

**B O N N E V I L L E**  
POWER ADMINISTRATION



**The Confederated  
Tribes and Bands  
of the Yakama  
Nation**

**Melvin R. Sampson  
Coho Hatchery  
Engineer-Procure-Construct  
Project**

**Technical Specifications  
90% Submittal  
Volume 1A  
(Divisions 1 – 22)**

**Volume 1A**  
Technical Specifications



April 2017

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**MELVIN R. SAMPSON COHO HATCHERY  
TECHNICAL SPECIFICATIONS**

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## SECTION 01 33 00 - CONTRACTOR SUBMITTALS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall make submittals to OWNER as per this Section and the other portions of the contract document. OWNER will review and return the noted number of submittal materials. OWNER will use submitted copies that are not returned to the CONTRACTOR for internal distribution.
- B. The CONTRACTOR shall submit at least five, but no more than eight, copies or samples of all materials to OWNER. Four copies will be retained by OWNER. In addition, one reproducible drawing prepared on bond paper shall be included with each shop drawing larger than 11 X 17 inches.
- C. Testing and certification of materials required for submittals shall be paid for by the CONTRACTOR. No materials will be delivered to the project site until the proposed material sources have been accepted by OWNER
- D. Within 15 days from Notice of Award, the CONTRACTOR shall supply to OWNER two copies of a list of all submittal data tabulated per specification section for review.
- E. Shop drawings, project data, and samples are to be submitted in advance to allow OWNER sufficient time to review. In no case shall less than 2 weeks time be provided for each review period, including reviews required for resubmittal materials.

#### 1.2 CONTRACTOR RESPONSIBILITIES

- A. The CONTRACTOR shall be responsible for verifying that all submittals comply with the information contained in the Contract Documents. This information shall include, but not be limited to, dimensions, suitability of intended application, material strengths and properties, catalog number and data, equipment and product information, tolerances, and construction sequencing and procedures.
- B. The CONTRACTOR shall submit shop drawings and product submittals to OWNER only after the CONTRACTOR has approved the submittals. All submittals from the CONTRACTOR shall be marked "Approved for Construction", and signed by the CONTRACTOR. Submittals shall be transmitted to OWNER using a Submittal Transmittal Form; in accordance with the form provided by OWNER
- C. The CONTRACTOR is to verify that field dimensions shown on the contract documents are accurate.
- D. The CONTRACTOR's responsibility for errors and omissions in submittals is not relieved by OWNER's review of submittals.
- E. The CONTRACTOR's responsibility for deviations in submittals from contract document requirements is not relieved by OWNER's review of submittals.
- F. The CONTRACTOR shall notify OWNER, in writing, prior to submission, of proposed deviations in submittals from contract requirements.
- G. The CONTRACTOR is responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes and for techniques of assembly.

- H. The CONTRACTOR shall number the submittals sequentially. Use a new sequential number for each item submitted. Submittal number will be in the form as follows: xx-y, where "xx" is the sequential number assigned to the CONTRACTOR, and "y" is for resubmittal iterations, i.e., -A, -B, -C being the first, second and third resubmittals, respectively. Submittal 5-B, therefore, is the second iteration (third time submittal) of submittal 5.
- I. The CONTRACTOR is required to and is responsible for maintaining a current set of as-built drawings throughout the course of construction.

## **PART 2 PRODUCTS**

### **2.1 SUBMITTAL DESCRIPTION**

- A. Shop drawings. Shop drawings are original drawings prepared by the CONTRACTOR, Subcontractor, supplier or distributor, which illustrate some portion of the work, showing fabrication, layout, setting or erection details, including erection plan and details as required. The drawings will be prepared as follows:
  - 1. Prepared by qualified detailer.
  - 2. Identify details by reference to sheet and detail numbers shown on contract drawings.
- B. Product data submittals will include the following:
  - 1. Manufacturer's standard schematic drawings;
    - a. Modified by deleting information, which is not applicable to project.
    - b. Standard information supplemented to provide additional information pertinent to intended project application.
  - 2. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data which must include the following:
    - a. Clearly marked copies to identify pertinent materials, products or models.
    - b. Dimensions and clearances clearly shown.
    - c. Performance characteristics and capacities clearly identified.
    - d. Wiring diagrams and controls clearly shown.
- C. Samples will be submitted to provide data as needed to illustrate materials, equipment or workmanship and to establish standards by which complete work is judged. The CONTRACTOR shall maintain one set of samples at the site as directed by OWNER. These samples must be stored in a protected and easily accessible location until no longer needed.
- D. Office samples will be of sufficient size to clearly illustrate the functional characteristics of color, texture, finish and other characteristics appropriate to the submittal of product or material, with integrally related parts and attachment devices.

### **2.2 QUALITY ASSURANCE**

- A. In relation to the coordination of submittals, the CONTRACTOR shall:
  - 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.



2. Verify that each item, and the submittal for it, conforms in all respects with the specified requirements.
3. Identify each submittal as "Approved for Construction", sign and date the submittal.
4. By affixing the CONTRACTOR's signature to each submittal, certify that this coordination has been performed. Submittals not so marked will be returned to the CONTRACTOR prior to review by OWNER.

### 2.3 SPECIFIED PRODUCTS LIST

- A. For any product specified under reference standards, the CONTRACTOR shall include with the listing of each product:
  1. Name and address of manufacturer.
  2. Trade name.
  3. Model or catalog designation.
  4. Manufacturer's data.
  5. Performance and test data.
  6. Reference standards.

## PART 3 EXECUTION

### 3.1 SUBMITTALS

- A. The CONTRACTOR shall coordinate each submittal with requirements of:
  1. The Work
  2. The Contract Documents
  3. The Work of Subcontractors

### 3.2 RESUBMISSION REQUIREMENTS

- A. Shop drawings; the CONTRACTOR shall:  
Revise initial drawings as required and resubmit in accordance with shop drawing submittal procedures.
  1. Indicate on drawings all changes which have been made in addition to those requested by OWNER
- B. Product data and samples; the CONTRACTOR shall submit new data and samples in accordance with procedures specified for initial submittal.

### 3.3 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

- A. Following review, OWNER will retain four copies of submittals and return the remaining copies to the CONTRACTOR.
- B. The CONTRACTOR shall distribute samples in accordance with the appropriate requirements.

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## SECTION 01 40 00 - QUALITY REQUIREMENTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide tests and reports described in this section with any tests, reports, and other information that may be additionally required in any section of the specifications.

#### 1.2 TESTS BY INDEPENDENT TESTING LABORATORY

- A. Testing Laboratory
  - 1. OWNER will select and direct an independent construction inspector and testing laboratory (Testing Lab) to perform inspection and testing services as described in this Section. The construction inspector and testing laboratory will work solely at the direction of the OWNER's own Quality Assurance program. The CONTRACTOR shall include the cost in the price proposal to provide his own testing services program.
- B. The CONTRACTOR shall:
  - 1. Make available and deliver to Testing Lab, at the CONTRACTOR's expense, all materials to be tested.
  - 2. Provide labor necessary to supply samples and assist in making tests.
  - 3. Advise Testing Lab of the identity of material sources and instruct suppliers to allow inspections by the laboratory if so desired by the OWNER.
- C. The Testing Lab is not authorized to:
  - 1. Release, revoke, alter or enlarge on, contract requirements.
  - 2. Approve or accept any portion of the work.
  - 3. Perform any duties required of the CONTRACTOR, including any testing work requested by the CONTRACTOR for verification.
- D. Tests shall be conducted in accordance with the requirements of the specifications as designated or, where not specified, as requested by the OWNER. All testing will be in accordance with the latest standards of American Society for Testing and Materials.

#### 1.3 INDEPENDENT TESTING LABORATORY SERVICES, TESTS AND RELATED CONTRACTOR RESPONSIBILITIES

- A. Testing Lab services will be performed for, though are not limited to, the following items:
  - 1. Compacted Soils
    - a. The Testing Lab will secure samples of onsite fills proposed for use or being used in construction and test for proper gradation (sieve analysis) in accordance with the applicable sections of these specifications. This will also be done on CONTRACTOR provided samples from offsite borrow sources.
    - b. The Testing Lab will establish optimum moisture - density relationship in accordance with ASTM D698 (Standard Proctor).

c. The OWNER reserves the right to make or request in-situ tests of fills and backfills at any time, above those required by the CONTRACTOR, in order to determine compliance with the specifications.

B. Concrete

1. The Testing Lab will test samples of aggregates CONTRACTOR proposes to use for compliance with specifications.
2. The Testing Lab will verify compliance with the specifications for cement proposed for use by the CONTRACTOR based on data submitted by the CONTRACTOR.
3. The Testing Lab will review the CONTRACTOR's proposed design concrete mix, as well as perform appropriate laboratory tests during construction, including compression tests of cylinders and slump test, if required, to substantiate mix designs.
4. When requested by the OWNER, the Testing Lab will inspect and collect test materials during concrete work to substantiate compliance with specifications and mix requirements.
5. Slump Test
  - a. The right to perform or request a slump test by the CONTRACTOR at any time, which may be in addition to the CONTRACTOR's testing, is reserved for the OWNER.
6. Test cylinders shall be prepared and supplied by the CONTRACTOR as required by SECTION 03 30 00 as follows:
  - a. Each set of test cylinders shall consist of three cylinders prepared by the CONTRACTOR.
  - b. Test cylinders shall be made and cured by the CONTRACTOR in conformity with ASTM C31. No sooner than 24 hours, but no more than 48 hours, after taking cylinders, the CONTRACTOR shall carefully transport the cylinders to the Testing Laboratory for moisture curing.
7. The Testing Lab will perform the required number of compression tests as follows:
  - a. Test one cylinder to failure at 7 days.
  - b. Test two (2) cylinders at 28 days in accordance with ASTM C39 and SECTION 03 30 00 of these specifications.
8. The CONTRACTOR will identify all test cylinders with symbols to indicate location on the job where concrete test was made. Symbols will be used to record placement locations on record drawings.

C. The Testing Lab will verify roadway Aggregate Gradation and Compaction in accordance with the applicable specifications.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Furnish product data meeting or exceeding contract requirements in accordance with the applicable specifications.
- B. Cooperate with any of OWNER and Testing Lab personnel, in providing access to work and to manufacturer's or suppliers operations.
  1. Direct CONTRACTOR's representative, if desired, to monitor each inspection, sampling and test.

