "WOG" indicated on valve body.
- E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. BrassCraft Manufacturing Company; a Masco company.
    - b. Conbraco Industries, Inc.; Apollo Div.
    - c. McDonald, A. Y. Mfg. Co.
  2. Body: Bronze, complying with ASTM B 584.
  3. Ball: Chrome-plated bronze.
  4. Stem: Bronze; blowout proof.
  5. Seats: Reinforced TFE; blowout proof.
  6. Packing: Threaded-body packnut design with adjustable-stem packing.
  7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

8. CWP Rating: 600 psig.
  9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  10. Service: Suitable for LPG service with "WOG" indicated on valve body.
- F. Bronze Plug Valves: MSS SP-78.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lee Brass Company.
    - b. McDonald, A. Y. Mfg. Co.
  2. Body: Bronze, complying with ASTM B 584.
  3. Plug: Bronze.
  4. Ends: Threaded or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  5. Operator: Square head or lug type with tamperproof feature where indicated.
  6. Pressure Class: 125 psig.
  7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  8. Service: Suitable for LPG service with "WOG" indicated on valve body.
- G. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kerotest Manufacturing Corp.
    - b. Lyall, R. W. & Company, Inc.
    - c. Perfection Corporation; a subsidiary of American Meter Company.
  2. Body: PE.
  3. Ball: PE.
  4. Stem: Acetal.
  5. Seats and Seals: Nitrile.
  6. Ends: Plain or fusible to match piping.
  7. CWP Rating: 80 psig.
  8. Operating Temperature: Minus 20 to plus 140 deg F.
  9. Operator: Nut or flat head for key operation.
  10. Include plastic valve extension.
  11. Include tamperproof locking feature for valves where indicated on Drawings.
- H. 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 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.

## **2.05 MOTORIZED GAS VALVES**

- A. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. White Rodgers.
  - b. ASCO Power Technologies, LP; Division of Emerson.
  - c. Jefferson Solenoid
  - d. Goyen Valve Corp.; Tyco Environmental Systems.
  - e. Magnatrol Valve Corporation.
  - f. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

## **2.06 EARTHQUAKE VALVES**

- A. Earthquake Valves: Comply with ASCE 25.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Pacific Seismic Products, Inc.
    - b. Little Firefighter
  2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  3. Maximum Operating Pressure: 0.5 psig.
  4. Cast-aluminum body with stainless-steel internal parts.
  5. Nitrile-rubber, reset-stem o-ring seal.
  6. Valve position, open or closed, indicator.
  7. Composition valve seat with clapper held by spring or magnet locking mechanism.
  8. Level indicator.
  9. End Connections: Threaded for valves NPS 2 and smaller.

## **2.07 PRESSURE REGULATORS**

- A. General Requirements:
  1. Single stage and suitable for LPG.
  2. Steel jacket and corrosion-resistant components.
  3. Elevation compensator.
  4. End Connections: Threaded for regulators NPS 2 and smaller.
- B. 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. Maxitrol Company.
  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: 2 psig.
- C. 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. SCP, Inc.
  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: 1 psig.

## **2.08 DIELECTRIC UNIONS**

- A. Dielectric Unions:
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.
  2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.

## **2.09 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**

#### **3.01 EARTHWORK**

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

#### **3.02 OUTDOOR PIPING INSTALLATION**

- A. Comply with NFPA 58 and NFPA 54 requirements for installation and purging of LPG piping.
- B. Install underground, LPG piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
  - 1. If LPG piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, LPG piping according to ASTM D 2774.
- D. 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.
- E. Install fittings for changes in direction and branch connections.
- F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

#### **3.03 INDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 for installation and purging of LPG piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, 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 LPG 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 readily 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 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. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- Q. Connect branch piping from top or side of horizontal piping.
- R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.
- S. Do not use LPG piping as grounding electrode.
- T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

### **3.04 VALVE INSTALLATION**

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, 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.

### **3.05 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 ID 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," Ch. 22, "Pipe and Tube."
- F. 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.
- G. 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.

### **3.06 HANGER AND SUPPORT INSTALLATION**

- A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "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 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
- D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
  1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
  2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
  3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod, 3/8 inch.

### **3.07 CONNECTIONS**

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install LPG 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 of each gas-fired appliances 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.

### **3.08 LABELING AND IDENTIFYING**

- A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

### **3.09 FIELD QUALITY CONTROL**

- A. Test, inspect, and purge LPG according to NFPA 58 and NFPA 54 and requirements of authorities having jurisdiction.
- B. LPG piping will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

### **3.10 OUTDOOR PIPING SCHEDULE**

- A. Underground LPG liquid piping shall be the following:
  - 1. Schedule 40 steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- B. Aboveground LPG liquid piping shall be the following:
  - 1. NPS 2 and Smaller: Schedule 40 steel pipe, malleable-iron threaded fittings and threaded joints. Coat pipe and fittings with protective coating for steel piping.
- C. Underground LPG vapor piping shall be the following:
  - 1. PE pipe and fittings joined by heat-fusion; service-line risers with tracer wire terminated in an accessible location.
- D. Aboveground LPG vapor piping shall be[ one of] the following:
  - 1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
- E. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### **3.11 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG**

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
  - 1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:
  - 1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.
- C. Underground, below building, piping shall be the following:
  - 1. Schedule 40, steel pipe with wrought-steel fittings and welded joints.
- D. Containment Conduit: Schedule 40, steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Schedule 40, steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

### **3.12 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground Vapor Piping: PE ball valve.

### **3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- A. Aboveground Liquid Piping:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- B. Valves for pipe NPS 2 and smaller at service meter shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- C. Distribution piping valves for pipe NPS 2 and smaller shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.
  - 2. Two-piece, full-port, bronze ball valves with bronze trim.
  - 3. Bronze plug valve.
- D. Valves in branch piping for single appliance shall be one of the following:
  - 1. One-piece, bronze ball valve with bronze trim.



2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

**END OF SECTION**

**SECTION 23 3300**  
**AIR DUCT ACCESSORIES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Backdraft and pressure relief dampers.
  - 2. Manual volume dampers.
  - 3. Flange connectors.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
  - 8. Duct accessory hardware.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

**1.03 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90 (Z275).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

**2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Duro Dyne Inc.
  - 2. Greenheck Fan Corporation.

3. Nailor Industries Inc.
4. Pottorff; a division of PCI Industries, Inc.
5. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 3000 fpm (15 m/s).
- D. Maximum System Pressure: 2-inch wg (0.5 kPa).
- E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Neoprene, mechanically locked.
- I. Blade Axles:
  1. Material: Aluminum.
  2. Diameter: 0.20 inch (5 mm).
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Synthetic pivot bushings.
- M. Accessories:
  1. Adjustment device to permit setting for varying differential static pressure.
  2. Counterweights and spring-assist kits for vertical airflow installations.
  3. Electric actuators.
  4. Chain pulls.
  5. Screen Mounting: Front mounted in sleeve.
    - a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
    - b. Sleeve Length: 6 inches (152 mm) minimum.
  6. Screen Mounting: Rear mounted.
  7. Screen Material: Galvanized steel.
  8. Screen Type: Bird.
  9. 90-degree stops.

## **2.03 MANUAL VOLUME DAMPERS**

- A. Standard, Steel, Manual Volume Dampers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Nailor Industries Inc.
    - b. Pottorff; a division of PCI Industries, Inc.
    - c. Ruskin Company.
  2. Standard leakage rating, with linkage outside airstream.
  3. Suitable for horizontal or vertical applications.
  4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  6. Blade Axles: Galvanized steel.

7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

#### **2.04 FLANGE CONNECTORS**

- A. Manufacturers:
  1. Ductmate Industries, Inc.
  2. Nexus PDQ; Division of Shilco Holdings Inc.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

#### **2.05 TURNING VANES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. METALAIRE, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Double wall.

#### **2.06 DUCT-MOUNTED ACCESS DOORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Ductmate Industries, Inc.
  2. Greenheck Fan Corporation.
  3. Nailor Industries Inc.
  4. Pottorff; a division of PCI Industries, Inc.
  5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
  1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.
    - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
    - e. Fabricate doors airtight and suitable for duct pressure class.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.

- c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
- d. Access Doors Larger than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

## **2.07 DUCT ACCESS PANEL ASSEMBLIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Flame Gard, Inc.
  - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.
- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).
- F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

## **2.08 FLEXIBLE CONNECTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Ventfabrics, Inc.
  - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
  - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
  - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

## **2.09 FLEXIBLE DUCTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flexmaster U.S.A., Inc.
  2. McGill AirFlow LLC.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
  1. Pressure Rating: 2-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
  2. Maximum Air Velocity: 4000 fpm (20 m/s).
  3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
  4. Insulation R-Value: 8.0.
- C. Flexible Duct Connectors:
  1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
  2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

## **2.10 DUCT ACCESSORY HARDWARE**

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  1. Upstream and downstream from duct filters.
  2. At outdoor-air intakes and mixed-air plenums.
  3. At drain pans and seals.

4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  6. At each change in direction and at maximum 50-foot (15-m) spacing.
  7. Control devices requiring inspection.
  8. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
  2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
  3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
  4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
  5. Body Access: 25 by 14 inches (635 by 355 mm).
  6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect diffusers to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Install duct test holes where required for testing and balancing purposes.
- O. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

### **3.02 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
  4. Inspect turning vanes for proper and secure installation.
  5. Ensure duct silencers are installed with airflow arrows in direction of airflow.

**END OF SECTION**

**SECTION 23 3423**  
**HVAC POWER VENTILATORS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Ceiling-mounted ventilators.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.

**1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Fan speed controllers.
- 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.

**1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

**1.06 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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

**1.07 COORDINATION**

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

**PART 2 - PRODUCTS**

**2.01 CEILING-MOUNTED VENTILATORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panasonic
  - 2. S&P USA Ventilation Systems
  - 3. AirKing
- 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: Plastic, 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. Filter: Washable aluminum to fit between fan and grille.
  - 4. Isolation: Rubber-in-shear vibration isolators.
  - 5. Manufacturer's standard roof jack or wall cap, and transition fittings.

## **2.02 MOTORS**

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230500 "Basic Mechanical Materials and Methods."
  - 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.
- B. Enclosure Type: Totally enclosed, fan cooled.

## **2.03 SOURCE QUALITY CONTROL**

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  - 1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- C. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 0.4 inch. Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### **3.02 CONNECTIONS**

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### **3.03 FIELD QUALITY CONTROL**

- A. 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.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Prepare test and inspection reports.

### **3.04 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

**END OF SECTION**

**SECTION 23 37 13**  
**DIFFUSERS, REGISTERS, AND GRILLES**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Perforated diffusers.
  - 2. Modular core supply grilles.
  - 3. Fixed face registers and grilles.
- B. Related Sections:
  - 1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 5. Duct access panels.
- C. Source quality-control reports.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Titus.
  - 2. Krueger.
  - 3. Price Industries.
  - 4. METALAIRE, Inc.

**2.2 CEILING DIFFUSERS**

- A. Perforated Diffuser 'A':
  - 1. Devices shall be specifically designed for variable-air-volume flows.
  - 2. Material: Steel backpan and pattern controllers, with steel face.
  - 3. Finish: Baked enamel, white.
  - 4. Face Size: 24 by 24 inches (600 by 600 mm).