2. The CONTRACTOR shall, within 24 hours, notify the OWNER in writing of reasons for not acknowledging field testing and sampling procedures.
- C. Provide to the Testing Lab, initial representative samples of materials to be tested, in specified quantities.
- D. Furnish copies of mill test reports.
- E. Furnish verification of compliance with contract requirements for materials and equipment.
- F. Furnish labor and facilities:
  1. To provide access to work to be tested.
  2. To obtain, handle and transport samples at site.
  3. To facilitate inspections and tests.
  4. For the Testing Lab's exclusive use for storage and pouring of concrete test samples.
- G. Notify the OWNER, Construction Inspector, and the Testing Lab sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. A minimum of two (2) days advance notice will be provided. CONTRACTOR shall notify the OWNER, Construction Inspector and the Testing Lab when work is ready for testing. The CONTRACTOR shall provide a schedule for the Testing Lab for acceptance by the Construction Inspector and OWNER. The CONTRACTOR shall pay for any testing he or any of his representatives or employees schedule as defined in these specifications.
- H. Work which is defective or which fails to conform to the contract documents shall be corrected by the CONTRACTOR at the CONTRACTOR's sole expense. Corrective work shall not be cause for delay in the project schedule or the work of other CONTRACTOR.
- I. Pay all costs of retesting when test results indicate non-compliance with contract requirements.
- J. Restore all surfaces and areas disturbed by testing operations to conditions existing before testing.

#### 1.5 QUALIFICATIONS FOR WELDING WORK

- A. Welders employed in executing work under this project shall possess qualification papers given by an independent testing laboratory under AWS Code, Standard Qualifications Procedure.
- B. The qualification papers shall be dated no earlier than six months prior to the start of the project. Welders not engaged in welding for a period of three or more months within the 6 months preceding construction must be re-qualified.

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## SECTION 01 60 60 – FACILITY STARTUP

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. Facility startup is prerequisite to satisfactory completion of the contract requirements and shall be completed within the Contract Times.
- B. Conduct all test, check out, startup, and related requirements indicated in the Contract Documents and provide documentation of same to the ENGINEER prior to requesting Substantial Completion from the ENGINEER. Where manufacturer onsite inspections are required before startup, the manufacturer shall furnish a written statement that the installation and check out is complete and proper and that the item(s) are ready for startup
- C. Startup of the facility is a complex operation requiring the combined expertise of the CONTRACTOR, Subcontractors, the ENGINEER, and the OWNER. The CONTRACTOR shall be responsible for coordinating all parties for a successful startup: the ENGINEER and OWNER shall be available for technical and operational advice prior to and during startup.
- D. General requirements for startup activities are included in this Section. More specific requirements may also be included in other portions of the Contract Documents.
- E. Temporary facilities may be necessary. If so, CONTRACTOR shall design, provide, operate, and later decommission them.
- F. During startup, product water shall be wasted.

#### 1.2 DEFINITIONS

- A. Startup is defined as testing, demonstrations, and other activities as required to achieve Substantial Completion. Startup includes pre-commissioning and commissioning activities, manufacturer's services, certifications of readiness for testing, and troubleshooting, checkout, and shakedown activities.
- B. Pre-commissioning is the systematic demonstration through testing and extended operation that major equipment and auxiliary systems, including related components, sub-systems, and systems operate properly and consistent with their intended function. Pre-commissioning involves balancing, adjustments, calibration, loop checks, and loop validation. Pre-commissioning shall simulate shutdown conditions, failure conditions, power fail and restart, bypass conditions, and failure resets. Pre-commissioning will not be considered complete until successful results and documentation of tests and manufacturer's certifications required by the Contract Documents are submitted and accepted by the ENGINEER. Pre-commissioning of all portions of the WORK shall be successfully completed prior to starting Commissioning.
- C. Commissioning is the verification that the complete WORK functions on an extended basis in full conformance with the Contract requirements.

### 1.3 SUBMITTALS

- A. **Schedule:** The schedule for startup shall be submitted in accordance to Section 01 33 00 - Contractor Submittals.
- B. **Startup Plan:** Not less than 60 Days prior to startup, submit for review a detailed Startup Plan. The CONTRACTOR shall revise the Plan as necessary based on review comments. The Plan shall include:
1. Schedules for manufacturers' equipment certifications
  2. Schedules for submitting final Technical Manuals
  3. Schedule for training the OWNER's personnel
  4. Description of temporary facilities and schedule for installation and decommissioning them
  5. List of OWNER and CONTRACTOR-furnished supplies
  6. Detailed schedule of operations to achieve successful pre-commissioning and commissioning.
  7. Checklists and data forms for each item of equipment
  8. Address coordination with the OWNER's staff.
  9. Designate a representative of the CONTRACTOR who has the authority to act in matters relating to startup and has experience in testing partial recirculating aquaculture systems, pump stations and pipelines. The Plan shall also designate the roles and responsibilities of any Subcontractors that may be involved in startup activities.
  10. Safety, startup, and testing procedures and proposed inspection and certification forms and records.
  11. Hydrostatic testing of water-holding structures and pipelines and other potable water equipment. Schedule and plan shall indicate source of water, testing and disinfection sequence, disinfection procedures, and the disposal of the water following disinfection.
- C. Records and Documentation
1. Where required by the specifications, submit equipment installation certifications under those sections.
  2. Records of startup activities.
- D. Training and Operational Support
1. One Full day of on-site training of MRS Coho Facility staff



2. Provide DVD of onsite training for use by facility personnel.
3. Review weekly water quality data collected by facility operators during the first month of operations.
4. Two 1 to 2 day site visits to provide operational support as requested by facility operators.
5. One year of technical support services beginning at the completion of successful system commissioning.

## **PART 2 -- PRODUCTS (NOT USED)**

## **PART 3 -- EXECUTION**

### **3.1 MALFUNCTIONS**

- A. During the extended operational demonstrations, all components, subsystems, systems, and equipment must properly run continuously 24 hours per day at rates indicated by the Contract Documents throughout the test period. Unless indicated otherwise, if any item fails or malfunctions during the test, the item shall be repaired and the test restarted at time zero with no credit given for the operating time before the failure or malfunction. Malfunctions satisfying all 3 of the following conditions will allow the demonstration period to resume at the elapsed time when the malfunction started:
  1. Malfunction did not cause any interruption of the continuous operation of any other components, subsystems, systems, and equipment.
  2. Malfunction was corrected without causing or requiring any components, subsystems, systems, and equipment to cease operations.
  3. Malfunction was corrected within one hour of the time the malfunction was detected (the one hour period includes the time required to locate the cause of the malfunction, beginning upon notification that a malfunction has occurred and ending when the item is corrected and the system is successfully placed back into operation).
- B. The CONTRACTOR shall arrange for manufacturer's representatives to visit the Site as often as necessary to correct malfunctions.

### **3.2 PREREQUISITES**

- A. The 7-Day demonstrations and the 8-Day demonstration shall start prior to midday on a Monday, Tuesday, or Wednesday. Testing periods shall not include holidays, based on the OWNER's calendar.
- B. The following shall be completed before pre-commissioning begins.
  1. All Technical Manual information required by the Contract Documents has been submitted.

2. Safety equipment, emergency shower and eyewash units, fire extinguishers, gas detectors, protective guards and shields, emergency repair kits, safety chains, handrails, gratings, safety signs, and valve and piping identification required by the Contract Documents are provided. Devices and equipment shall be fully functional, adjusted, and tested.
3. Manufacturer's certifications of proper installation have been accepted.
4. Leakage tests, electrical tests, and adjustments have been completed.
5. The ENGINEER has approved the Startup Plan.
6. Temporary facilities are functional, adjusted, and ready for use.
7. Individual instrumentation loops (analog, status, alarm, and control) have been verified functionally.
8. Pressure switches, flow switches, timing relays, level switches, vibration switches, temperature switches, RTD monitors, pressure regulating valves, and other control devices to the settings determined by the ENGINEER or the equipment manufacturer have been adjusted for accuracy.
9. Individual interlocks between the field-mounted control devices and the motor control circuits, control circuits of variable-speed controllers, and packaged system controls have been verified.

### 3.3 GENERAL

- A. **Startup Records:** The CONTRACTOR shall maintain the following during testing and startup and submit originals to ENGINEER:
1. Lubrication and service records for each mechanical and electrical equipment item
  2. Hours of daily operation for each mechanical and electrical equipment item
  3. Equipment alignment and vibration measurement records
  4. Logs of electrical measurements and tests
  5. Instrumentation calibration and testing logs
  6. Testing and validation of SCADA inputs, outputs, logic functions, status indications, and alarms
  7. Factory and field equipment settings
  8. Log of problems encountered and remedial action taken
  9. Other records, logs, and checklists as required by the Contract Documents

### 3.4 PRE-COMMISSIONING

- A. After individual equipment items and subsystems have been tested and certified as required by the Technical Specifications, tests of systems comprised of single or multiple equipment items with appurtenant equipment and instruments and controls shall be conducted. Items of equipment shall be tested as part of a system to the maximum extent possible.
- B. Subject to the malfunction criteria above, each system shall be demonstrated for a continuous, 7 Day, 24 hour/day period. If any system malfunctions, the item or equipment shall be repaired and the test restarted at time zero with no credit given for the elapsed time before the malfunction.
- C. The CONTRACTOR shall demonstrate the manual and automatic modes of operation to verify proper control sequences, software interlocks, proper operation of software logic and controllers, etc. System testing shall include the use of water or other process media, as applicable, to simulate the actual conditions of operation.
- D. Systems testing activities shall follow the detailed procedures and checklists in the Testing and Startup Plan. Completion of systems shall be documented by a report.
- E. The CONTRACTOR shall demonstrate utility, chemical feed, safety equipment, and other support systems before whole process systems.
- F. Furnish the ENGINEER and OWNER at least 10 Days written notice confirming the start of pre-commissioning. The OWNER's staff will observe pre-commissioning

### 3.5 COMMISSIONING

- A. The CONTRACTOR shall start up the plant and operate it without malfunction for a continuous 8 Day, 24 hour/day period. Defects that appear shall be promptly corrected.
- B. Commissioning shall not begin until leakage tests, instrumentation tests and adjustments, electrical tests and adjustments, equipment field tests, and system tests have been completed to the satisfaction of the ENGINEER.
- C. During commissioning, the CONTRACTOR shall:
  - 1. Lubricate and maintain equipment in accordance with the manufacturers' recommendations.

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## SECTION 01 77 00 - PROJECT CLOSEOUT

### PART 1 -- GENERAL

#### 1.1 FINAL CLEANUP

- A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the OWNER will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

#### 1.2 CLOSEOUT TIMETABLE

- A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the OWNER sufficient time to schedule attendance at such activities.

#### 1.3 FINAL SUBMITTALS

- A. The CONTRACTOR, prior to requesting final payment, shall obtain and submit the following items to the OWNER:
  - 1. Written guarantees, where required.
  - 2. Technical Manuals and instructions.
  - 3. Maintenance stock items; spare parts; special tools.
  - 4. Completed record drawings.
  - 5. Bonds for maintenance as required.
  - 6. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
  - 7. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.

#### 1.4 MAINTENANCE AND GUARANTEE

- A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in the Contract Documents.
- B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected

private owner or public agency releasing the OWNER from further responsibility in connection with such repair or resurfacing.

- C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the OWNER. If the CONTRACTOR fails to make such repairs or replacements promptly, the OWNER reserves the right to do the WORK and the CONTRACTOR and its surety shall be liable to the OWNER for the cost thereof.

**PART 2 -- PRODUCTS (NOT USED)**

**PART 3 -- EXECUTION (NOT USED)**

- END OF SECTION -

## SECTION 02 15 00 - COFFERDAMS AND PROTECTIVE WORKS

### PART 1--GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall design, furnish, install, maintain and remove the cofferdams or protective works required for the project facilities. The CONTRACTOR shall secure all necessary permits to complete the requirements of this Section and of the Specifications.
- B. Responsibility for Cofferdam and Protective Works Construction. The CONTRACTOR shall review the available subsurface data and river hydrology for the project site prior to bidding. It is the CONTRACTOR's responsibility to evaluate the subsurface conditions and range of potential river flows at the project site with respect to required cofferdams and protective works and develop a comprehensive design that meets the construction needs and project requirements.
  - 1. The CONTRACTOR shall be fully responsible to contract the services of qualified professionals to obtain recommendations and plans for development of a project cofferdams or protective works.
  - 2. The CONTRACTOR shall accept sole responsibility for development of the cofferdams or protective works that allow for safe and effective installation of the project facilities.
- C. The WORK includes furnishing all design, labor and equipment necessary to construct and maintain all cofferdams and protective works necessary during construction of facilities located in or adjacent to static or moving bodies of water as specified herein.
- D. All cofferdam and related protective work shall be located within the approved disturbance area limits and cofferdam boundaries as shown on the Contract Drawings.
- E. Remove all of temporary cofferdams or other temporary protective works upon completion of the facilities located in or adjacent to bodies of water.
- F. The WORK described in this Section should also be coordinated with Specification 31 23 19 – Dewatering.

#### 1.2 SUBMITTALS

- A. The CONTRACTOR shall submit a proposed cofferdam and protective works plan in accordance with Section 01 33 00 – Contractor Submittals which shall address, as a minimum, the following items:
  - 1. Type of cofferdam or other protective works to be used.
  - 2. Sequence of construction for cofferdam or other protective works related Work items.

3. Provision for limiting siltation or other effects on the rivers, streams and creeks and water bypass areas.
  4. Provisions for removal of temporary cofferdams or protective works and replacement or grading of the foundation areas following removal.
  5. Provisions for excavating and dewatering insides of the cofferdams or protective works.
  6. Regulatory requirements for cofferdam and cofferdam related activities.
  7. All calculations required to substantiate the design of the cofferdam and protective works.
- B. The cofferdam and protective works submittal will be prepared and signed by a Professional Engineer (PE) registered in the state in which the work is to be constructed and who is experienced with cofferdam design.
- C. The cofferdam and protective works plan shall be submitted for review a minimum of sixty (60) calendar days prior to planned cofferdam work, shall be subject to review, permitting and acceptance by governing authorities and the owners of any facilities utilized for water conveyance; as well as OWNER.

### 1.3 DEFINITIONS

- A. Original Ground. The elevation of the original ground surface before construction (including original ground surfaces under water).
- B. Finish Grade. Represents the grade required by the Contract Documents to be the finished ground surface upon completion of construction.

## **PART 2--PRODUCTS**

### 2.1 GENERAL

- A. The type of construction used for cofferdams or other protective works (e.g., sheetpile cofferdams, or sandbag cofferdam) shall be at the choice of the CONTRACTOR, provided that the selected alternative fulfills the requirements of project permits and the Contract Documents.
- B. Cofferdams or other protective works shall be constructed, maintained, and removed using materials and methods which do not produce siltation or other degradation of the water quality of the river or stream which exceeds the limits of applicable federal, state and local regulations.
- C. Cofferdams shall be designed and constructed of such a size that in no instance they encroach within 5 feet of disturbed areas for other work.
- D. Sheet piling or any other methods requiring disturbance below original ground surface may not be used in any archeologically sensitive areas.

### 2.2 WOOD SHEETING



- A. Wood used for sheeting, shoring and bracing will be sound; straight grained; free from shakes, loose knots, and other defects liable to impair its strength or durability; and will be Yellow Pine, Douglas Fir, or equivalent and will be either tongue-and-grooved or splined. Wood sheeting will not be less than nominal 2 inches thick.

## 2.3 STEEL SHEETING

- A. Steel sheeting will conform to ASTM A328.

## 2.4 STRUCTURAL STEEL

- A. All structural steel will conform to ASTM A36 or ASTM A992.

## 2.5 SANDBAGS IN WATER

- A. All temporary sandbags if used to be placed in water will conform to all applicable federal, state and local laws and regulations.

# **PART 3--EXECUTION**

## 3.1 COFFERDAMS

- A. Cofferdams shall be designed and construction methods will be selected by the CONTRACTOR.
  - 1. The design of the cofferdams will take into account the range of river flows which can be expected during the time allowed for in-water construction. The CONTRACTOR shall review available flow records to make this determination. If there are no flow records available, CONTRACTOR shall utilize generally accepted hydrologic models to approximate the range of expected design flows with an appropriate factor of safety.
- B. Cofferdam areas shall be dewatered such that the bottoms of the excavations within the cofferdams are firm, free of standing water, and in all respects acceptable to act as a foundation. The dewatering methods used shall prevent boiling, quick conditions, or softening of foundation strata and shall maintain the bottom of the excavation in a condition so that every phase of the WORK can be performed in the dry. Dewatering shall be performed in accordance with the requirements of Section 31 23 19 - Dewatering.
- C. After construction, the cofferdams shall be removed after areas are graded to finished grade, where indicated, or otherwise returned to original grades; however, removal of cofferdams will not occur prior to the installation and backfill of all buried utilities which lie within 30 feet of the cofferdam areas.
- D. Any loss of water and any damage to ground, structures, facilities, agricultural projects, fishery resources, or any other existing items that may be affected by the CONTRACTOR's cofferdam operations, shall be the responsibility and liability of the CONTRACTOR and will be repaired or restored by the CONTRACTOR as required, to the OWNER's satisfaction. Any damage or injury to a person directly or indirectly caused by the CONTRACTOR's cofferdam operations shall be the responsibility of the CONTRACTOR.

- E. It is the CONTRACTOR's responsibility to design, install, and maintain functionally effective and structurally sound cofferdams. The failure of the cofferdam either in function or structurally for any reason, subsurface conditions inclusive, and the consequences of such a failure and liability for such a failure, will be the responsibility of the CONTRACTOR. In the event the cofferdam has failed or is not functional as designed; the CONTRACTOR shall repair or rebuild the cofferdam at no additional cost to OWNER.

- END OF SECTION -

## SECTION 02 41 00 – DEMOLITION, SALVAGE, AND REHABILITATION

### PART 1 -- GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. The work includes furnishing all material, equipment and labor to perform demolition, recycling and demolition-related activities as shown on the Drawings and specified herein.

#### 1.2 GENERAL

- A. This section covers the dismantling, demolition, removal, and disposal of the designated facilities and clean-up and removal of existing site refuse. All materials resulting from the demolition work, unless specified otherwise, will become the property of the CONTRACTOR and will be disposed of at an approved off site location.

#### 1.3 SUBMITTALS

- A. The Procedures Proposed for Demolition Work.
  - 1. This procedure manual will provide for safe conduct of the work, removal and disposition of materials as specified, whether shown on the drawings or not, protection of property which is to remain undisturbed, and coordination with other work in progress. The procedures shall include a detailed description of the methods and equipment to be used for each operation and the dates, duration and sequence of operations

#### 1.4 DUST CONTROL

- A. The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to haul road right-of-way, occupied portions of buildings, and to avoid creation of a nuisance or damage to crops in the surrounding area. Use of water will not be permitted when it will result in or create hazardous or objectionable conditions such as ice, flooding, and pollution.

#### 1.5 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The CONTRACTOR shall take all necessary precautions to ensure against damage to existing facilities and trees to remain in-place, to be reused, or to remain the property of designated receivers of such property, and any damage to such facilities shall be repaired or replaced as approved. Existing facilities shall not be removed prior to approval of the submittal required by subparagraph 1.3.A.

#### 1.6 COORDINATION

- A. The CONTRACTOR shall carefully coordinate the WORK in areas where existing facilities are interconnected with new facilities and where existing facilities remain operational. The WORK as indicated is not all inclusive, and the CONTRACTOR shall be responsible to perform the reconstruction indicated plus that which can be reasonably

inferred from the Contract Documents as necessary to complete the Project. The Specifications and Drawings identify the major facilities that shall be demolished and reconstructed, but auxiliary utilities such as water, drainage, electrical are not necessarily shown.

- B. The CONTRACTOR shall note that the Drawings used to indicate demolition and reconstruction are based on record drawings of the existing site and related topographic survey work. Prior to beginning construction, the CONTRACTOR shall conduct a comprehensive review at the Site to verify the correctness and exactness of the Drawings, the scope of WORK, and the extent of auxiliary utilities

#### 1.7 DEMOLITION

- A. Existing pavement, structures, utilities, and related appurtenances such as anchors, supports, and hardware indicated or required to be demolished as part of the WORK shall be removed and disposed of unless otherwise indicated. Removal of buried structures, utilities, and appurtenances includes the related excavation and backfill as required. Removed items shall be disposed of offsite by the CONTRACTOR.

#### 1.8 REHABILITATION

- A. Existing civil, landscaping, structural, architectural, WORK disturbed or damaged by reconstruction activities shall be repaired and rehabilitated as indicated.
- B. Damaged items shall be repaired or replaced with new items to restore items or surfaces to a condition equal to and matching that existing prior to damage.