5. Duct Inlet: Round or Square.
  6. Face Style: Flush.
  7. Mounting: T-bar.
  8. Pattern Controller: Modular core.
  9. Dampers: Opposed blade, where indicated
  10. Accessories:
    - a. Equalizing grid.
    - b. Plaster ring.
    - c. Safety chain.
    - d. Wire guard.
    - e. Sectorizing baffles.
    - f. Operating rod extension.
- B. Perforated Return Registers 'B':
1. Type: Perforated Face.
  2. Frame: Inverted T-bar type 24 inch x 24 inch.
  3. Fabrication: Steel with steel frame and baked enamel finish. Color as selected by architect.
- C. Modular Core Supply Grilles 'C':
1. Throw: Extended distance for airflow rates.
  2. Material: Steel.
  3. Grilles per Unit: Four.
  4. Finish: White baked acrylic.
  5. Border: 1-1/2-inch (38-mm) width with countersunk screw holes.
  6. Blades:
    - a. Set in modules.
  7. Modules: Removable; rotatable.
  8. Mounting: Surface.
  9. Accessory: Opposed-blade steel damper.
- D. Round Ceiling Diffuser 'E':
1. Devices shall be specifically designed for variable-air-volume flows.
  2. Material: Steel.
  3. Finish: Baked enamel, white.
  4. Face Style: Three cone.
  5. Mounting: Duct connection.
  6. Pattern: Fully adjustable.
  7. Dampers: Radial opposed blade.
  8. Accessories:
    - a. Equalizing grid.
    - b. Plaster ring.
    - c. Safety chain.
    - d. Wire guard.
    - e. Sectorizing baffles.

- f. Operating rod extension.

## **2.3 REGISTERS AND GRILLES**

- A. Fixed Face Register 'D' and 'F':
  - 1. Material: Steel.
  - 2. Finish: Baked enamel, white.
  - 3. Face Arrangement: 1/8 by 3/4 inch blades on 3/4 inch centers. Double deflection blades for supply.
  - 4. Frame: 1-1/4 inches (32 mm) wide.
  - 5. Mounting: Countersunk screw.
  - 6. Damper Type: Adjustable opposed blade, where indicated.

## **2.4 SOURCE QUALITY CONTROL**

- B. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## **PART 3 EXECUTION**

### **3.01 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.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install diffusers, registers, and grilles level and plumb.
- 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 practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### **3.03 ADJUSTING**

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

**END OF SECTION**

**SECTION 235400**

**FURNACES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Gas-fired, condensing furnaces and accessories complete with controls.
  - 2. Air filters.
  - 3. Refrigeration components.

**1.03 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each of the following:
  - 1. Furnace.
  - 2. Thermostat.
  - 3. Air filter.
  - 4. Refrigeration components.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals for each of the following:
  - 1. Furnace and accessories complete with controls.
  - 2. Air filter.
  - 3. Refrigeration components.
- D. Warranty: Special warranty specified in this Section.

**1.04 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. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- C. Comply with NFPA 70.

**1.05 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

**1.06 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:
  - a. Furnace Heat Exchanger: 10 years.
  - b. Integrated Ignition and Blower Control Circuit Board: Five years.
  - c. Draft-Inducer Motor: Five years.
  - d. Refrigeration Compressors: 10 years.
  - e. Evaporator and Condenser Coils: Five years.

**1.07 EXTRA MATERIALS**

- 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. Disposable Air Filters: Furnish two complete sets.

**PART 2 - PRODUCTS**

**2.01 GAS-FIRED FURNACES, CONDENSING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Carrier Corporation; Div. of United Technologies Corp.
  2. Trane.
  3. York International Corp.; a division of Unitary Products Group.
- B. General Requirements for Gas-Fired, Condensing Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3, "Gas-Fired Central Furnaces," and with NFPA 54.
- C. Cabinet: Galvanized steel.
  1. Cabinet interior around heat exchanger shall be factory-installed insulation.
  2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
  3. Factory paint external cabinets in manufacturer's standard color.
  4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- D. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.
  1. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  2. Special Motor Features: Electronically controlled motor (ECM) controlled by integrated furnace/blower control for variable speed operation.
- E. Type of Gas: Propane.
- F. Heat Exchanger:
  1. Primary: Aluminized steel.
  2. Secondary: Stainless steel.
- G. Burner:

1. Gas Valve: 100 percent safety modulating main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
  2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.
- H. Gas-Burner Safety Controls:
1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
  2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
  3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.
- I. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.
- J. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport.
- K. Accessories:
1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through roof.
  2. PVC Plastic Vent Materials:
    - a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
    - b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
    - c. PVC Solvent Cement: ASTM D 2564.
      - 1) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      - 2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## **2.02 THERMOSTATS**

- A. Solid-State Thermostat: Provide Infinity control for variable fan speed, modulating gas valve and two-stage cooling operation. Wall-mounting, programmable, microprocessor-based unit with automatic switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, vacation mode, and battery backup protection against power failure for program settings. Provide remote duct mounted temperature sensor in return air where indicated on the drawings.
- B. Control Wiring: Unshielded twisted-pair cabling.
1. No. 24 AWG, 100 ohm, four pair.
  2. Cable Jacket Color: Blue.
- C. Controls shall comply with requirements in ASHRAE/IESNA 90.1-2004, "Controls."

## **2.03 AIR FILTERS**

- A. Disposable Filters: 1-inch- (25-mm-) thick fiberglass media with ASHRAE 52.2 MERV rating of 13 or higher, in sheet metal frame.



## **2.04 REFRIGERATION COMPONENTS**

- A. General Refrigeration Component Requirements:
  - 1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
  - 2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1-2004, "Energy Standard for Buildings except Low-Rise Residential Buildings."
- B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment." Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1-2004.
  - 1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.
- C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.
  - 1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I, 1/2 inch (13 mm) thick.
- D. Air-Cooled, Compressor-Condenser Unit:
  - 1. Casing: Steel, finished with baked enamel, 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: Two stage hermetically sealed scroll type.
    - a. Crankcase heater.
    - b. Vibration isolation mounts for compressor.
    - c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - e. Refrigerant Charge: R-410A.
  - 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
  - 4. Fan: Aluminum-propeller type, directly connected to motor.
  - 5. Motor: Permanently lubricated, with integral thermal-overload protection.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.
- B. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.
  - 1. Anchor furnace to substrate to resist code-required seismic acceleration.
- C. Controls: Install thermostats at mounting height indicated in the drawings.
- D. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.
- E. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

### **3.03 CONNECTIONS**

- A. Gas piping installation requirements are specified in Division 23 Section "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.
  - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - 3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    - a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    - b. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
    - c. Requirements for Low-Emitting Materials:
      - 1) Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 2) Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Slope pipe vent back to furnace or to outside terminal.
- D. Connect ducts to furnace with flexible connector. Comply with requirements in Division 23 Section "Air Duct Accessories."
- E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled, compressor-condenser unit.
  1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
  2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
  3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

### **3.04 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  1. Perform electrical test and visual and mechanical inspection.
  2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
  4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
  5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

### **3.05 STARTUP SERVICE**

- A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
  1. Inspect for physical damage to unit casings.
  2. Verify that access doors move freely and are weathertight.
  3. Clean units and inspect for construction debris.
  4. Verify that all bolts and screws are tight.
  5. Adjust vibration isolation and flexible connections.
  6. Verify that controls are connected and operational.
- B. Adjust fan belts to proper alignment and tension.

- C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.
- D. Measure and record airflows.
- E. Verify proper operation of capacity control device.
- F. After startup and performance test, lubricate bearings[ and adjust belt tension].

**3.06 ADJUSTING**

- A. Adjust initial temperature and humidity set points.
- B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including dampers, and relays, to provide optimum heating performance and system efficiency.

**3.07 CLEANING**

- A. After completing installation, clean furnaces internally according to manufacturer's written instructions.
- B. Install new filters in each furnace within 14 days after Substantial Completion.

**3.08 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

**SECTION 23 81 26**  
**SPLIT-SYSTEM AIR-CONDITIONERS**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

**1.03 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. Samples for Initial Selection: For units with factory-applied color finishes.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- E. Warranty: Sample of special warranty.

**1.04 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: Applicable requirements in ASHRAE 62.1-2004, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.

**1.05 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 Division 03 Section "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

**1.06 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five year(s) from date of Substantial Completion.
    - b. For Parts: Five year(s) from date of Substantial Completion.
    - c. For Labor: Five year(s) from date of Substantial Completion.

**1.07 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. 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.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
  - 2. Trane; a business of American Standard companies.
  - 3. YORK; a Johnson Controls company.

### **2.02 COOLING COILS**

- A. Duct-mounted Refrigerant Coil:
  - 1. Refrigerant Coil: A-style, copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 210/240.
  - 2. Condensate Drain Pans:
    - a. Fabricated with slope of at least 0.125 in. per foot 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) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
    - b. Double-wall, galvanized-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 one end of pan.
      - 1) Minimum Connection Size: 0.65 In. OD, 0.63 In. ID.
    - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

### **2.03 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, 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: Rotary.
    - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - c. Refrigerant Charge: R-410A.
    - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240.
  - 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. Mounting Base: Polyethylene.

## **2.04 ACCESSORIES**

- A. Thermostat: Hardwired low voltage with subbase to control compressor and evaporator fan.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. 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.
- D. Drain Hose: For condensate.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.
- D. Install seismic restraints.
- E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 0.4 inch. See Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- F. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

### **3.03 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.

### **3.04 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.

### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

**END OF SECTION**



## **SECTION 26 05 19**

### **LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

##### **1.02 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

##### **1.03 INFORMATIONAL SUBMITTALS**

- A. Field quality-control test reports.

##### **1.04 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.

#### **PART 2 PRODUCTS**

##### **2.01 CONDUCTORS AND CABLES**

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, XHHW.
- C. Multiconductor Cable: Comply with NEMA WC 70 for armored cable, Type AC or metal-clad cable, Type MC with ground wire. NM cable allowed where permissible by code and local authority having jurisdiction

##### **2.02 CONNECTORS AND SPLICES**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

#### **PART 3 EXECUTION**

##### **3.01 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper, or aluminum for feeders No. 1 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

##### **3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC or Metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC or Metal-clad cable, Type MC, NM cable where permissible by code and local authority having jurisdiction.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, in raceway or Power-limited cable, concealed in building finishes.

### **3.03 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

### **3.04 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### **3.05 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

### **3.06 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

- b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Grounding systems and equipment.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

**1.03 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. Comply with UL 467 for grounding and bonding materials and equipment.

**PART 2 PRODUCTS**

**2.01 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

**2.02 CONNECTORS**

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

**2.03 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel, 5/8 by 96 inches (16 by 2400 mm) in diameter.

**PART 3 EXECUTION**

**3.01 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, as indicated on plans. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.02 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
  - 1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
  - 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.03 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Test Wells: Ground rod driven through drilled hole in bottom of handhole.
  1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
  1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

### **3.04 LABELING**

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
  1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

### **3.05 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections and prepare test reports:
  1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.
- B. Report measured ground resistances that exceed the following values:
  1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

**END OF SECTION**

## **SECTION 26 05 29**

### **HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

##### **1.02 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

##### **1.03 SUBMITTALS**

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

##### **1.04 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

#### **PART 2 PRODUCTS**

##### **2.01 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:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 5. 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. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated 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:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  - 2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  - 5. Toggle Bolts: All-steel springhead type.
  - 6. Hanger Rods: Threaded steel.

## **2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES**

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

## **PART 3 EXECUTION**

### **3.01 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 RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) 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.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### **3.02 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### **3.03 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.
- B. Field Welding: Comply with AWS D1.1/D1.1M.

### **3.04 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### **3.05 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 minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Clean and touchup paint field welds, bolted connections, and abraded areas on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### **END OF SECTION**

**SECTION 26 05 53**  
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

**1.02 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

**1.03 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.

**PART 2 PRODUCTS**

**2.01 METAL CONDUIT AND TUBING**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  - 2. Fittings for EMT: Steel or die-cast, compression type.