#### 1.9 DISPOSAL AND RECYCLING

- A. The CONTRACTOR shall be responsible for the offsite disposal of debris resulting from reconstruction in compliance with local, state, and federal codes and requirements. Demolition debris shall be recycled to the degree practical.

### **PART 2 -- PRODUCTS (NOT USED)**

### **PART 3 -- EXECUTION**

#### 3.1 DEMOLITION

- A. All existing concrete slabs and other items not designated for salvage or to remain shall become property of the CONTRACTOR and will be demolished and removed from the project sites.

#### 3.2 DISPOSAL

- A. Materials resulting from the demolition work shall be disposed of at an approved offsite location. Rubbish and debris will be removed daily to prevent hazardous accumulation within the work areas. Materials that cannot be removed daily will be stored in areas as directed.

#### 3.3 RESTORATION OF WORK AREAS

- A. Work areas shall be graded and finished to designed contours and provide smooth transitions into natural and existing drainage patterns, and grass will then be seeded. .

- END OF SECTION -

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## SECTION 03 11 13 - CONCRETE FORMING

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall furnish concrete formwork, bracing, shoring, and supports for cast-in-place concrete and shall design and construct falsework, all in accordance with the Contract Documents.

#### 1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.
- B. Manufacturer's information demonstrating compliance with requirements for the following:
1. Form ties and related accessories, including taper tie plugs, if taper ties are used.
  2. Form gaskets.
  3. Form release agent, including NSF certification if not using mineral oil.
  4. Manufacturer's information on formwork, form materials, and locations for use.

#### 1.3 QUALITY CONTROL

- A. **Tolerances:** The variation from required lines or grade shall not exceed 1/4-inch in 10-foot, non-cumulative, and there shall be no offsets or visible waviness in the finished surface. Other tolerances shall be within the tolerances of ACI 117 - Standard Tolerances for Concrete Construction and Materials

### PART 2 -- PRODUCTS

#### 2.1 GENERAL

- A. Except as otherwise expressly accepted by the OWNER, lumber brought on the Site for use as forms, shoring, or bracing shall be new material. Forms shall be smooth surface forms and shall be of the following materials:

Walls	Steel, fiberglass, or plywood panel
Columns	Steel, plywood or fiberglass
Roof and floor	Plywood
All other WORK	Steel panels, fiberglass, plywood or tongue and groove lumber

- B. Form materials that may remain or leave residues on or in the concrete shall be certified as compliant with NSF Standard 61 – Drinking Water System Components.

## 2.2 FORM AND FALSEWORK MATERIALS

- A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
  1. Lumber shall be Douglas Fir or Southern Yellow Pine, construction grade or better, in conformance with U.S. Product Standard PS 20 - American Softwood Lumber Standard
  2. Plywood for concrete formwork shall be new, waterproof, synthetic resin bonded, exterior type Douglas Fir or Southern Yellow Pine plywood manufactured especially for concrete formwork, shall conform to the requirements of PS 1 – Construction and Industrial Plywood, for Concrete Forms, Class I, and shall be edge sealed.
  3. Form materials shall be metal, wood, plywood, or other material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade indicated. Metal forms shall accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.
  4. Steel leave in place forms shall not be used.
- B. Unless otherwise indicated, exterior corners in concrete members shall be provided with 3/4-inch chamfers or be tooled to 1/2-inch radius. Re-entrant corners in concrete members shall not have fillets unless otherwise indicated.
- C. Forms and falsework to support the roof and floor slabs shall be designed for the total dead load, plus a live load of 50 psf minimum. The minimum design load for combined dead and live loads shall be 100 psf.

## 2.3 FORM TIES

- A. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to insure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties or other removable form tie fasteners having a circular cross-section shall not exceed 1-1/2 inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures shall have integral waterstops that tightly fit the form tie so that they cannot be moved from mid-point of the tie. Form ties shall be **Snap-Ties** by **Dayton/Richmond**; or equal.
- B. Removable taper ties may be used when approved by the OWNER. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie. Use **Taper-Tie** by **MeadowBurke**, **Taper-Tie** by **Dayton/Richmond**, or equal.



## PART 3 -- EXECUTION

### 3.1 GENERAL

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The CONTRACTOR shall assume full responsibility for the adequate design of forms, and any forms that are unsafe or inadequate in any respect shall promptly be removed from the WORK and replaced. Provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be available to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state, and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by CONTRACTOR's personnel and shall be in sufficient number and properly installed. During concrete placement, the CONTRACTOR shall continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. Concrete forms shall conform to the shape, lines, and dimensions of members required, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and shape under a load of freshly-placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.
- C. Forms shall be removed unless approved otherwise by the OWNER.

### 3.2 FORM DESIGN

- A. Forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Plywood, 5/8-inch and greater in thickness, may be fastened directly to studding if the studs are spaced close enough to prevent visible deflection marks in the concrete. The forms shall be tight so as to prevent the loss of water, cement, and fines during placing and vibrating of the concrete.

### 3.3 CONSTRUCTION

- A. **Vertical Surfaces:** Vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is indicated. Not less than 1-inch of concrete shall be added to the indicated thickness of a concrete member where concrete is permitted to be placed against trimmed ground in lieu of forms. Permission to do this on other concrete members will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.

B. **Construction Joints:** Concrete construction joints will not be permitted at locations other than those indicated, except as may be acceptable to the OWNER. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.

C. Form Ties

1. **Embedded Ties:** Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties that cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of the concrete.
2. **Removable Ties:** Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with non-shrink grout for water bearing and below-grade walls. The hole shall be completely filled with non-shrink or regular cement grout for above-grade walls that are dry on both sides. Exposed faces of walls shall have the outer 2-inches of the exposed face filled with a cement grout that shall match the color and texture of the surrounding wall surface.

### 3.4 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the OWNER. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the OWNER

### 3.5 REMOVAL OF FORMS

- A. Careful procedures for the removal of forms shall be strictly followed, and this WORK shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. In the case of roof slabs and above-ground floor slabs, forms shall remain in place until test cylinders for the roof concrete attain a minimum compressive strength of 75 percent of the 28 Day strength in Section 03 30 00. No forms shall be disturbed or removed under an individual panel or unit before the

concrete in the adjacent panel or unit has attained 75 percent of the 28 Day strength and has been in place for a minimum of 7 Days. Forms for vertical walls of waterholding structures shall remain in place at least 36 hours after the concrete has been placed. Forms for parts of the WORK not specifically mentioned herein shall remain in place for periods of time as recommended in ACI 347 - Guide to Formwork for Concrete.

### 3.6 MAINTENANCE OF FORMS

- A. Forms shall be maintained in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the OWNER. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the CONTRACTOR shall perform the oiling at least 2 weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

### 3.7 FALSEWORK

- A. The CONTRACTOR shall be responsible for the design, engineering, construction, maintenance, and safety of falsework, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and Health Standards for Construction, and the requirements herein.
- B. Falsework shall be designed and constructed to provide the necessary rigidity and to support the loads. Falsework for the support of a superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.
- C. Falsework shall be placed upon a solid footing, safe against undermining, and be protected from softening. When falsework is supported on any portion of the structure which is already constructed, the load imposed by the falsework shall be spread, distributed, and braced in such a way as to avoid any possibility of damage to the structure.

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## **SECTION 03 20 00 - REINFORCEMENT STEEL**

### **PART 1 -- GENERAL**

#### **1.1 SUMMARY**

- A. The CONTRACTOR shall provide reinforcement steel and appurtenant WORK, complete and in place, in accordance with the Contract Documents.

#### **1.2 CONTRACTOR SUBMITTALS**

- A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.
- B. Shop Drawings
  - 1. Shop bending diagrams, placing lists, and drawings of reinforcement steel prior to fabrication. The shop bending diagrams shall show the actual lengths of bars to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. Include bar placement diagrams that clearly indicate the dimensions of each bar splice.
  - 2. Details of the concrete reinforcement steel and concrete inserts shall be submitted at the earliest possible date after receipt by the CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 - Details and Detailing of Concrete Reinforcement and the requirements herein.

#### **1.3 QUALITY CONTROL**

- A. If requested by the OWNER, the CONTRACTOR shall furnish samples from each heat of reinforcement steel in a quantity adequate for testing. Costs of initial tests will be paid by the OWNER. Costs of additional tests if material fails initial tests shall be the CONTRACTOR's responsibility.

### **PART 2 -- PRODUCTS**

#### **2.1 MATERIAL REQUIREMENTS**

- A. Materials that may remain or leave residues on or within the concrete shall be certified as compliant with NSF Standard 61- Drinking Water System Components.

#### **2.2 REINFORCEMENT STEEL**

- A. Reinforcement steel for cast-in-place reinforced concrete construction shall conform to the following requirements:
  - 1. Bar and spiral reinforcement shall conform to ASTM A 615 - Deformed and Plain Billet - Steel Bars, for Grade 60 reinforcement unless otherwise indicated.

## B. Accessories

1. Accessories shall include necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. Bar supports shall meet the requirements of the CRSI Manual of Standard Practice, including special requirements for supporting epoxy-coated reinforcing bars. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating that extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.
2. Concrete blocks (dobies) used to support and position reinforcement steel shall have the same or higher compressive strength as required for the concrete in which they are located. Wire ties shall be embedded in concrete block bar supports.

## 2.3 EPOXY GROUT

- A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet Section 03 60 00 - Grout.

## PART 3 -- EXECUTION

### 3.1 GENERAL

- A. Reinforcement steel and other appurtenances shall be fabricated, and placed in accordance with the Building Code and the supplementary requirements herein.

### 3.2 FABRICATION

#### A. General

1. Reinforcement steel shall be accurately formed to the dimensions and shapes indicated, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318 - Building Code Requirements for Reinforced Concrete, except as modified by the Drawings. Bars shall be bent cold. Bars shall be bent per ACI 318.
2. The CONTRACTOR shall fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings.

- B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall satisfy the following fabricating tolerances:

1. Sheared length: plus and minus 1-inch
2. Depth of truss bars: plus zero, minus 1/2-inch
3. Stirrups, ties, and spirals: plus and minus 1/2-inch
4. Other bends: plus and minus 1-inch

### 3.3 PLACING

- A. Reinforcement steel shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. Reinforcement steel shall be supported by concrete, plastic or metal support spacers, or metal hangers that are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. Concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties that are embedded in the blocks. For concrete over formwork, the CONTRACTOR shall provide concrete, metal, plastic, or other acceptable bar chairs and spacers.
- B. Limitations on the use of bar support materials shall be as follows.
  - 1. Concrete Dobies
    - a. Permitted at any location except where architectural finish is required.
    - b. Required for slabs on grade and surfaces in contact with or above ozonated process water.
  - 2. Wire Bar Supports: permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces where covered with waterproofing.
  - 3. Plastic Bar Supports: permitted at every location except on grade.
- C. Tie wires shall be bent away from the forms in order to provide the required concrete coverage.
- D. Bars additional to those indicated that may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position shall be provided by the CONTRACTOR at its own expense.
- E. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits in Section 7.5 of ACI 318 except where in conflict with the Building Code.
- F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be as reviewed and accepted by the OWNER.
- G. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

### 3.4 SPACING OF BARS

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars, nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one-inch.
- B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one-inch.
- C. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

### 3.5 SPLICING

#### A. General

- 1. Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at points other than where indicated, the character of the splice shall be as reviewed and accepted by the OWNER.
- 2. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

#### B. Splices of Reinforcement

- 1. The length of lap for reinforcement bars, unless otherwise indicated, shall be in accordance with ACI 318, Section 12.15.1 for a Class B splice.

- C. **Bending or Straightening:** Reinforcement shall not be straightened or re-bent in a manner which will injure the material. Bars shall be bent or straight as indicated. Do not use bends different from the bends indicated. Bars shall be bent cold, unless otherwise permitted by the OWNER. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the OWNER.

### 3.6 CLEANING AND PROTECTION

- A. Reinforcement steel shall always be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary, re-cleaned.

- END OF SECTION -



## SECTION 03 29 00 - JOINTS IN CONCRETE

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide joints in concrete, complete and in place, in accordance with the Contract Documents.
- B. Joints in concrete structures shall be the types defined below and will be permitted only where indicated, unless specifically accepted by the ENGINEER.

#### 1.2 TYPES OF JOINTS

##### A. Construction Joints

- 1. When fresh concrete is placed against a hardened concrete surface, the joint between the pours shall be defined as a construction joint.
- 2. Unless otherwise indicated, joints in water-bearing members shall be provided with a waterstop and/or sealant groove of the shape indicated.

##### B. Contraction Joints

- 1. Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the earlier pour.
- 2. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, in order to allow shrinkage of the concrete of the later pour.
- 3. Waterstop and/or sealant groove shall be provided where indicated.

##### C. Expansion Joints

- 1. In order to allow the concrete to expand freely, a space shall be provided between the 2 pours, and the joint shall be formed as indicated.
- 2. The space shall be obtained by placing a filler joint material against the earlier pour to act as a form for the later pour.
- 3. Unless otherwise indicated, expansion joints in water bearing members shall be provided with a center-bulb type waterstop.
- 4. Provide premolded expansion joint material with the edge at the indicated distance below or back from the finished concrete surface.

5. Provide a slightly tapered, dressed and oiled wooden strip secured to or placed at the edge of the expansion joint during concrete placement, and remove the strip later to form a space for the sealing material.
6. The space so formed shall be filled with a joint sealant material as indicated below. In order to keep the two wall or slab elements in line
7. If indicated on the drawings, the joint shall be provided with a sleeve-type dowel as indicated.

D. Control Joints

1. The function of the control joint is to provide a weaker plane in the concrete where shrinkage cracks would likely occur.
2. Formed Groove
  - a. A groove, of the shape and dimensions indicated, shall be formed or saw-cut in the concrete and the groove shall then be filled with a joint sealant material.
  - b. The formed groove shall be placed in the first of the two sections cast at the control joint, in order to assure that the sealant bonds to the second section across the joint and not to the cement paste from the first pour.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.
- B. Shop Drawings
  1. Furnish placement drawings showing the location and types of joints for each structure.
  2. Test Reports
    - a. Furnish certified test reports from the sealant manufacturer on the actual batch of material supplied, demonstrating compliance with the indicated requirements.
    - b. Furnish the test reports before using the sealant on the Project.
  3. Welding Certification
    - a. Furnish copies of the waterstop welding certification by manufacturer or authorized agent of the manufacturer.
    - b. Every person who is to be involved with waterstop installation shall be required to have individual certification on file with the ENGINEER,

stating that the named individual is certified and trained to install waterstop in accordance with the manufacturer's recommendations and specifications.

4. Furnish manufacturer's information demonstrating compliance of the following with the indicated requirements:
  - a. bearing pad
  - b. neoprene sponge
  - c. preformed joint filler
  - d. backing rod
  - e. waterstop
  - f. slip dowels

C. Samples

1. Prior to production of the material required under this Section, submit qualification samples of waterstops which accurately represent the material being provided.
2. Such samples shall be extruded or molded sections of each size or shape to be installed.
3. The balance of the material to be used shall not be produced until after the ENGINEER has reviewed the qualification samples.

D. Certificates

1. Furnish written certification from the manufacturer, as an integral part of the shipping form, that the material shipped to the Site meets or exceeds the indicated physical property requirements.
2. Supplier certificates will not be accepted.

1.4 QUALITY CONTROL

A. Waterstop Inspection

1. Waterstop field joints shall be subject to inspection, and no such WORK shall be scheduled or started without having made prior arrangements with the ENGINEER for the required inspections.
2. Provide not less than 24 hours notice for the scheduling of such inspections.
3. Field joints in waterstops shall be subject to inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects that

would reduce the potential resistance of the material to water pressure at any point.

4. Defective field joints shall be replaced with material that passes inspection, and faulty material shall be removed from the Site and destroyed.
- B. Waterstop Defects. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:
1. Offsets at joints greater than 1/16 inch or 15 percent of material thickness at any point, whichever is less
  2. Exterior cracking at the joint due to incomplete bond, which is deeper than 1/16 inch or 15 percent of material thickness at any point, whichever is less
  3. Any combination of offset or exterior cracking that will result in a net reduction in the cross-section of the waterstop in excess of 1/16 inch or 15 percent of material thickness at any point, whichever is less
  4. Misalignment of the joint which results in misalignment of the waterstop in excess of 1/2 inch in 10 feet
  5. Porosity in the welded joint as evidenced by visual inspection
  6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a penknife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)
  7. Visible signs of separation when the cooled splice is bent by hand at any sharp angle
  8. Evidence of burned material
- C. Waterstop Samples
1. Prior to use of the waterstop material in the field, a sample of a prefabricated (shop made fitting) mitered cross and a tee constructed of each size or shape of material to be used shall be submitted.
  2. Samples shall be prefabricated (shop made fitting) so that the material and workmanship represent the fittings to be provided.
  3. In addition, field samples of prefabricated fittings (crosses, tees, and the like) may be selected at random by the ENGINEER for testing by a laboratory at the OWNER's expense.
  4. When tested, the tensile strength across the joints shall be at least 1120 psi for PVC waterstops and 10,000 psi for stainless steel waterstops.

D. Construction Joint Sealant

1. The CONTRACTOR shall prepare adhesion and cohesion test specimens at intervals of 5 Days while sealants are being installed.
2. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:
  - a. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch).
  - b. Spacing between the blocks shall be one inch.
  - c. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to set and hold sealant cross-sections of 1/2-inch by 2-inch with a width of one inch.
  - d. The sealant shall be cast and cured in accordance with the manufacturer's recommendations, except that the curing period shall be not less than 24 hours.
  - e. Following the curing period, the gap between the blocks shall be widened to 1-1/2 inches, and spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.5 SPECIAL CORRECTION OF DEFECTS REQUIREMENT

- A. The CONTRACTOR shall furnish a 5-year written warranty of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that the CONTRACTOR agrees to repair or replace, to the satisfaction of the OWNER, any defective areas which become evident within the 5-year period.

**PART 2 -- PRODUCTS**

2.1 GENERAL

- A. Joint materials shall be listed as compliant with NSF Standard 61.

2.2 WATERSTOPS

A. PVC Waterstops

1. Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the indicated requirements of this Section.
2. No reclaimed or scrap material shall be used.

3. The CONTRACTOR shall obtain from the waterstop manufacturer and shall furnish to the ENGINEER for review, current test reports and a written certification of the manufacturer that the material to be shipped to the Site meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572-PVC Waterstops, and those indicated.
4. Flatstrip and Center-Bulb Waterstops
  - a. Flatstrip and center-bulb waterstops shall be manufactured such that at no place shall the thickness of waterstops, including the center bulb type, be less than 3/8 inch.
  - b. The waterstop shall be provided with hog rings installed at 12 inches on centers along the waterstop.
  - c. Shapes shall be as indicated, or as acceptable to the ENGINEER.
5. Multi-Rib Waterstops
  - a. Multi-rib waterstops shall be as indicated or as acceptable to the ENGINEER.
  - b. Prefabricated joint fittings shall be used at intersections of the ribbed-type waterstops.
6. Retrofit Waterstops
  - a. Retrofit waterstops and batten bars shall be as indicated or as acceptable to the ENGINEER.
  - b. The waterstop shall be supplied as a complete system including waterstop, SS batten bar, SS anchor bolts, and epoxy gel.
7. When tested in accordance with the indicated test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std
Tensile Strength-min, psi	2000	D 638, Type IV
Ultimate Elongation-min, percent	350	D 638, Type IV
Low Temp Brittleness, max degrees F	-35	D 746
Stiffness in Flexure, min, psi	600	D 747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min, psi	1500	D 638, Type IV

Ultimate Elongation, min, percent	300	D 638, Type IV
Effect of Alkalies (CRD-C572)		
Change in Weight, percent	plus 0.25/minus 0.10	-----
Change in Durometer, Shore A	plus and minus 5	D 2240
Finish Waterstop		
Tensile Strength-min, psi	1400	D 638, Type IV
Ultimate Elongation, min percent	280	D 638, Type IV

B. Preformed Hydrophilic Waterstop

1. Hydrophilic (bentonite-free) waterstops shall be **Hydro-Flex Waterstop** as manufactured by **Henry Co.**, or **Earthshield Type 23**, as manufactured by **JP Specialties**, or equal.
2. The cross-sectional area of the waterstop shall not be less than 0.5 square inch.
3. Hydrophilic waterstop shall be the type that expands in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.
4. The waterstop shall be manufactured from butyl rubber with hydrophilic properties.
5. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
6. The minimum expansion ratio of modified chloroprene shall be not less than 2-to-1 volumetric change in distilled water at 70 degrees F (21 degrees C).
7. The bonding agent for hydrophilic waterstop shall be the manufacturer's recommended adhesive for wet, rough concrete.