**2.02 NONMETALLIC CONDUIT AND TUBING**

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

**2.03 METAL WIREWAYS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, 3R or 4X stainless steel, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: As indicated.
- E. Finish: Manufacturer's standard enamel finish.

## **2.04 NONMETALLIC WIREWAYS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Hoffman.
  - 2. Lamson & Sessions; Carlon Electrical Products.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## **2.05 SURFACE RACEWAYS**

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.
  - 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. Thomas & Betts Corporation.
    - b. Walker Systems, Inc.; Wiremold Company (The).
    - c. Wiremold Company (The); Electrical Sales Division.
- B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect.
  - 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. Butler Manufacturing Company; Walker Division.
    - b. Enduro Systems, Inc.; Composite Products Division.
    - c. Hubbell Incorporated; Wiring Device-Kellems Division.
    - d. Lamson & Sessions; Carlon Electrical Products.
    - e. Panduit Corp.
    - f. Walker Systems, Inc.; Wiremold Company (The).
    - g. Wiremold Company (The); Electrical Sales Division.

## **2.06 BOXES, ENCLOSURES, AND CABINETS**

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- I. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## **PART 3 EXECUTION**

### **3.01 RACEWAY APPLICATION**

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit.
  - 2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT.
  - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X Stainless steel.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 6. Damp or Wet Locations: Rigid steel conduit.
  - 7. Raceways for Optical Fiber or Communications Cable: EMT.
  - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

### **3.02 INSTALLATION**

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows:
  - 1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
  - 2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
  - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
    - d. Attics: 135 deg F (75 deg C) temperature change.
  - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.
  - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### **3.03 INSTALLATION OF UNDERGROUND CONDUIT**

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit.
  - 2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches

- (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
3. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
  4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete.
    - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
  5. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

#### **3.04 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels.
  - 8. Miscellaneous identification products.

**1.02 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.

**1.03 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

**PART 2 PRODUCTS**

**2.01 POWER RACEWAY IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

**2.02 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Colors for Raceways Carrying Circuits at 600 V and Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

**2.03 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.



- C. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

#### **2.04 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

#### **2.05 FLOOR MARKING TAPE**

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

#### **2.06 UNDERGROUND-LINE WARNING TAPE**

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
  - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
  - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
  - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
  - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
  - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- C. Tag:
  - 1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
  - 2. Overall Thickness: 5 mils (0.125 mm).
  - 3. Foil Core Thickness: 0.35 mil (0.00889 mm).
  - 4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
  - 5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

#### **2.07 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
  - 1. Preprinted aluminum signs punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
  - 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
  - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
  - 3. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

## **2.08 INSTRUCTION SIGNS**

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
  1. Engraved legend with black letters on white face.
  2. Punched or drilled for mechanical fasteners.
  3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

## **2.09 EQUIPMENT IDENTIFICATION LABELS**

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

## **2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# **PART 3 EXECUTION**

## **3.01 INSTALLATION**

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

## **3.02 IDENTIFICATION SCHEDULE**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Install labels at 10-foot (3-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  1. Power.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

- b. Colors for 208/120-V Circuits:
    - 1) Phase A: Black, 120/240V
    - 2) Phase B: Red, 120/240V
    - 3) Phase C: Blue.
  - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, Stenciled legend 4 inches (100 mm) high.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

**END OF SECTION**

## **SECTION 26 05 73**

### **OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. This Section includes computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

##### **1.02 SUBMITTALS**

- A. Product Data: For computer software program to be used for studies.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.
- C. Qualification Data: For coordination-study specialist.
- D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.
  - 1. Coordination-study input data, including completed computer program input data sheets.
  - 2. Study and Equipment Evaluation Reports.
  - 3. Coordination-Study Report.
  - 4. Arc Flash Study.

##### **1.03 QUALITY ASSURANCE**

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
  - 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

#### **PART 2 PRODUCTS**

##### **2.01 COMPUTER SOFTWARE DEVELOPERS**

- A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:
  - 1. CGI CYME.
  - 2. EDSA Micro Corporation.
  - 3. ESA Inc.
  - 4. Operation Technology, Inc.
  - 5. SKM Systems Analysis, Inc.

##### **2.02 COMPUTER SOFTWARE PROGRAM REQUIREMENTS**

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device

settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
  - a. Arcing faults.
  - b. Simultaneous faults.
  - c. Explicit negative sequence.
  - d. Mutual coupling in zero sequence.

### **PART 3 EXECUTION**

#### **3.01 POWER SYSTEM DATA**

- A. Gather and tabulate the following input data to support coordination study:
  1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Impedance of utility service entrance.
  3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
    - a. Circuit-breaker and fuse-current ratings and types.
    - b. Relays and associated power and current transformer ratings and ratios.
    - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
    - d. Generator kilovolt amperes, size, voltage, and source impedance.
    - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
    - f. Busway ampacity and impedance.
    - g. Motor horsepower and code letter designation according to NEMA MG 1.
  4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    - d. Generator thermal-damage curve.
    - e. Ratings, types, and settings of utility company's overcurrent protective devices.
    - f. Special overcurrent protective device settings or types stipulated by utility company.
    - g. Time-current-characteristic curves of devices indicated to be coordinated.
    - h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    - j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

#### **3.02 FAULT-CURRENT STUDY**

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
  1. Switchgear and switchboard bus.

2. Motor-control center.
  3. Distribution panelboard.
  4. Branch circuit panelboard.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141 IEEE 241 and IEEE 242.
1. Transformers:
    - a. ANSI C57.12.22.
    - b. ANSI C57.12.40.
    - c. IEEE C57.12.00.
    - d. IEEE C57.96.
  2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
  3. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:
1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
- F. Equipment Evaluation Report:
1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
  2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
  3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

### 3.03 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
  2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
  3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 141, IEEE 241 and IEEE 242 recommendations for fault currents and time intervals.
- C. Transformer Primary Overcurrent Protective Devices:
1. Device shall not operate in response to the following:
    - a. Inrush current when first energized.
    - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
  2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
    - a. Device tag.
    - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
    - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
    - d. Fuse-current rating and type.
    - e. Ground-fault relay-pickup and time-delay settings.
  2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
    - a. Device tag.
    - b. Voltage and current ratio for curves.
    - c. Three-phase and single-phase damage points for each transformer.
    - d. No damage, melting, and clearing curves for fuses.
    - e. Cable damage curves.
    - f. Transformer inrush points.
    - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of overcurrent protective devices.

### **3.04 ARC FLASH HAZARD ANALYSIS**

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2015. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 3.03) and the protective device time-current coordination analysis (Section 3.04)
  - B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
  - C. Circuits 240V or less where available bolted short circuit current is less than 10 kA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E Table 130.7(C)(9)(a), including footnote 3.
  - D. Circuits 240V or less fed by transformers 112.5 kVA or less may be omitted from the computer model and will be assumed to have a hazard risk category 0 per IEEE 1584.
  - E. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.
  - F. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
  - G. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.
- The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.



- H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 5 cycles.
- I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.
- J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.
- M. Provide the following:
  - 1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
  - 2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
  - 3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

### **3.05 FIELD ADJUSTMENT**

- A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

### **3.06 ARC FLASH LABELS**

- A. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The labels shall be designed according to the following standards:
  - 1. UL969 – Standard for Marking and Labeling Systems
  - 2. ANSI Z535.4 – Product Safety Signs and Labels
  - 3. NFPA 70 (National Electric Code) – Article 110.16
- C. The label shall include the following:
  - 1. System Voltage
  - 2. Flash protection boundary
  - 3. Personal Protective Equipment category
  - 4. Arc Flash Incident energy value (cal/cm<sup>2</sup>)
  - 5. Limited, restricted, and prohibited Approach Boundaries
  - 6. Study report number and issue date
- D. Labels shall be printed by a thermal transfer type printer, with no field markings.

- E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
  - 1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
  - 2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
  - 3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.
- F. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

**END OF SECTION**

**SECTION 26 24 16**  
**PANELBOARDS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
  - 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 and the unit will be fully operational after the seismic event."

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
- C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces.
- D. Field quality-control reports.
- E. Panelboard schedules for installation in panelboards.
- F. Operation and maintenance data.

**1.04 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. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.01 GENERAL REQUIREMENTS FOR PANELBOARDS**

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces.
- B. Enclosures: Flush- and surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.

- c. Kitchen and Wash-Down Areas: NEMA 250, Type 3R.
  - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R.
- 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
- 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
- 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses: Tin-plated Aluminum.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Main and Neutral Lugs: Mechanical type.
  - 2. Ground Lugs and Bus Configured Terminators: Mechanical type.
  - 3. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  - 4. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

## **2.02 DISTRIBUTION PANELBOARDS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Mains: Lugs only.
- E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

## **2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only, as indicated on panel schedules.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

## **2.04 LOAD CENTERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Load Centers: Comply with UL 67.
- C. Select first option in first paragraph below for load centers with main overcurrent protective devices; select second option for load centers with only main lugs for the incoming feeder.
- D. Mains: Circuit breaker.
- E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

## **2.05 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
  - 4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    - d. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    - e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    - f. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## **2.06 ACCESSORY COMPONENTS AND FEATURES**

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- B. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform, unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

### **3.02 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### **3.03 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**END OF SECTION**

**SECTION 26 27 26**  
**WIRING DEVICES**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Snap switches and wall-box dimmers.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

**1.03 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.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

**2.02 STRAIGHT BLADE RECEPTACLES**

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).

**2.03 GFCI RECEPTACLES**

- A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; GF20.
    - b. Pass & Seymour; 2084.

## 2.04 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221PL for 120 V.
    - b. Hubbell; HPL1221PL for 120 V.
    - c. Leviton; 1221-PLR for 120 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.
  - 3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  - 3. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120 V, 20 A; for use with mechanically held lighting contactors.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995.
    - b. Hubbell; HBL1557.
    - c. Leviton; 1257.
    - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995L.
    - b. Hubbell; HBL1557L.
    - c. Leviton; 1257L.
    - d. Pass & Seymour; 1251L.



## **2.05 ROCKER SWITCHES**

- A. Rocker Switches by Cooper, Hubbell, Leviton or Pass & Seymour, Mfg. Co's, Grounding: UL Listed, CSA Certified, colors as selected from manufacturer's standard colors.
  - 1. Commercial Spec Grade, Back and Side Wired.
    - a. 20 amp, 120 volt single-pole, double-pole, 3-way and 4-way.
    - b. 20 amp, Illuminated ON, single-pole 120 volt, 3-way 120 volt.
    - c. 20 amp, Illuminated OFF, single-pole 120 volt, 3-way 120 volt.
    - d. 20 amp, 120 volt, antimicrobial, single-pole and 3-way.

## **2.06 WALL-BOX DIMMERS**

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off rocker switches and Snap Switches with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
  - 1. 600 W; dimmers shall require no derating when ganged with other devices. Illuminated when "OFF."
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## **2.07 WALL PLATES**

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
  - 3. Material for Kitchen and Unfinished Spaces: Stainless steel.
  - 4. Material for Damp Locations: Stainless steel with spring-loaded lift cover and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic "while in use" with lockable cover.

## **2.08 FLOOR SERVICE FITTINGS**

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Blank cover with bushed cable opening.

## **2.09 FINISHES**

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Emergency Power System: Red.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to ensure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan speed control are listed for that application.
  3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

### 3.02 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions remove malfunctioning units and replace with new, and retest as specified above.

**END OF SECTION**

## **SECTION 26 28 13**

### **FUSES**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in enclosed switches and enclosed controllers.

##### **1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

##### **1.03 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. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

##### **2.02 CARTRIDGE FUSES**

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

#### **PART 3 EXECUTION**

##### **3.01 FUSE APPLICATIONS**

- A. Motor Branch Circuits: Class RK1, time delay.
- B. Other Branch Circuits: Class RK1, time delay.

##### **3.02 INSTALLATION**

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

##### **3.03 IDENTIFICATION**

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

**END OF SECTION**

## **SECTION 26 28 16**

### **ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

#### **PART 1 GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Shunt trip switches.
  - 4. Molded-case circuit breakers (MCCBs).
  - 5. Enclosures.

##### **1.02 DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

##### **1.03 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 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 and the unit will be fully operational after the seismic event."

##### **1.04 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- D. Field quality-control reports.
- E. Operation and maintenance data.

##### **1.05 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. Comply with NFPA 70.

#### **PART 2 PRODUCTS**

##### **2.01 FUSIBLE SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 3. Lugs: Suitable for number, size, and conductor material.

## **2.02 NONFUSIBLE SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Lugs: Suitable for number, size, and conductor material.

## **2.03 SHUNT TRIP SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Ferraz Shawmut, Inc.
  - 3. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
  - 1. Oiltight key switch for key-to-test function.
  - 2. Oiltight ON pilot light.
  - 3. Isolated neutral lug.
  - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  - 5. Form C alarm contacts that change state when switch is tripped.
  - 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
  - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

## **2.04 MOLDED-CASE CIRCUIT BREAKERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

- 3. Siemens Energy & Automation, Inc.
- 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

## **2.05 ENCLOSURES**

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen and Wash-Down Areas: NEMA 250, Type 3R.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3R.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

### **3.02 IDENTIFICATION**

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### **3.03 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

**END OF SECTION**



**SECTION 26 51 19**  
**LED INTERIOR LIGHTING**

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.

**1.03 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

**1.04 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

**1.05 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Lighting luminaires.

2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
  4. Structural members to which equipment and/or luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling-mounted projectors.
  7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
- G. Sample warranty.

#### **1.06 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### **1.07 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. Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
  2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### **1.08 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.

- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
  - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### **1.09 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Period: Five year(s) from date of Substantial Completion.

### **PART 2 PRODUCTS**

#### **2.01 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

#### **2.02 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Recessed Fixtures: Comply with NEMA LE 4.
- D. Bulb shape complying with ANSI C79.1.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. CRI of minimum 80. CCT of 2700 K, 3000 K, 3500 K, 4000 K or 5000 K.
- G. Rated lamp life of 35,000 hours minimum.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Integral driver.
- J. Nominal Operating Voltage: 120 V ac, 208 V ac.
  - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- K. Housings:
  - 1. Extruded-aluminum housing and heat sink.
  - 2. Clear, anodized, powder-coated or painted finish.

#### **2.03 DOWNLIGHT**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Amerlux.
  2. Architectural Lighting Works.
  3. Cooper Lighting.
  4. Edge Lighting.
  5. Edison Price Lighting.
  6. Elite Lighting Corporation.
  7. Eureka.
  8. Focal Point LLC.
  9. Gallium Lighting, LLC.
  10. GE Lighting Solutions.
  11. Juno Lighting Group by Schneider Electric.
  12. Lighting Science Group.
  13. Lighting Services Inc.
  14. Lightolier; a Philips group brand.
  15. Lithonia Lighting; Acuity Brands Lighting, Inc.
  16. MP Lighting.
  17. OSRAM SYLVANIA.
  18. Peerless; Acuity Brands Lighting, Inc.
  19. Pure Lighting.
  20. RAB Lighting.
  21. Sea Gull Lighting.
  22. Specialty Lighting Industries, Inc.
  23. Or approved equivalent.
- B. Minimum 500 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Universal mounting bracket.
- D. Integral junction box with conduit fittings.

#### **2.04 RECESSED LINEAR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Albeo Technologies, Inc; A GE Company.
  2. Architectural Lighting Works.
  3. Axis Lighting, Inc.
  4. Cooper Lighting.
  5. Elite Lighting Corporation.
  6. Finelite.
  7. Focal Point LLC.
  8. GE Lighting Solutions.
  9. Lithonia Lighting; Acuity Brands Lighting, Inc.
  10. Lumen Pulse.
  11. ON-Q Lighting Systems.
  12. OSRAM SYLVANIA.
  13. RAB Lighting.
  14. Selux Corporation.
  15. Or approved equivalent.
- B. Minimum 1,000 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

#### **2.05 STRIP LIGHT**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Lighting.
  2. Elite Lighting Corporation.
  3. GE Lighting Solutions.

4. Lighting Science Group.
  5. Lithonia Lighting; Acuity Brands Lighting, Inc.
  6. OSRAM SYLVANIA.
  7. Philips Lighting Company.
  8. Stile Lighting.
  9. Or approved equivalent.
- B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

## **2.06 SURFACE MOUNT, LINEAR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Albeo Technologies, Inc; A GE Company.
  2. Architectural Lighting Works.
  3. Axis Lighting, Inc.
  4. Cooper Lighting.
  5. Elite Lighting Corporation.
  6. Finelite.
  7. Focal Point LLC.
  8. GE Lighting Solutions.
  9. Lighting Science Group.
  10. Lightolier; a Philips group brand.
  11. Lithonia Lighting; Acuity Brands Lighting, Inc.
  12. Lumen Pulse.
  13. MP Lighting.
  14. OSRAM SYLVANIA.
  15. Pure Lighting.
  16. Specialty Lighting Industries, Inc.
  17. Stile Lighting.
  18. Tech Lighting.
  19. The Lighting Quotient.
  20. Or approved equivalent.
- B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

## **2.07 SURFACE MOUNT, NONLINEAR**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Architectural Lighting Works.
  2. Cooper Lighting.
  3. Edge Lighting.
  4. Elite Lighting Corporation.
  5. Eureka.
  6. Focal Point LLC.
  7. GE Lighting Solutions.
  8. Lithonia Lighting; Acuity Brands Lighting, Inc.
  9. Lumen Pulse.
  10. MP Lighting.
  11. OSRAM SYLVANIA.
  12. Peerless: Acuity Brands Lighting, Inc.
  13. Philips Lighting Controls.
  14. Pure Lighting.
  15. Tech Lighting.

- 16. Or approved equivalent.
- B. Minimum 750 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

## **2.08 SUSPENDED, LINEAR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Architectural Lighting Works.
  - 2. Axis Lighting, Inc.
  - 3. Axlen LED Lighting.
  - 4. Cooper Lighting.
  - 5. Edge Lighting.
  - 6. Elite Lighting Corporation.
  - 7. Finelite.
  - 8. Focal Point LLC.
  - 9. Gallium Lighting, LLC.
  - 10. GE Lighting Solutions.
  - 11. Lightolier; a Philips group brand.
  - 12. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 13. Lumen Pulse.
  - 14. MP Lighting.
  - 15. ON-Q Lighting Systems.
  - 16. OSRAM SYLVANIA.
  - 17. Pure Lighting.
  - 18. Selux Corporation.
  - 19. Specialty Lighting Industries, Inc.
  - 20. Stile Lighting.
  - 21. Tech Lighting.
  - 22. Or approved equivalent.
- B. Minimum 1,500 lumens. Minimum allowable efficacy of 80 lumens per watt.

## **2.09 SUSPENDED, NONLINEAR**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Architectural Lighting Works.
  - 2. Cooper Lighting.
  - 3. Edge Lighting.
  - 4. Elite Lighting Corporation.
  - 5. Eureka.
  - 6. Focal Point LLC.
  - 7. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 8. Or approved equivalent.
- B. Minimum 1,500 lumens. Minimum allowable efficacy of 80 lumens per watt.
- C. Integral junction box with conduit fittings.

## **2.10 MATERIALS**

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

- C. Diffusers and Globes:
  - 1. Tempered Fresnel glass, prismatic glass, diffuse glass, clear glass, prismatic acrylic or clear, UV-stabilized acrylic.
  - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 3. Glass: Annealed crystal glass unless otherwise indicated.
  - 4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Housings:
  - 1. Extruded-aluminum housing and heat sink.
  - 2. Clear, anodized, powder-coated or painted finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## **2.11 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## **2.12 LUMINAIRE FIXTURE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

# **PART 3 EXECUTION**

## **3.01 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.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.02 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

## **3.03 INSTALLATION**

- A. Comply with NECA 1.

- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls, to a minimum 20 gauge backing plate attached to wall structural members or using through bolts and backing plates on either side of wall.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
  - 2. Ceiling mount with pendant mount with 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 120 inches (6 m) in length.
  - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire to the luminaire opening using approved fasteners at a minimum of four locations, spaced near corners of luminaire.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure at a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### **3.04 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."



### **3.05 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

### **3.06 STARTUP SERVICE**

- A. Comply with requirements for startup specified in Section 260923 "Lighting Control Devices."

**END OF SECTION**

SECTION 310000  
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes general specifications for the grading and earthwork shown on the approved plan(s) and/or referenced in the geotechnical report(s) attached. Observations of the earthwork by the project Geotechnical Consultant during the course of earthwork may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Site Clearing: 31 1000
- B. Temporary Facilities and Temporary Controls: 01 5000
- C. Water Agencies Standards, Appendix Section WAS 02 223 Trenching, Excavation, Backfill, and Compaction
- D. Cast-In-Place Concrete: 03 3000
- E. Geotechnical Investigation prepared by Nova Services, Inc., dated January 22, 2020.

1.3 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with General Conditions.
- B. Submit a report from a testing laboratory verifying that the proposed import material are environmentally clean, and contains less than 1% asbestos by weight or volume and conforms to the gradation specified. Material test report shall be dated within 6 months from the Notice to Proceed.
- C. Submit manufacturer's catalog data and a sample of filter fabric. Submit manufacturer's installation instructions and details for filter fabric.
- D. Submit shop drawings for all materials to be incorporated into the work. Shop drawings shall include a physical analysis, sieve analysis, product source, sand equivalency, and durability index.

- E. Submit items required by the Waste Management Plan including, but not limited to: Site specific health and safety plan (HSP) and Cal-OSHA certification for personnel involved in soil excavations in former sludge pit area of the site.
- F. In addition to a site specific health and safety plan, the contractor is required to submit a Community Health and Safety Plan (CHSP) that emphasizes the methods to assure adequate controls for the surrounding area (versus just the persons working in the area).

#### 1.4 EARTHWORK CONTRACTOR

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading and earthwork activities. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications. The Contractor shall prepare and submit to the owner a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, grading plans, and the recommendations in the referenced geotechnical report(s).

The Contractor shall have the proper certifications and staff to be able to perform work with contaminated soils as described in the Waste Management Plan attached to these contract documents.

#### 1.5 TESTING

- A. The County will test for compaction and relative density as described below.
  - 1. Determine laboratory moisture-density relations of soils per ASTM D1557. If nuclear methods are used for in-place density determination, the compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.
  - 2. Determine the relative density of cohesionless soils per ASTM D4253 and D4254.
  - 3. Sample materials per ASTM D75.
  - 4. "Relative compaction" is the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density.
  - 5. Compaction shall be deemed to comply with the specifications when no tests fall below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the specifications.
  - 6. Contractor to be charged if soils technician is scheduled and then canceled within 24 hours of the scheduled test. 4-hour minimum charge.
- B. The County will also test:

1. Particle size analysis of soils and aggregates using ASTM D 422
2. Determination of sand equivalent value using ASTM D 2419

#### 1.6 STOCKPILE SOIL SAMPLING

- A. The County or its consultant will characterize the soils stockpiled as part of the Waste Management Plan. This work includes:
  1. Sampling and analyzing the soil.
  2. Transporting soils to a certified laboratory for analysis.