- C. When types of waterstops not listed above are indicated, they shall be subjected to the same requirements as those listed in this Section.

2.3 JOINT SEALANT FOR WATER-BEARING JOINTS

- A. The joint sealant shall be a polyurethane polymer designed for bonding to concrete which is continuously submerged in water.

- B. No material will be accepted which has an unsatisfactory history as to bond or durability when used in the joints of water-retaining structures.
- C. Joint sealant material shall meet the following requirements (73 degrees F and 5 percent R.H.):

Work Life, minutes	45 - 180
Time to Reach 20 Shore A Hardness (at 77 degrees F, 200 gram quantity), max	24 hours
Ultimate Hardness (ASTM D 2240, Shore A)	20 - 45
Tensile Strength (ASTM D 412), min	175 psi
Ultimate Elongation (ASTM D 412), minimum	400 percent
Tear Resistance (Die C, ASTM D 624), pounds per inch of thickness, min	75
Color	Light Gray

- D. Polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:
  1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ASTM C 920 – Elastomeric Joint Sealant, or Federal Specification TT-S-0227 E(3) - Sealing Compound, Elastomeric Type, Multicomponent, for Caulking, Sealing, and Glazing Buildings and Other Structures, for 2-part material, as applicable.
  2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used, conforming to the requirements of ASTM C 920, Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.
  3. For plane horizontal joints, use the self-leveling compounds meeting the requirements of ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I.
  4. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics and having a Shore A hardness range of 35 to 45 shall be used.
  5. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the manufacturer.

E. Sealant Manufacturers



1. Sealants shall be **PSI-270** as manufactured by **Polymeric Systems Inc.**, **Sikaflex 2C**, as manufactured by **Sika Corporation**, or equal.
- F. Sealants for non-waterstop joints in concrete shall be in conformance with the requirements of Section 07 92 00 – Joint Sealants.

## 2.4 JOINT MATERIALS

### A. **Bearing Pad**

1. The bearing pad shall be neoprene conforming to ASTM D 2000 - Standard Classification System for Rubber Products in Automotive Applications, BC 420, 40 durometer hardness, unless otherwise indicated.

### B. **Neoprene Sponge**

1. The sponge shall be neoprene, closed-cell, expanded, conforming to ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber, Type 2C5-E1.

### C. **Joint Filler**

1. Joint filler for expansion joints in waterholding structures shall be neoprene conforming to ASTM D 1056, Type 2C5-E1.
2. Joint filler material in other locations shall be of the preformed non-extruding type, constructed of cellular neoprene sponge rubber or polyurethane of firm texture.
3. Bituminous fiber type will not be accepted.
4. Non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, for Type I, except as otherwise indicated.

## 2.5 BACKING ROD

- A. The backing rod shall be an extruded closed-cell, polyethylene foam rod.
- B. The rod material shall be compatible with the joint sealant material, and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi.
- C. The rod shall be 1/8 inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

## 2.6 SLIP DOWELS

- A. Slip dowels in joints shall be smooth epoxy-coated bars conforming to ASTM A 775 - Epoxy Coated Reinforcing Steel Bars.

## 2.7 PVC TUBING

- A. PVC tubing in joints shall be SDR 13.5, conforming to ASTM D 2241 - Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

# **PART 3 -- EXECUTION**

## 3.1 GENERAL

- A. Waterstops shall be embedded in the concrete across joints as indicated.
- B. Waterstops shall be fully continuous for the extent of the joint.
- C. Splices necessary to provide such continuity shall conform to the printed instructions of the waterstop manufacturer.
- D. The CONTRACTOR shall take suitable precautions and provide means to support and protect the waterstops during the progress of the WORK, and shall repair or replace any waterstops damaged during progress of the WORK at no additional cost to the OWNER.
- E. Waterstops shall be stored so as to permit free circulation of air around the waterstop material.
- F. When any waterstop is installed in the concrete on one side of a joint while the other portion of the waterstop remains exposed to the atmosphere for more than 2 Days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure time until the exposed portion of waterstop is embedded in concrete.

## 3.2 SPLICES IN PVC WATERSTOPS

- A. Splices in PVC waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations.
- B. It is essential that:
  - 1. The material shall not be damaged by heat sealing.
  - 2. The splices shall have a tensile strength of not less than 80 percent of the unspliced material.
  - 3. The continuity of the waterstop ribs and of its tubular center axis shall be maintained.

4. No edge welding will be accepted.
- C. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.
- D. Other Joints
  1. Joints with waterstops involving more than 2 ends to be jointed together, and joints that involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections, shall be prefabricated prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint.
  2. Upon inspection and approval, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt-welded to the straight run portions of waterstop in place in the forms.
- E. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

### 3.3 JOINT CONSTRUCTION

#### A. Setting Waterstops

1. In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken as to the correct positioning of the waterstops during installation.
2. Adequate provisions shall be made to support and anchor the waterstops during the progress of the WORK and to ensure proper embedment in the concrete.
3. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints.
4. The center axis of the waterstops shall be coincident with the joint openings.
5. Thoroughly work the concrete in the vicinity of joints for maximum density and imperviousness.

#### B. Waterstop Placement

1. In placing waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed.
2. Waterstops shall be held in place with light wire ties on 12-inch centers, which shall be passed through hog rings at the edge of the waterstop and tied to the curtain of reinforcing steel.

3. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked.
4. In placing concrete around horizontal waterstops with their flat face in a horizontal plane, the concrete shall be worked under the waterstops by hand in order to avoid the formation of air and rock pockets.
5. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
6. Waterstop in vertical wall joints shall terminate 6 inches from the top of the wall, where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.

#### C. Joint Location

1. Construction joints and other types of joints shall be provided where indicated.
2. If not indicated, construction joints shall be provided at a 25-foot maximum spacing.
3. Where joints are indicated to be spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing.
4. The location of joints, regardless of type, shall be submitted for acceptance by the ENGINEER.

#### D. Joint Preparation

1. Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required.
2. Unless otherwise indicated, such bonding shall be required at every horizontal joint in walls.
3. Surfaces shall be prepared in accordance with Section 03 30 00 – Cast-in-Place Concrete.

#### E. Retrofit Joint Preparation

1. Existing surfaces to receive a retrofit waterstop shall be clean and free from any loose or foreign material.
2. The surface shall be given a light sandblast or hydroblast finish to 1/8-inch amplitude prior to the application of epoxy and waterstop.

#### F. Construction Joint Sealant

1. Construction joints in water-bearing floor slabs and elsewhere as indicated shall be provided with tapered grooves which shall be filled with a construction joint sealant.
2. The material used to form the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant.
3. After removing the forms from the grooves, laitance and fins shall be removed, and the grooves shall be sand blasted.
4. The grooves shall be allowed to thoroughly dry, after which they shall be blown out and immediately thereafter they shall be primed and filled with the construction joint sealant.
5. The primer shall be furnished by the sealant manufacturer, and no sealant shall be used without a primer.
6. Care shall be used to completely fill the sealant grooves.
7. Areas designated to receive a sealant fillet shall be thoroughly cleaned as outlined for the tapered grooves prior to application of the sealant.
8. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application.
9. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant.
10. The sealant shall achieve final cure at least 7 Days before the structure is filled with water.
11. The sealant shall be installed by a competent waterproofing specialty contractor with a successful record of performance in similar installations.

#### G. Mixing

1. Catalyst-cured, 2-part materials shall be thoroughly and uniformly mixed, and special care shall be taken to properly mix the sealer before its application.
2. Before any sealer is placed, the CONTRACTOR shall arrange to have workers performing the WORK carefully instructed on the proper method of mixing and application by a representative of the sealant manufacturer.

#### H. Failure to Cure

1. Any joint sealant that fails to fully and properly cure after the manufacturer's recommended curing time for the conditions of the WORK shall be

completely removed, and the groove shall be thoroughly sandblasted to remove traces of the uncured or partially cured sealant and primer.

2. The groove shall be re-sealed with the indicated joint sealant.
3. Costs of such removal, joint treatment, re-sealing, and appurtenant WORK shall be the CONTRACTOR's responsibility as part of the WORK.

I. Hydrophilic Waterstop

1. Where a hydrophilic waterstop is indicated, it shall be installed in accordance with the manufacturer's instructions and recommendations except as may be modified in this Section.
2. When requested by the ENGINEER, the CONTRACTOR shall arrange for the manufacturer to furnish technical assistance in the field.
3. Hydrophilic waterstop shall only be used where complete confinement by concrete is provided.
4. Hydrophilic waterstop shall not be used in expansion or contraction joints nor in the first 6 inches of a non-intersecting joint.
5. Location
  - a. The hydrophilic waterstop shall be located as near as possible to the center of the joint, and it shall be continuous around the entire joint.
  - b. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.
6. Placement
  - a. Where the thickness of the concrete member to be placed on the hydrophilic waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete.
  - b. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide.
  - c. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2-1/2 inches.
7. Where a hydrophilic waterstop is used in combination with PVC waterstop, the hydrophilic waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be adhered to PVC waterstop by a single component water-swelling sealant as recommended by the manufacturer.
8. The hydrophilic waterstop shall not be installed where the air temperature falls below the manufacturer's recommended range.

9. Preparation

- a. The concrete surface under the hydrophilic waterstop shall be smooth and uniform, and the concrete shall be ground smooth if needed.
- b. Alternatively, the hydrophilic waterstop shall be bonded to the surface using an epoxy grout that completely fills voids and irregularities beneath the waterstop material.
- c. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.

10. Securing

- a. The hydrophilic waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing.
- b. The above requirement shall be in addition to the adhesive recommended by the manufacturer.

J. Retrofit Waterstop

1. Retrofit waterstops shall be set in a bed of epoxy over a sandblasted surface with stainless steel batten bars and 1/4-inch diameter stainless steel anchors at 6 inches on-center, staggered, and in accordance with the manufacturer's written recommendations.