#### 1.7 DISPOSAL OF EXCESS MATERIALS

- A. Excess site excavated or wasted material shall be disposed of offsite by the Contractor at his expense. No prearranged disposal site or related permits have been determined or secured by the County. The Contractor shall dispose of all excess excavated or wasted material at a permitted disposal site complying with all local, state, and federal regulations.
- B. Impacted soils may be encountered which require special handling and disposal. Contractor shall provide the County with the additional cost to dispose of soils determined to be contaminated at a hazardous waste or specified waste facility.
  1. Note that following the stockpiling and characterization of the soil in the area described in the Waste Management Plan, any soils determined suitable for disposal at a non-hazardous waste facility shall be the responsibility and at the expense of the Contractor.

#### 1.8 MATERIAL AVAILABILITY

- A. Contractor is responsible for calculation of their own earthwork quantities. Export unused material to a legal disposal site. Obtain backfill material from offsite borrow areas as determined by the Contractor. The County has not identified or located sources for required earthwork materials.

#### 1.9 MEASUREMENT AND PAYMENT

- A. Payment for all the work in this section, exclusive of authorized overexcavation shall be included as part of the lump-sum bid amount for other items of work as stated in the Bid Schedule and no additional compensation will be allowed therefore.

#### 1.10 MEASUREMENT AND PAYMENT FOR AUTHORIZED OVEREXCAVATION

- A. Measurement of the volume of material for payment of authorized overexcavation will be made by taking cross sections after excavation and calculating the volume using the average end area method. The County will measure and calculate the volume. A change order will be made as described in the General Conditions based upon a unit price according to actual time and material volume of earthwork. No payment will be made for unauthorized excavated and fill material exceeding the contract lines and grades.

## PART 2 - MATERIALS

### 2.1 FILL MATERIAL

- A. Material to be used as fill shall be essentially free from organic matter, roots, debris, clay, and rocks larger than 3 inches in the greatest dimension. Furthermore, material shall be granular and have an expansion index less than 50 (per ASTM Test Method D4829). Imported soils and/or borrow site shall be evaluated by the County or its representative prior to importation. If there is insufficient backfill material available at the site, Contractor shall furnish and import sufficient material that meets the requirements listed and approved by the County's geotechnical consultant at his expense.
- B. Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 3 inches, shall not be buried or placed in fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction
- C. Excavated onsite material may be used as fill material provided it meets the requirements specified above and specific written permission has been obtained from the County Engineer. This will require the material to be tested by the County's geotechnical consultant at the Contractor's expense.

### 2.2 IMPORTED GRANULAR MATERIAL

- A. Imported granular material shall be used within the Pipe Zones (pressure pipe) and Trench Zones (pressure and non-pressure pipe) in accordance with WAS Section 02223. Additionally, imported granular material shall be used as backfill below and around concrete vaults, storm drain structures, and manholes and any other locations as indicated on the drawings. Imported granular material shall be installed a minimum of 3 feet from the outside edge of the structure, all around the structure, and to the full depth (and below as required) of the structure.
- B. Imported Granular material shall be free from clay balls, organic matter, and other deleterious substances and shall conform to the gradation indicated in WAS Section 02223.

### 2.3 SAND

- A. Joint Sand and bedding sand under concrete pavers should conform to the paver manufactures specifications. The bedding sand should have symmetrical particles, generally sharp, washed, with no foreign material. Masonry sand for mortar shall not be used for bedding, nor should limestone screenings or stone dust. Waste screenings or stone dust shall not be used.

### 2.4 SAND-CEMENT SLURRY BACKFILL

- A. Sand-cement slurry backfill shall consist of two sacks (188 pounds) of Type I or II portland cement added per cubic yard of imported sand and sufficient water for workability.

2.5 WATER FOR COMPACTION

- A. Water shall be free of organic materials and shall have a pH of 7.0 to 9.0, a maximum chloride concentration of 500 mg/L, and a maximum sulfate concentration of 500 mg/L. Provide all water needed for earthwork. Provide temporary piping and valves to convey water from the source to the point of use.

2.6 AGGREGATE BASE

- A. Aggregate base shall be crushed aggregate base as specified in Section 200-2 of the Public Works Specifications. Aggregate shall contain less than 1% asbestos by weight or volume.

2.7 CRUSHED ROCK

- A. Crushed rock shall be used in the Pipe Zone for installations of all non-pressure pipe and shall be in accordance with WAS Section 02 223.

2.8 FILTER FABRIC

- A. Filter fabric shall be used when excessively wet, soft, spongy, or similarly unstable material is encountered or in areas of suspected high groundwater.
- B. Filter fabric shall be manufactured from polyester, nylon, or polypropylene material; shall be of nonwoven construction; and shall meet the following requirements:
  - 1. Grab tensile strength (ASTM D4632): 90 lbs minimum for a 1-inch grip.
  - 2. Apparent opening size per ASTM D4751: 100.
- C. Filter fabric shall be MIRAFL No. 140N, manufactured by Celanese Fibers Marketing Co., Charlotte, North Carolina; Horchst Fibers No. 1145; or equal.

2.9 DRAINPIPE

- A. Back of wall drainpipe shall be 4-inch-diameter perforated and solid pipe, Schedule 80 polyvinyl chloride (PVC) conforming to the requirements of ASTM D1785. Perforated sections of pipe shall have two rows of 3/8-inch-diameter holes 60 degrees apart spaced at 6 inches on center. Fittings for drainpipe shall be Schedule 80 Type II PVC solvent weld type conforming to ASTM D2467.

PART 3 - EXECUTION

3.1 GENERAL

- A. As referenced in the project geotechnical documents there are areas of the project site that previously acted as sludge pits as part of the County's former wastewater operations (abandoned operations approximately 1970). The undocumented fill associated with these

areas were found to be impacted with concentrations of TPH, VOCs, SVOCs, PCBs, and Total Lead in a more recent (2010) subsurface environmental investigation.

If any of these potentially hazardous materials are encountered during drilling, excavation, or grading activities, the Contractor shall reference the Waste Management Plan included as part of these Contract Documents for proper protocol.

### 3.2 SITE GRADING

- A. Perform earthwork to the lines and grades shown in the drawings. Shape, trim, and finish slopes of channels to conform to the lines, grades, and cross sections as shown. Remove exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves of not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces.

### 3.3 EXCAVATION

- A. Excavations shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926 Subpart P-Excavations, CAL/OSHA requirements and Section 02 150.
- B. Excavation is unclassified. Perform excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.
- C. After the required excavation has been completed, the County and/or its consultants will observe the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation will be at the Contractor's expense and shall be conducted in all areas within the influence of the structure where soft, wet, or unacceptable (in the County's opinion) subgrade materials exist at the exposed subgrade. Additional excavation shall include the removal of all such unacceptable material that exists within a zone outside and below the structure defined by a line sloping downward at 1-horizontal to 1-vertical from 3 feet outside the edge of the footing or as directed by the County. Refill the overexcavated areas with imported granular material.
- D. The Contractor will not receive any additional payment for refill material for overexcavation used for his convenience.
- E. Contractor shall refer to the Geotechnical Investigation to review the existing soil conditions, including but not limited to the presence of subsurface rock.

### 3.4 PREPARATION OF AREAS TO BE FILLED

Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the County, its representatives, and governing agencies.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume).

Processing: Existing ground that has been declared satisfactory for support of fill by the

County's representative shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

**Overexcavation:** In addition to any removals and overexcavations recommended in the approved grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the County's representative during grading. Such overexcavations will not result in additional payment to the Contractor.

**Benching:** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

**Evaluation/ Acceptance of Fill Areas:** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

### 3.5 PLACEMENT OF FILL AND COMPACTION

- A. **Fill Layers:** Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 8 inches in loose thickness. The County and/or its consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.
- B. **Fill Moisture Conditioning:** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum per the recommendations of the County's Geotechnical Consultant. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).
- C. **Compaction of Fill:** After each layer has been moisture conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D 1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.
- D. **Compaction of Fill Slopes:** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D 1557-91.



- E. Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the County's Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

### 3.6 FOUNDATION SUBGRADE

- A. The finished subgrade for structure foundations shall be within a tolerance of  $\pm 0.08$  of a foot of the grade and cross section indicated, shall be smooth and free from irregularities, and shall be at the specified relative compaction. The subgrade shall extend over the full width and extend 1 foot plus the depth of overexcavation beyond the edge of the foundations, unless otherwise shown on the Plans.
- B. Remove soft, wet, or unacceptable material as described above. Fill holes and depressions to the required line, grade, and cross sections with structural backfill.

### 3.7 PLACING AND COMPACTING IMPORTED GRANULAR MATERIAL

- A. Place imported granular material used within Pipe and Trench Zones per WAS Section 02223 "Trenching, Excavation, Backfill and Compaction" requirements.
- B. Obtain the specified compressive strength and finish of concrete work per Section 03000 before backfilling.

END OF SECTION

SECTION 31 10 00  
SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Protecting existing vegetation to remain.
  - 2. Removing existing vegetation.
  - 3. Clearing and grubbing.
  - 4. Stripping and stockpiling topsoil.
  - 5. Removing above- and below-grade site improvements.
  - 6. Disconnecting, capping or sealing, and removing site utilities.
  - 7. Temporary erosion- and sedimentation-control measures.
- B. Comply with the requirements in Division 01 for the preservation of existing trees. The work also includes the removal and disposal of obstacles above and below ground that conflict with the work in this project whether or not such obstructions are as shown on the plans.
- C. Related Sections:
  - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities
  - 2. Section 01 73 00 "Execution" for field engineering and surveying.
  - 3. Section 02 41 16 "Structure Demolition" for demolition of buildings, structures, and site improvements.
  - 4. Section 02 41 19 "Selective Demolition" for partial demolition of buildings or structures.

1.3 REFERENCE STANDARDS:

- A. The editions, specifications and standards referenced herein, published by the following organizations apply to the construction only to the extent specified by the reference.
- B. Standard Specifications:
  - 1. Standard Specifications for Public Works Construction (current edition).
  - 2. Standard Special Provisions of the Regional Standards Committee.
  - 3. California Department of Transportation, "Manual of Traffic Controls, for Construction and maintenance Work Zones", (current edition), Document No. 869159.
- C. Standard Drawings:
  - 1. San Diego Regional Standard Drawings (current edition).

#### 1.4 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. (50 mm) Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, defined by the limits of the drip line, or as recommended by an arborist.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.5 MATERIAL OWNERSHIP

- A. Cleared materials shall become Contractor's property and shall be removed from Project site.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or videotape.
  - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

#### 1.7 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at location to be determined by Owner.

#### 1.8 PROJECT CONDITIONS

- A. The plans show general information only. It shall be the responsibility of the Contractor to examine the site to determine the exact existing conditions and character and extent of the work to be performed and clearing operations required.
- B. Existing underground lines shown on the plans are shown from best possible information available and shall be verified prior to start of any work. The Contractor is responsible for locating all underground lines by potholing and/or locator service.

- C. Preserve in operating condition all active utilities transversing or within and about the site. Promptly repair any damage to such utility or work due to work under this contract, to the satisfaction of the Owner's Representative.
  - D. Existing appurtenances and improvements, which are to remain, shall be protected from damage due to work under this section. Such damaged facilities shall be promptly repaired and/or replaced in kind.
  - E. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
    - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
    - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
  - F. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
    - 1. Do not proceed with work on adjoining property until directed by Owner's Representative.
  - G. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises as directed.
  - H. Utility Locator Service: Notify Digalert for area where Project is located before site clearing.
  - I. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
  - J. The following practices are prohibited within protection zones:
    - 1. Storage of construction materials, debris, or excavated material.
    - 2. Parking vehicles or equipment.
    - 3. Foot traffic.
    - 4. Erection of sheds or structures.
    - 5. Impoundment of water.
    - 6. Excavation or other digging unless otherwise indicated.
    - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
  - K. Do not direct vehicle or equipment exhaust towards protection zones.
  - L. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
  - M. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.
- 1.9 BARRICADES AND WORK AREA:
- A. Provide barricades and warnings (signs and lighting), and maintenance and supervision thereof, in accordance with applicable Federal and State codes and their respective requirements, or as may be directed from time to time by the Owner's Representative. Do not commence site clearing until barricades and warnings are in place.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 00 00 "Earthwork."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Clear and grub per Section 0300-1 standard specifications except as modified herein.

### 3.2 LIMITS

- A. The limits of clearing, grubbing and demolition shall include all areas of work.

### 3.3 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.4 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.5 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner's Representative.

### 3.6 EXISTING UTILITIES

- A. Existing utility lines shall be removed as indicated on plans. Prior to their removal, all required new re-routing and new connections shall be completed and made operative so that their functions to other existing structures served by them can be continuous and uninterrupted. Abandoned utility lines encountered during construction shall be removed.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
  - 1. Arrange with utility companies to shut off indicated utilities.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's Representative's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections and Section 02 41 16 "Structure Demolition" and Section 02 41 19 "Selective Demolition."

### 3.7 USE OF EXPLOSIVES:

- A. Use of explosives will not be permitted.

### 3.8 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
- B. Remove all trash, rubbish and all other material not suitable for construction operations.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.

3. Use only hand methods for grubbing within protection zones.
  4. Chip removed tree branches and dispose of off-site.
- C. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches , and compact each layer to a density equal to adjacent original ground.

### 3.9 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches .
  2. Do not stockpile topsoil within protection zones.
  3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
  4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

### 3.10 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
  2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. All removed and demolished material, including but not limited to concrete, asphalt concrete, trees, brush, vegetation and trash resulting from the work of this section is the property of the Contractor and shall be promptly removed to a legal disposal area off site. Asphalt and concrete shall not be used as fill material unless otherwise noted.

- B. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION



SECTION 32 12 16  
ASPHALT PAVING

GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Cold milling of existing asphalt pavement.
- 2. Hot-mix asphalt patching.
- 3. Hot-mix asphalt paving.
- 4. Hot-mix asphalt overlay.
- 5. Asphalt curbs.
- 6. Asphalt traffic-calming devices.
- 7. Asphalt surface treatments.

- B. Related Requirements:

- 1. Section 02 41 16 "Selective Demolition" for demolition and removal of existing asphalt pavement.
- 2. Section 31 00 00 "Earthwork" for subgrade preparation, fill material, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Owner specified location.

- 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include technical data and tested physical and performance properties.
- 2. Prepare mix design; sample and test materials and equipment for compliance with the specifications. Properly mark samples to show the name of the material, name of the

supplier, contract number and the segment of the work where the material represented by the sample is to be used. Submit copies of weighmaster's certificates or certified delivery tickets for each truck load of material.

3. Certificates: Submit manufacturer's certificate of compliance for the bituminous and paint materials.
4. Job-Mix Formula: Submit a job mix for each type of bituminous mixture prior to starting work. The formula shall be within the specified design range.
5. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and testing agency.
- B. Material Certificates: For each paving material. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.
- C. Material Test Reports: For each paving material, by a qualified testing agency.
- D. Field quality-control reports.

#### 1.6 REFERENCED STANDARDS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
  1. State of California, Department of Transportation:
    - a. Current Edition; Standard Specifications.
  2. American Society for Testing and Materials (ASTM) Publications:
    - a. D 2172-81 - Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Caltrans.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Caltrans for asphalt paving work.
  1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F .
2. Tack Coat: Minimum surface temperature of 60 deg F .
3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
4. (4.4 deg C) Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
  1. The grading and proportioning of aggregates shall be such that the combined mineral aggregate conforms to the specified requirements.
- B. Aggregate for asphaltic concrete shall conform to Section 39 of the Caltrans Standard Specifications, Class B for individual test result conforming to 1/2 inch maximum size gradation, medium.
- C. Coarse Aggregate: ASTM D 692/D 692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- D. Fine Aggregate: ASTM D 1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
  1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- E. Mineral Filler: ASTM D 242/D 242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320, PG 64-10
- B. Asphalt Cement:
  1. Asphalt Cement: Section 92 of the Standard Specifications, Grade AR-8000 for parking lots and AR-4000 for streets.
- C. Water: Potable.
- D. Undersealing Asphalt: ASTM D 3141/D 3141M; pumping consistency.

### 2.3 MIXES

- A. Hot-Mix Asphalt:
  1. The bituminous concrete shall consist of mineral aggregate, uniformly mixed with bituminous material in a central plant in accordance with Section 39 of the Caltrans

Standard Specifications. The percentage of asphalt cement binder shall be in accordance with Section 39 of the Caltrans Standard Specifications. The mixing plant and construction equipment shall conform to the requirements of Section 39 of the Caltrans Standard Specifications.

B. Pavement Marking Paint:

1. Paint shall be reflectorized white traffic paint, and conforming to the requirements of the Standard Specifications, State of California, Department of Transportation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph .
  2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons .
  3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Owner's Representative, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
  1. Mill to a depth of 1-1/2 inches .
  2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
  3. Control rate of milling to prevent tearing of existing asphalt course.
  4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
  5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
  6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
  7. Keep milled pavement surface free of loose material and dust.
  8. Do not allow milled materials to accumulate on-site.

3.3 PATCHING

- A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove

excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

- B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseal concrete pieces firmly.
  - 1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
  - 2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. .
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

### 3.4 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch .
  - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
  - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
  - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

### 3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. . Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  2. Protect primed substrate from damage until ready to receive paving.
- D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth . Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  2. Protect primed substrate from damage until ready to receive paving.
- E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.6 PLACING HOT-MIX ASPHALT

- A. Deliver bituminous mixtures to the roadbed at temperatures specified in Section 39 of the Caltrans Standard Specifications. Spread in accordance with Section 39 of the Caltrans Standard Specifications. Cover all loads with tarpaulin or other material during transportation.
- B. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  3. Spread mix at a minimum temperature of 250 deg F .
  4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
  5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- C. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
  2. Complete a section of asphalt base course before placing asphalt surface course.

- D. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches .
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches .
  - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time.
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Initial or breakdown rolling and the final rolling of the uppermost layer of the asphalt concrete shall be in accordance with Section 39 of the Caltrans Standard Specifications. Compaction by vehicular traffic shall not be permitted.
  - 2. Complete compaction before mix temperature cools to 185 deg F .
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 96 percent of reference laboratory density according to [ASTM D 6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Joining Pavement: Carefully make joints between old and new pavements or between successive day's work made in such manner as to insure a continuous bond between old and new sections of the course. Expose and clean edges of existing pavement. Cut edge to straight, vertical surfaces. Paint all joints with a uniform coat of tack coat before the fresh

mixture is placed. Prepare joints in the new pavement in accordance with Section 39 of the Caltrans Standard Specifications.

- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- H. Protection of Pavement: After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened and in no case less than 6 hours.
- I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.9 ASPHALT CURBS

- A. Construct hot-mix asphalt curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F .
  - 1. Asphalt Mix: Same as pavement surface-course mix.
- B. Place hot-mix asphalt to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

### 3.10 ASPHALT TRAFFIC-CALMING DEVICES

- A. Construct hot-mix asphalt speed bumps, over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at a minimum temperature of 250 deg F .
  - 1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
  - 2. Asphalt Mix: Same as pavement surface-course mix.
  - 3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.
- B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

### 3.11 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch .
  - 2. Surface Course: Plus 1/4 inch , no minus.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:



1. Base Course: 1/4 inch .
  2. Surface Course: 1/8 inch .
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch .
- C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

### 3.12 SURFACE TREATMENTS

- A. Seal Coat: Seal coat shall be furnished and applied in accordance with the provisions in Section 37 of the Standard Specifications of the State of California, Department of Transportation, and shall be applied at a rate of 0.05 to 0.1 gallons of asphaltic emulsion per square yard of paving followed by a uniform layer of plaster sand over the entire paved surface. Ten days following seal coating, all excess and loose sand shall be swept and cleaned from the site. Care shall be exercising to avoid splattering asphalt on concrete structures, piping, etc. All structures, equipment and piping that are adjacent to surfaces being sealed shall be wrapped with 15-pound building felt to a height of 4 feet prior to applying liquid asphalt.
- B. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- C. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

### 3.13 PAVEMENT MARKING

- A. Requirements: The work shall consist of applying painted stripes and markings in accordance with Section 84 of the Standard Specifications.
- B. General: All pavement striping and marking shall be given two coats of water borne paint. Repaint existing markings damaged by construction.
- C. Weather Limitations: Apply paint only when the pavement is dry. Paint shall not be applied when the atmospheric temperature is below 50 degrees nor under unfavorable conditions.

### 3.14 INSPECTION OF PLANT AND EQUIPMENT

- A. The Owner's Representative shall have access at all times to all parts of the batch plant for checking the adequacy of the equipment in use, inspecting the operation of the plant, verifying weight, proportions and character of materials and checking temperatures being maintained in the preparation of the mixture.

### 3.15 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. The in-place density of compacted base course will be determined. No payment will be made for the areas of pavement deficient in composition, density or thickness until they

- are removed and replaced. Determine maximum density in accordance with ASTM D 1557, Method D. Perform in place density tests in accordance with ASTM D 1556.
  - 2. The asphalt content in percent by extraction in accordance with ASTM D 2172, Method A will be determined.
  - 3. The field density of compacted asphalt concrete shall be determined by a properly calibrated nuclear asphalt testing device.
  - 4. Compaction tests to be at a rate determined by the Owner for each lift or course of asphalt concrete placed.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979 or AASHTO T 168.
- 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- F. Replace and compact hot-mix asphalt where core tests were taken.
- G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.16 WASTE HANDLING

- A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION

**PART VI**

RESERVED

**PART VII**

**SPECIAL PROVISIONS - MODIFICATIONS TO  
SECTIONS 1 THROUGH 9 AND SECTION 12  
OF THE  
CALTRANS STANDARD SPECIFICATIONS**

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**NOTE TO CONTRACTORS**

The. 2010 Standard Specifications can be found at  
[http://www.dot.ca.gov/hq/esc/oe/construction\\_contract\\_standards/std\\_specs/2010\\_StdSpecs/2010\\_StdSpecs.pdf](http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpecs.pdf)

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Sections 1 through 9 and Section 12 of the Standard Specifications, dated 2010, State of California, Department of Transportation and the Amendments to Sections 1 through 9 and Section 12 of said Standard Specifications, contained in Part VI of these Contract Documents, are modified below. A modification to an amended subsection of Sections 1 through 9 or Section 12 shall take precedence over and be used in lieu of that modification to the unamended subsection.

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISIONS  
**SUBSECTION 1-1.07, DEFINITIONS**

**Add:**

Attorney General. Wherever used in the Standard Specifications shall refer to County Counsel.

Standard Specifications. The Standard Specifications dated May 2010, State of California, Department of Transportation.

County. County of San Diego, a political subdivision of the State of California, as created by law.