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## SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide cast-in-place concrete in accordance with the Contract Documents.
- B. The term "hydraulic structure" used in these Specifications means environmental engineering concrete structures for the containment, treatment, or transmission of water, wastewater, other fluids, or gases.
- C. The following types of concrete are covered in this Section:
  - 1. Structural Concrete
    - a. CM1: Concrete Mix 1 shall be used for foundations, foundation walls, and slabs for the Hatchery, Shop and Residential Buildings.
    - b. CM2: Concrete Mix 2 shall be used for all water conveying structures and structures exposed to the environment, including the but not limited to the Adult Holding, Surface Water Microstrainer and Clarifier structures
  - 2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, fence and guard post embedment, underground duct bank encasement, and other concrete appurtenant to electrical facilities unless otherwise indicated.
  - 3. Lean Concrete: Concrete to be used for thrust blocks, pipe trench cut-off blocks, and cradles that are indicated on the Drawings as unreinforced. Lean concrete shall be used as protective cover for dowels intended for future connections.

#### 1.2 CONTRACTOR SUBMITTALS

- A. **Mix Designs:** Prior to beginning the WORK and within 14 Days of the Notice to Proceed, submit preliminary concrete mix designs which shall show the name of the batch plant where the concrete will be batched, the concrete strength, slump, water to cementitious ratio, and the proportions and gradations of materials, including source, proposed for each class and type of concrete. Costs related to laboratory testing shall be CONTRACTOR's responsibility as part of the WORK. The submittal shall conform to ACI 318, ACI 211.5R and ACI 301. The documentation of compressive strength shall be based on one of the following:
  - 1) Record of Past Performance: Provide a minimum of 15 field tests, not more than 12 months old, for the proposed mix design, validating the compressive strength at the specified age, slump and temperature of the mix at the time of testing. Tests shall be by an independent testing laboratory.
  - 2) Trial Batch: If record of past performance is not available provide a trial batch of the proposed mix design and batches with a varied water to cementitious ratio less than and greater than the proposed water to cementitious ratio. Tests shall be by an independent testing laboratory

- B. **Delivery Tickets:** Where ready-mix concrete is used, the CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state-certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, the amount of water in the aggregate added at the batching plant, and the amount allowed to be added at the Site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.
- C. Additional Submittals. Test data relating to the cement, aggregate, and admixtures shall be less than 6 months old. Furnish the following submittals in accordance with ACI 301 – Structural Concrete:
1. Mill tests for cement.
  2. Admixture certification. Chloride ion content shall be included.
  3. Aggregate gradation test results and certification.
  4. Materials and methods for curing.

### 1.3 QUALITY CONTROL

#### A. General

1. Tests on component materials and for compressive strength and shrinkage of concrete shall be performed as indicated. Tests for determining slump shall be in accordance with ASTM C 143 – Test Method for Slump of Hydraulic Cement Concrete.
2. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness, according to ASTM C 33 – Concrete Aggregates.
3. The cost of laboratory tests on cement, aggregates, and concrete shall be the CONTRACTOR's responsibility. The cost of laboratory tests on field-placed cement, aggregates, and concrete will be the OWNER'S responsibility. However, the CONTRACTOR shall be responsible for the cost of any tests and investigations of WORK that is determined to be Defective WORK. The laboratory shall meet or exceed ASTM C 1077 – Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation.
4. Concrete for testing shall be furnished by the CONTRACTOR, and the CONTRACTOR shall assist the ENGINEER in obtaining samples and disposal and cleanup of excess material.

#### B. Field Compression Tests

1. Compression test specimens shall be taken during construction from the first placement of each type of concrete and at intervals thereafter as selected by the ENGINEER to insure continued compliance with the Specifications. Each set of specimens shall be a minimum of 5 cylinders.

2. Compression test specimens for concrete shall be made in accordance with Section 9.2 of ASTM C 31 – Practices for Making and Curing Concrete Test Specimens in the Field. Specimens shall be 6-inches diameter by 12-inches tall cylinders.
3. Compression tests shall be performed in accordance with ASTM C 39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens. One test cylinder will be tested at 7 Days and 2 at 28 Days. The remaining cylinders will be held to verify test results, if needed.

C. Evaluation and Acceptance of Concrete

1. Evaluation and acceptance of the compressive strength of concrete will be according to ACI 318 – Building Code Requirements for Reinforced Concrete, Chapter 5 "Concrete Quality," and as indicated.
2. A statistical analysis of compression test results will be performed according to ACI 214 – Recommended Practice for Evaluation of Strength Test Methods. The standard deviation of the test results shall not exceed 640 psi, when ordered at equivalent water content as estimated by slump.
3. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for subsequent batches of the type of concrete affected.
4. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any 3 consecutive tests being below the required compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard deviation.
5. Concrete that fails to meet the ACI requirements and these Specifications is subject to removal and replacement.

D. **Aggregate Testing:** Aggregate testing shall be performed within 12 months of the start of construction and every 12 months during construction to determine continued compliance.

E. **Construction Tolerances:** The CONTRACTOR shall set and maintain concrete forms and perform finishing operations to ensure that the completed WORK is within tolerances. Surface defects and irregularities are defined as finishes and are different from tolerances. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Drawings. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117 – Standard Tolerance for Concrete Construction and Materials.

1. The following non-cumulative construction tolerances apply to finished walls and slabs unless otherwise indicated:

Item	Tolerance
Variation of the constructed linear outline from the established position in plan.	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch

Variation from the level or from the grades indicated.	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch
Variation from plumb	In 10-feet: 1/4-inch; In 20-feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch; Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

## PART 2 -- PRODUCTS

### 2.1 CONCRETE MATERIALS

#### A. General

1. Materials shall be classified as acceptable for potable water use according to NSF Standard 61.
2. Ready-mix concrete shall conform to the requirements of ASTM C 94 – Ready Mixed Concrete.
3. Cement for concrete that will contact potable water shall not be obtained from kilns that burn metal rich hazardous waste fuel.
4. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. Cement shall be used in the sequence of receipt of shipments.

#### B. Storage of materials shall comply with ACI 301, as applicable.

#### C. Materials. Materials for concrete shall comply with ACI 301 and shall conform to the following requirements:

1. Cement. Cement shall be standard brand portland cement conforming to ASTM C 150 –Portland Cement, for Type I/II or Type V. A minimum of 85 percent of cement by weight shall pass a 325 screen. A single brand of cement shall be used throughout the WORK, and prior to its use, the brand shall be accepted by the ENGINEER. The cement shall be suitably protected from exposure to moisture until used. Cement that has become lumpy shall not be used. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the ENGINEER, if requested, regarding compliance with the Specifications.
2. Water. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (greater than 1000 mg/l TDS) shall not be used.

3. Aggregates. Aggregates shall be obtained from pits acceptable to the ENGINEER, shall be non-reactive, and shall conform to ASTM C 33 – Concrete Aggregates. Maximum size of coarse aggregate shall be as indicated. Substituting lightweight sand for fine aggregate will not be permitted.
  - a. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof. The coarse aggregates shall be prepared and handled in 2 or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the 2 size groups shall be combined.
  - b. Fine aggregates shall be natural sand or a combination of natural and manufactured sand that is hard and durable. When tested in accordance with ASTM D 2419 – Test Methods for Sand Equivalent Value of Soils and Fine Aggregate, the sand equivalency shall not be less than 75 percent for an average of 3 samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33 when tested in accordance with ASTM C 136 for the fineness modulus of the sand used, including the optional grading in Section 6.2. The fineness modulus of sand used shall not be over 3.1.
  - c. Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.
  - d. When tested in accordance with ASTM C 33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.
  - e. When tested in accordance with ASTM C 33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.
  - f. When tested in accordance with ASTM C 33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions or 10.5 percent after 100 revolutions.
  - g. When tested in accordance with ASTM C 33, the loss resulting after 5 cycles of the soundness test shall not exceed 10 percent for fine aggregate and 12 percent for coarse aggregate when using sodium sulfate.
4. Flyash. If used, flyash shall be Class F and meet ASTM C618.
5. Admixtures. Admixtures shall be compatible and be furnished by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.
  - a. Air-entraining agents: Agents shall meet the requirements of ASTM C 260 – Air Entraining Admixtures for Concrete shall be used. Concrete floors to receive a dry-shake floor hardener shall have an air content not to exceed 3 percent. The OWNER reserves the right, at any time, to sample and test the air-entraining

agent. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement. Air entraining agent shall be **MB-AE 90** by **BASF**; **Daravair** by **W.R. Grace**; or equal

- b. Set controlling and water reducing admixtures: Admixtures may be added at the CONTRACTOR's option, subject to the ENGINEER's approval, to control the set, effect water reduction, and increase workability. The cost of adding an admixture shall be the CONTRACTOR's responsibility. Concrete containing an admixture shall be first placed at a location determined by the ENGINEER. Admixtures shall conform to ASTM C 494 – Chemical Admixtures for Concrete. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.
  - 1) Set controlling admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently greater than 80 degrees F, a set retarding admixture such as **Delvo** by **Master Builders**, **Daratard** by **W.R. Grace**, or equal shall be used. Where the air temperature at the time of placement is expected to be consistently less than 40 degrees F, a non-corrosive set accelerating admixture such as **Polarset** by **W.R. Grace**, or equal shall be used.
  - 2) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the manufacturer's instructions and recommendations. Normal range water reducing admixtures shall be approved by the ENGINEER prior to use.
  - 3) High range water reducer shall conform to ASTM C 494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating the water/cement ratio. High range water reducing admixtures shall be approved by the ENGINEER prior to use.
  - 4) If the high range water reducer is added to the concrete at the Site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3-inches plus or minus 1/2-inch prior to adding the high range water reducing admixture at the Site. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the primary system.
  - 5) Concrete shall be mixed at mixing speed for a minimum of 70 mixer revolutions or 5 minutes after the addition of the high range water reducer, unless recommended otherwise by the manufacturer.
6. **Lithium Additives:** Lithium additives shall not be used in concrete mix design for water bearing structures.

- D. **Alkali-Silica Reactivity (ASR) of Aggregates.** All aggregates used in the concrete mix designs shall generally be considered non-reactive (innocuous) aggregate according to the requirements of ASTM C1260 and tested according to the requirements listed below. Fine and coarse aggregates to be used in all concrete shall be evaluated individually and tested for alkali-aggregate reactivity, according to ASTM C1260. The average expansion of the mortar bars for the fine aggregate test according to ASTM C1260 shall not exceed 0.08% at 16-days of immersion in a 1N NaOH solution. Likewise, the average expansion of the mortar bars for the coarse aggregate test according to ASTM C1260 shall not exceed 0.08% at 16-days of immersion in a 1N NaOH solution.