**Delete and Substitute:**

Delete this section in its entirety and substitute the following:

Department, Also Department of Transportation: Wherever used in the Standard Specifications, refers to the Board, except when used in reference to test methods of, or to denote publications or designate the mailing address of an agency of the State of California.

**Add:**

Director. Also Director of Transportation: Means, wherever used in the Standard Specifications, the Board.

Division of Measurement Standards. Wherever used in the Standard Specifications, shall refer to the Department of Agriculture-Weights and Measures of the County of San Diego.

Engineer. The County Engineer, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties delegated to them. Wherever used in the Standard Specifications, shall refer to the County Engineer.

Laboratory. The established laboratory authorized by the County Engineer to test materials used in the work.

Liquidated Damages. The amount prescribed in the specifications to be paid to the Owner or to be deducted from any payment due or to become due the Contractor for each day's delay in completing the whole or any specified portion of the work beyond the time allowed in the specifications.

Owner. The political subdivision of the State of California, as created by law, designated in the Notice to Contractors Inviting Bids.

Plans. At "The Standard Plans issued by the Department of Transportation.", delete the period and add: "and the San Diego Area Regional Standard Drawings."

State. Also, State of California. As used in these specifications relative to the contract administration, refers to the political subdivision indicated as the Owner in the Notice to Contractors Inviting Bids.

Proposal. "Contract Documents, including Plans, Specifications, and Proposal Forms are available to be downloaded, free of charge, from the Department of Purchasing & Contracting BuyNet website at: <http://buynet.sdcountry.ca.gov>".

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISIONS  
**SUBSECTION 2, BIDDING**

No Modifications.

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISIONS  
**SUBSECTION 3, CONTRACT AWARD AND EXECUTION**

**Add:**

3-1.02 Contract Bonds. Delete the first paragraph and substitute the following:

"The successful bidder shall furnish a surety bond as security for the faithful performance of the contract, and shall furnish a separate surety bond as security for the payment of all persons performing labor and furnishing materials in connection with the contract as specified by Chapter 5 (commencing at Section 3225) and Chapter 7 (commencing at Section 3247), Title 15, Part 4, Division 3, of the California Civil Code. The aforesaid bonds shall be in amounts as stated in the Notice to Contractors Inviting Bids and shall conform to the bond forms included in the Contract Documents for the project."

**Delete:**

3-1.07 Insurance Policies. Delete this section in its entirety.

**Modify:**

3-1.18 Contract Execution. Delete the first paragraph in its entirety and substitute the following:

"The contract shall be signed by the successful bidder and returned together with the contract bonds within 10 days, not including Saturdays, Sundays and legal holidays, of receiving notice that the contract has been awarded."

Replace the word "Office Engineer" with the County of San Diego, Department of Purchasing and Contracting Officer.

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISIONS  
**SUBSECTION 4, SCOPE OF WORK**

No Modifications.

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISIONS  
**SUBSECTION 5, CONTROL OF WORK**

**Modify:**

5-1.02 Contract Components. In the second paragraph delete Items 1 through 5 in their entirety and substitute the following:

“1. The governing ranking of contract parts in descending order is:

- 1.1.1 Special Provisions-Technical Provisions
  - 1.1.2 Special Provisions-Special Conditions
  - 1.2 Project plans
  - 1.3 Revised Standard Plans
  - 1.4 Standard Plans
  - 1.4.1 Modifications to Amendments to Section 1 through 9 and Section 12 of the Standard Specifications
  - 1.4.2 Modifications to Sections 1 through 9 and Section 12 of the Standard Specifications
  - 1.5 Amendments to the Standard Specifications
  - 1.6 Standard Specifications
  - 1.7 Project information
2. Written numbers and notes on a drawing govern over graphics
3. A detail drawing governs over a general drawing
4. A detail specification governs over a general specification
5. A specification in a section governs over a specification referenced by that section.”

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISION  
**SUBSECTION 6, CONTROL OF MATERIALS**

**Modify:**

6-3.05A, General. In the table labeled “California Tests”, in the first line labeled “Relative Compaction” under the headings, delete “216 or 231” and substitute “216F”.

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISION  
**SUBSECTION 7, LEGAL RELATIONS AND RESPONSIBILITY**

**Delete: “7-1.06D Liability Insurance” and Add:**

“7-1.06D(2) Liability Limits / Additional Insureds. Without limiting Contractor’s indemnification obligations under this Contract, Contractor shall provide at its sole expense and maintain during the term of this Contract, or as may be further required herein, the insurance specified in this Article. Contractor’s insurance shall protect Contractor against claims which may arise out of or result from Contractor’s operations under the Contract and for which Contractor may be legally liable, whether such operations are performed by Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable.

**1. Minimum Scope of Insurance**

Coverage shall be at least as broad as:

- A. Commercial General Liability, Occurrence form, Insurance Services Office form CG0001.
- B. Automobile Liability covering all owned, non owned and hired auto, Insurance Services Office form CA0001.
- C. Workers’ Compensation, as required by State of California and Employer’s Liability Insurance.
- D. Professional Errors and Omissions Liability required if Contractor provides or engages any type of professional services including but not limited to engineers and architects.

**2. Minimum Limits of Insurance**

The insurance required shall be written for not less than limits of liability specified in this Contract or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment. Coverages, except for Professional Errors and Omissions Liability, shall include a Waiver of Subrogation endorsement in favor of County of San Diego, the members of the Board of Supervisors of the County and the officers, agents, employees and volunteers of the County, individually and collectively. Contractor shall maintain limits no less than:

- A. Commercial General Liability including Premises, Operations, Products and Completed Operations, Contractual Liability, Independent Contractors Liability: \$1,000,000 per occurrence for bodily injury, personal injury, and property damage. . The General Aggregate limit shall be \$2,000,000 and shall be a Project Specific Aggregate. Contractor shall maintain Commercial General Liability (CGL) insurance, including Completed Operations and Products with a limit of not less than less than \$1,000,000 per occurrence for three (3) years following County filing of the Notice of Completion (NOC) for the contracted work.
- B. Automobile Liability: \$1,000,000 each accident for bodily injury and property damage. Coverage will include contractual liability equivalent to that provided in the 1990 and later editions of CA 0001.
- C. Worker’s Compensation and Employer’s Liability: \$1,000,000 each accident for bodily injury or disease.
- D. Professional Errors and Omissions Liability: \$1,000,000 per claim with an aggregate limit of not less than \$2,000,000. Any self retained limit shall not be greater than \$50,000 per



occurrence/event without County's Risk Manager's approval. Coverage shall include contractual liability coverage. If policy contains one or more aggregate limits, a minimum of 50% of any such aggregate limit must remain available at all times; if over 50% of any such aggregate limit has been paid or reserved, County will require additional coverage to be purchased by Contractor to restore the required limits. This coverage shall be maintained for a minimum of three years following termination or completion of Contractor's work pursuant to the Contract.

### **3. Deductibles and Self-Insured Retentions**

Any deductible or self-insured retention must be declared to, stated on the Certificates of Insurance, and approved by County Risk Management. At the option of the County, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the County, the members of the Board of Supervisors of the County and the officers, agents, employees and volunteers; or the Contractor shall provide a financial guarantee satisfactory to the County, guaranteeing payment of losses and related investigations, claim administration and defense expenses.

### **4. Other Insurance Provisions**

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

- A. Additional Insured endorsement [Does not apply to professional liability]  
Any general liability policy provided by Contractor shall contain an additional insured endorsement applying coverage to the County of San Diego, the members of the Board of Supervisors of the County and the officers, agents, employees and volunteers of the County, individually and collectively.
- B. Primary Insurance endorsement  
For any claims related to this project, the Contractor's insurance coverage shall be primary insurance as respects the County, the members of the Board of Supervisors of the County and the officers, agents, employees and volunteers of the County, individually and collectively. Any insurance or self-insurance maintained by the County, its officers, employees, or volunteers shall be excess of the Contractor's insurance and shall not contribute with it.
- C. Notice of Cancellation  
Each required insurance policy shall be endorsed to state that coverage shall not be canceled by either party, except after thirty (30) days' prior written notice, or ten (10) days notice for non-payment of premium, by certified mail, return receipt requested, has been given to the County at the address shown in section of Contract entitled "Notices".
- D. Severability of Interest clause  
General Liability and Auto Liability policy will contain clause that coverage applies separately to each insured, except with respect to the limits of liability, and that an act or omission by one of the named insureds shall not reduce or avoid coverage to the other named insureds.

## **General Provisions**

### **5. Qualifying Insurers**

All required policies of insurance shall be issued by companies which have been approved to do business in the State of California by the State Department of Insurance, and which hold a current policy holder's alphabetic and financial size category rating of not less than A-, VII according to the current Best's Key Rating guide, or a company of equal financial stability that is approved by County's Risk Manager.

## **6. Evidence of Insurance**

Prior to commencement of this Contract, but in no event later than the effective date of the Contract, Contractor shall furnish the County with certificate of insurance and amendatory endorsements effecting coverage required by this clause. If requested by the County in writing, the Contractor shall furnish certified copies of the actual required insurance policies within thirty (30) days after effective receipt of such request. Thereafter, copies of renewal policies (if requested), certificate and amendatory endorsements shall be furnished to County within thirty (30) days of the expiration of the term of any required policy. Contractor shall permit County at all reasonable times to inspect any policies of insurance which Contractor has not delivered to County.

## **7. Failure to Obtain or Maintain Insurance; County's Remedies**

Contractor's failure to provide insurance specified or failure to deliver certified copies of policies or certificates of insurance, or failure to make premium payments required by such insurance, shall constitute a material breach of the Contract, and County may, at its option, terminate the Contract for any such default by Contractor.

## **8. No Limitation of Obligations**

The foregoing insurance requirements as to the types and limits of insurance coverage to be maintained by Contractor, and any approval of said insurance by the County are not intended to and shall not in any manner limit or qualify the liabilities and obligations otherwise assumed by Contractor pursuant to the Contract, including, but not limited to, the provisions concerning indemnification.

## **9. No Recourse**

The insurer shall have no recourse against County for payment of any premium or for assessments under any insurance policy maintained in connection with this Contract.

## **10. Review of Coverage**

County retains the right at any time to review the coverage, form and amount of insurance required herein and may require contractor to obtain insurance reasonably sufficient in coverage, form and amount to provide adequate protection against the kind and extent of risk which exists at the time a change in insurance is required.

## **11. Self-Insurance**

Contractor may, with the prior written consent of County Risk Management, fulfill some or all of the insurance requirements contained in the Contract under a plan of self-insurance. Contractor shall only be permitted to utilize such self-insurance if in the opinion of County Risk Management, Contractor's (i) net worth, and (ii) reserves for payment of claims of liability against Contractor, are sufficient to adequately compensate for the lack of other insurance coverage required by this Contract. Contractor's utilization of self-insurance shall not in any way limit liabilities assumed by Contractor under the Agreement.

## **12. Claims Made Coverage**

If coverage is written on a "claims made" basis, the Certificate of Insurance shall clearly so state. In addition to the coverage requirements specified above, such policy shall provide that:

- A. The policy retroactive date coincides with or precedes Contractor's commencement of work under the Contract (including subsequent policies purchased as renewals or replacements).
- B. Contractor will make every effort to maintain similar insurance during the required extended period of coverage following expiration of the Contract, including the requirement of adding all additional insureds.

- C. If insurance is terminated for any reason, Contractor shall purchase an extended reporting provision of at least three (3) years to report claims arising in connection with the Contract.
- D. The policy allows for reporting of circumstances or incidents that might give rise to future claims.

### **13. Subcontractors' Insurance**

Contractor shall require that any and all subcontractors hired by Contractor are insured in accordance with this Contract. If any subcontractor's coverage does not comply with the foregoing provisions, Contractor shall defend and indemnify the County from any damage, loss, cost, or expense, including attorneys' fees, incurred by County as a result of subcontractors failure to maintain required coverage.

In addition to the foregoing, Contractor shall require that any and all subcontractors performing any excavation of the Project have Explosion, Collapse and Underground Damage Liability Insurance and coverage in the amount of One Million Dollars (\$1,000,000) per occurrence.

### **14. Waiver of Subrogation**

The insurer shall waive all rights of recovery or subrogation against County, its agents, officers and employees which might arise by reason of any payment under the policies. Contractor hereby waives all rights to recovery against County, its agents, officers and employees, on account of loss or damage occasioned to Contractor or others under Contractor's control to the extent such loss or damage is insured against under any insurance policies which may be in force at the time of the loss or damage. Included in any policy or policies of insurance provided by Contractor, shall be a standard Waiver of Rights of Subrogation against County by the insurance company issuing said policy or policies. This provision does not apply to Professional Liability coverage.

Contractor's Bonds. Prior to execution of the Contract, Contractor shall file with the County on the approved forms, the two surety bonds in the amounts and for the purposes noted below, duly executed by a reputable surety company satisfactory to County, and Contractor shall pay all premiums and costs thereof and incidental thereto, as security for payment of persons named in California Civil Code Section 3181 or amounts due under Unemployment Insurance Code with respect to Work or Labor performed by any such claimant. All alterations, time extensions, extra and additional work, and other changes authorized by the Specifications, or any part of the Contract, may be made without securing consent of the surety or sureties on the contract bonds. Each bond shall be signed by both Contractor and the sureties.

- A. The Payment Bond for public works shall be in an amount of one hundred percent (100%) of the Contract price, as determined from the prices in the bid form, and shall insure to the benefit of persons performing labor or furnishing materials in connection with the work of the proposed Contract. This bond shall be maintained in full force and effect until all work under the Contract is completed and accepted by the County, and until all claims for materials and labor have been paid.
- B. The Performance Bond shall be in an amount of one percent (100%) of the Contract price as determined from the prices in the bid form, and shall insure the faithful performance by the Contractor of all work under the Contract. It shall also insure the replacing of, or making acceptable, any defective materials or faulty workmanship.
- C. Qualification of Sureties. Should any surety or sureties be deemed unsatisfactory at any time by the County, notice will be given Contractor to that effect, and Contractor shall substitute a new surety or sureties satisfactory to the County. No further payment shall be

deemed due or will be made under the contract until the sureties qualify and are accepted by the County.

Miscellaneous. Nothing contained in the Contract is intended to make the public or any member thereof a third party beneficiary of the Insurance, Indemnity or Bonding provisions of these Standard Specifications, nor is any term, condition or other provision of the Contract intended to establish a standard of care owed to the public or any member thereof."

Rights in Land and Improvements. "The Contractor shall not occupy State-owned property outside the right of way as shown on the plans or maps available in the County Engineer's office, unless he enters into a rental agreement with the Department. The agreement will be based on the fair rental values."

## CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISION **SUBSECTION 8, PROSECUTION AND PROGRESS**

### **Delete and Substitute:**

8-1.13 Contractor's Control Termination. Delete this section in its entirety and substitute the following:

"If the Engineer deems that a Contractor has failed to supply an adequate working force, or material of proper quality, or has failed in any other respect to prosecute the work with the diligence and force specified by the contract, the Director of Purchasing and Contracting may:

1. After written notice of at least five (5) days to the Contractor, specifying the defaults to be remedied, provide any such labor or materials and deduct the cost from any money due or to become due to the Contractor under the contract; or
2. If it considers that the failure is sufficient ground for such action, the Director of Purchasing and Contracting may give written notice of at least five (5) days to the Contractor and the Contractor's sureties, that if the defaults are not remedied the Contractor's control over the work will be terminated.

If the defaults are not remedied within the time specified in the notice, the Contractor's control shall terminate as of the expiration of that time.

"In the event of such termination, the County shall immediately serve written notice thereof upon surety and Contractor. Surety shall have the rights and obligations set forth in the performance bond. Subject to the surety's rights under the performance bond (which rights are waived upon a default under the performance bond), the County may, at its sole option, take over the Work and prosecute it to completion by contract or by any other methods it may deem advisable, or require the surety to prosecute the Work to completion. The County may take possession of and use all or any part of the Contractor's materials, tools, equipment, and appliances upon the premises to complete the contract. The County may effectuate the provisions of this paragraph through any necessary written agreement with the Surety, Contractor, or other contractors.

"If the Contractor's control of the work is terminated or the Contractor abandons the work and the contract work is completed in conformance with the provisions of this subsection, any dispute concerning the amount to be paid by the Owner to the Contractor or its Surety or to be paid to the Owner by the Contractor or its Surety shall be subject to arbitration in accordance with the provisions of Section 9-1.10, 'Arbitration', of the Standard Specifications. The Surety shall be bound by the arbitration award and is entitled to participate in such arbitration proceedings."

CALTRANS STANDARD SPECIFICATIONS, DIVISION I – GENERAL PROVISION  
**SUBSECTION 9, MEASUREMENT AND PAYMENT**

**Add:**

9-1.22 Arbitration. Add the following at the end of the first paragraph:

"However, any unresolved claims shall be resolved by first submitting such claims to mediation prior to their being taken to formal arbitration or litigation by any party, pursuant to the Special Condition entitled either "Claims" or "Dispute and Claims Resolution" in the Contract Documents for the project."

Change the capital "C" in "Claims" to a small "c" and add the following at the beginning of the second paragraph:

"Any mediated, yet still unresolved"

**Delete and Substitute:**

Delete the last sentence of the last paragraph, and substitute the following:

"A Complaint in Arbitration by the Contractor shall be made not later than 60 days after completion or termination of mediation on the claim."

CALTRANS STANDARD SPECIFICATIONS, DIVISION II – GENERAL CONSTRUCTION  
**SUBSECTION 10, GENERAL**

No Modifications.

CALTRANS STANDARD SPECIFICATIONS, DIVISION II – GENERAL CONSTRUCTION  
**SUBSECTION 11, QUALITY CONTROL AND ASSURANCE**

No Modifications.

CALTRANS STANDARD SPECIFICATIONS, DIVISION II – GENERAL PROVISION  
**SUBSECTION 12, TEMPORARY TRAFFIC CONTROL**

**Delete and Substitute:**

12-1.03 Flagging Costs. In the first sentence delete "You and the State share" and substitute "Contractor is responsible to pay for 100% of cost to furnish all flaggers, including transporting flaggers and furnishing stands and towers for flaggers to provide for passage of traffic through the work as specified in section 7-1.03 and 7-1.04."

**END OF SECTION**

**PART VIII**

RESERVED

## **PART IX**

### **STANDARD DRAWINGS, STANDARD PLANS AND PROJECT PLANS**

**STANDARD DRAWINGS AND SPECIFICATIONS:**

**CALTRANS STANDARD SPECIFICATIONS**

[http://ppmoe.dot.ca.gov/hq/esc/oe/construction\\_contract\\_standards/std\\_specs/2010\\_StdSpecs/2010\\_StdSpecs.pdf](http://ppmoe.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpecs.pdf)

**GREENBOOK STANDARD SPECIFICATIONS FOR PUBLIC WORKS  
CONSTRUCTION**

<http://www.greenbookspecs.org/>

**CALTRANS 2010 REVISED STANDARD PLANS**

[http://ppmoe.dot.ca.gov/hq/esc/oe/old%20hq-esc-oe%20pages/2010\\_SP\\_errata\\_1-15-16.html](http://ppmoe.dot.ca.gov/hq/esc/oe/old%20hq-esc-oe%20pages/2010_SP_errata_1-15-16.html)

**WATER AGENCIES' STANDARD DESIGN GUIDELINES (WADG)**

<http://www.sdwas.org/Standard-Specifications>

**SAN DIEGO AREA REGIONAL STANDARD DRAWINGS**

<http://www.regional-stds.com/home/book/drawings>



## **PROJECT PLANS:**

- 1 T-1.1 TITLE SHEET
- 2 C1.0 GRADING & DRAINAGE PLAN
- 3 C2.0 SEWER & WATER PLAN
- 4 C3.0 EROSION CONTROL PLAN
- 5 A-0.1 EXISTING SITE/DEMOLITION PLAN
- 6 A-02 PROPOSED BUILDING SITE PLAN
- 7 A-1.1 BUILDING SLAB PLAN
- 8 A-1.2 BUILDING FLOOR PLAN
- 9 A-1.3 BUILDING FINISH FLOOR PLAN
- 10 A-1.4 INTERIOR ELEVATIONS
- 11 A-1.5 INTERIOR ELEVATIONS
- 12 A-1.6 TERRARIUM PLANS
- 13 A-2.1 BUILDING CEILING PLAN
- 14 A-3.1 BUILDING ROOF PLAN
- 15 A-4.1 BUILDING SECTIONS
- 16 A-4.2 WALL SECTIONS
- 17 A-4.3 WALL SECTIONS
- 18 A-5.1 BUILDING ELEVATIONS
- 19 A-6.1 DOOR SCHEDULE AND DETAILS
- 20 A-6.2 WINDOW & WALL SCHEDULE AND DETAILS
- 21 A-6.3 FINISH SCHEDULE
- 22 A-7.1 DETAILS
- 23 S-0.1 STRUCTURAL NOTES AND SPECIAL INSPECTIONS
- 24 S-0.2 STRUCTURAL SCHEDULES
- 25 S-0.3 STRUCTURAL DETAILS
- 26 S-0.4 STRUCTURAL DETAILS
- 27 S-0.5 STRUCTURAL DETAILS
- 28 S-1.01 FOUNDATION AND FRAMING PLANS
- 29 S-1.02 TERRARIUM FOUNDATION AND FRAMING PLANS
- 30 S-5.01 FOUNDATION DETAILS
- 31 S-5.02 FRAMING DETAILS
- 32 M0.1 MECHANICAL LEGEND AND NOTES
- 33 M0.2 MECHANICAL SCHEDULES
- 34 M0.3 TITLE 24
- 35 M0.4 TITLE 24
- 36 M0.5 TITLE 24
- 37 M2.1 MECHANICAL FLOOR PLAN
- 38 M2.2 MECHANICAL ROOF PLAN
- 39 M5.1 MECHANICAL DETAILS
- 40 P0.1 PLUMBING LEGEND AND NOTES
- 41 P0.2 PLUMBING SCHEDULES AND CALCULATIONS
- 42 P1.1 PLUMBING SITE PLAN
- 43 P2.1 PLUMBING FLOOR PLAN-SEWER & VENT
- 44 P2.2 PLUMBING FLOOR PLAN-DOMESTIC WATER
- 45 P2.3 PLUMBING ROOF PLAN
- 46 P5.1 PLUMBING DETAILS
- 47 E0.1 ELECTRICAL NOTES AND LEGEND
- 48 E0.2 LIGHT FIXTURE SCHEDULE
- 49 E0.3 TITLE 24
- 50 E0.4 TITLE 24
- 51 E0.5 TITLE 24
- 52 E0.6 TITLE 24
- 53 E1.01 ELECTRICAL DEMOLITION SITE PLAN
- 54 E1.1 ELECTRICAL SITE PLAN
- 55 E2.1 LIGHTING FLOOR PLANS
- 56 E2.2 POWER FLOOR PLAN
- 57 E4.1 SINGLE LINE DIAGRAM
- 58 E5.1 ELECTRICAL DETAILS

**END OF SECTION**