If either of the aggregates do not pass the ASTM C1260 test requirements as described above, CONTRACTOR shall provide information to the CONTRACTOR that the proposed fine and coarse aggregate is the best (i.e. least reactive) locally available material within 50 miles of the project site. In addition, the CONTRACTOR shall provide additional testing of the proposed aggregates (fine and coarse) along with approved mitigating additives (i.e. fly ash, class N pozzolan, GGBF slag, silica fume or other approved additives) to the concrete mix design, according to the requirements of ASTM C1567 and the following requirements:

1. The concrete mix design parameters used in the ASTM C1567 expansion test shall be within the allowable ranges of mix design parameters as specified under Part 2.5.D of this Section. After 16-days of immersion in a 1N NaOH solution, the average expansion of the three mortar bars shall not exceed 0.06 percent as measured according to ASTM C1567 standards and protocol.
2. ASR test on both the fine and coarse aggregate and concrete mix additives (i.e. flyash, pozzolan, or other approved additives), sample bar preparation, testing and all analytical methods shall meet the ASTM C1567 testing procedural requirements.
3. Results of the ASR test show that expansion of the concrete sample is less than 0.06 percent at 16-days after the start of the expansion test procedure.
4. Preliminary test results shall be reported to the CONTRACTOR and Design Engineer at 7-days and 11-days and test completion, as well as the final test results at the full 16-day duration.
5. The Concrete Supplier is still actively mining and using aggregate from the same representative portion of the aggregate pit from which the aggregate samples were taken for testing.
6. Fly ash used as a mitigation measure for ASR shall be a minimum of 20% and shall be limited to 25% where exposed to deicing chemicals or severe freeze thaw, otherwise it shall not exceed 35% by weight of Portland cement content per cubic yard.

## 2.2 CURING MATERIALS

- A. Curing compounds shall be resin-based and compliant with local VOC requirements.
1. Regular curing compounds shall be white pigmented and conform to ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete, Type 2, Class B. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be approved by the ENGINEER prior to use.

2. When curing compound must be removed for finishes or grouting, compounds shall be a dissipating type meeting ASTM C 309, type 1 or 2, Class B. Concrete curing compound shall be approved by the ENGINEER prior to use.
- B. Polyethylene sheet for use as concrete curing blanket shall be white and shall have a nominal thickness of 6-mils. The loss of moisture when determined in accordance with ASTM C 156 – Test Method for Water Retention by Concrete Curing Materials, shall not exceed 0.055 grams per square centimeter of surface.
  - C. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, have a nominal thickness of 2-mils, and be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A – Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant). The loss of moisture, when determined in accordance with ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.
  - D. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mils thick with white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.
  - E. Curing mats for use in Curing Method 6 below shall be heavy shag rugs or carpets or cotton mats quilted at 4-inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.
  - F. Evaporation retardant shall be a material such as **Confilm** by **MBT/Degussa Building Systems**, **Eucobar** by **Euclid Chemical Company**, **E-CON** by **L & M Construction Chemicals, Inc.**, or equal.

### 2.3 NON-WATERSTOP JOINT MATERIALS

- A. Materials for non-waterstop joints in concrete shall conform to the following requirements:
  1. Preformed joint filler shall be a non-extruding neoprene sponge or polyurethane type conforming to Section 03290 - Joints in Concrete.
  2. Elastomeric joint sealer shall conform to Section 07920 - Sealants and Caulking.
  3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement from expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth below, if testing is required by the ENGINEER.



## 2.4 MISCELLANEOUS MATERIALS

- A. **Damproofing Agents.** Damproofing agent shall be an asbestos-free, fibered asphalt emulsion intended for cold application to green concrete, both above and below grade. Damproofing shall meet the requirements of ASTM D 1227 – Emulsified Asphalt Used as a Protective Coating for Roofing, Type II, Class I. Damproofing shall be approved by the ENGINEER prior to use.
- B. **Bonding Agents.** Bonding agents shall be epoxy adhesives conforming to the following:
1. For bonding freshly-mixed, plastic concrete to hardened concrete, **Sikadur 32 Hi-Mod Epoxy Adhesive** by **Sika Corporation**, **Concresive Liquid (LPL)** by **MBT/Degussa Building Systems**, **BurkEpoxy MV** by **Burke** by **Edoco**, or equal.
  2. For bonding hardened concrete or masonry to steel, **Sikadur 31 Hi-Mod Gel** by **Sika Corporation**, **BurkEpoxy NS** by **Burke** by **Edoco**, **Concresive Paste (LPL)** by **MBT/Degussa Building Systems**, or equal.
- C. **Vapor Retarder**
1. Vapor retarder shall be 30-mils thick, Class A, 3 ply, nylon or polyester cord-reinforced high density polyethylene sheet laminated to a non-woven geotextile fabric, in accordance with ASTM E 1745 - Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
  2. **Granular Material Above Vapor Retarder:** Crushed stone, gravel, or sand with the following size distribution and meeting the deleterious substance limits of ASTM C 33 for fine aggregates.

Sieve Size	Percentage Passing
3/8-inch	100
4.75 mm	85-100
No. 100	10 – 30

3. Seams in vapor retarder sheet shall be sealed with tape, adhesive, or other material as recommended by sheet manufacturer for the areas to be sealed and sheet material.
- D. **Colorant.** Colorant for duct bank concrete shall be an integral red oxide coloring pigment used in the proportion of 8 pounds per cubic yard of concrete.

## 2.5 CONCRETE DESIGN REQUIREMENTS

- A. **General:** Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results. Changes shall be subject to review by the ENGINEER.

- B. **Fine Aggregate Composition:** In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table.

FINE AGGREGATE	
Fineness Modulus	Maximum Percent
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.1	44

1. For other concrete, the maximum percentage of fine aggregate of total aggregate by weight shall not exceed 50.
- C. Duct bank concrete shall contain an integral red-oxide coloring pigment. Concrete shall be dyed red throughout. Surface treatment to color duct banks will not be acceptable.
- D. **Water/Cement Ratio W/C:** The water/cement ratio indicated is for saturated-surface dry condition of aggregate. The batch water added shall be continually adjusted for the total free water in the aggregates by use of moisture meters in the batch plant.
1. Total free moisture of aggregates shall be determined by:
    - a. Starting with the total moisture content of all aggregate, calculated by ASTM C 566 -Test Method for Total Moisture Content of Aggregate by Drying
    - b. Subtracting the moisture absorbed by the coarse aggregate, calculated by ASTM C 127 – Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
    - c. Subtracting the moisture absorbed by the fine aggregate, calculated by ASTM C 128 – Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate

E. Concrete Property Tables

	Structural Concrete			
Type of WORK	CM1 (Concrete mix for Hatchery, Shop and Residence buildings)	CM2 (Concrete mix for Headbox, Clarifier, and Raceway structures)	Sitework Concrete (curbs, gutters, sidewalks, catch basins, fence embedments, encasements, and ductbanks)	Lean Concrete (thrust blocks, pipe trench cut-off blocks, and cradles)
Min 28 Day Compressive Strength, psi	4000	4500	3000	2000
Max Aggregate Size, in	3/4	1	1	1

	<b>Structural Concrete</b>			
<b>Type of WORK</b>	<b>CM1</b> (Concrete mix for Hatchery, Shop and Residence buildings)	<b>CM2</b> (Concrete mix for Headbox, Clarifier, and Raceway structures)	<b>Sitework Concrete</b> (curbs, gutters, sidewalks, catch basins, fence embedments, encasements, and ductbanks)	<b>Lean Concrete</b> (thrust blocks, pipe trench cut-off blocks, and cradles)
<b>Cement Content, lbs /cubic yard,</b>	540 Min	535 Min	470 min	376 min
<b>Max Allowable Fly Ash Content (FA); lbs/cubic yard</b>	Up to 35% max of cement content	25% max where freeze thaw or deicing chemicals are used otherwise 35% max of cement content	25% max where freeze thaw or deicing chemicals are used otherwise 35% max of cement content	Up to 35% max of cement content
<b>Max W/C Ratio by weight</b>	0.45	0.42	0.45	0.60
<b>Total Air Content, percent</b>	1.5 +1.5/-0.0	7 +/- 1.5	3 to 6	3 to 6
<b>Slump, in</b>	Per Mix Design +/- 1-in;	3-in +/- 1-in; with high range water reducer 7-in +/- 2-in	Per Mix Design +/- 1-in; ductbanks and encasements 5-in +/- 1-in	Per Mix Design +/- 1.5-in

NOTE: The CONTRACTOR is cautioned that the limiting parameters above are not a mix design. Admixtures may be required to achieve workability required by the CONTRACTOR's construction methods and aggregates. The CONTRACTOR is responsible for providing concrete with the required workability and strength.

- F. **Adjustments to Mix Design:** The CONTRACTOR may elect to decrease the water/cement ratio to achieve the strength and shrinkage requirements and/or add water reducers, as required to achieve workability. The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the CONTRACTOR shall be entitled to no additional compensation because of such changes. Any changes to the accepted concrete mix design shall be submitted to the ENGINEER for review and shall be tested again in accordance with these Specifications.

## 2.6 CONSISTENCY

- A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete that can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143 – Test Method for Slump of Hydraulic Cement Concrete. The slumps shall be as indicated with the concrete properties.

## 2.7 MEASUREMENT OF CEMENT AND AGGREGATE

- A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the ENGINEER. Weighing tolerances for the materials shall be a maximum of that given below.

<b>Material</b>	<b>Percent of Total Weight</b>
Cement	1
Aggregates	3
Admixtures	3

## 2.8 MEASUREMENT OF WATER

- A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the ENGINEER and capable of measuring the water in variable amounts within a tolerance of one percent. The water feed control mechanism shall be capable of being locked in position so as to deliver constantly any required amount of water to each batch of concrete. A positive quick-acting valve shall be used for a cut-off in the water line to the mixer. The operating mechanism shall prevent leakage when the valves are closed.

## 2.9 READY-MIXED CONCRETE

- A. At the CONTRACTOR'S option, ready-mixed concrete may be used if it meets the requirements as to materials, batching, mixing, transporting, and placing indicated herein and is in accordance with ASTM C 94, including the following supplementary requirements.
- B. Ready-mixed concrete shall be delivered to the WORK, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever occurs first.
- C. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified. The counter shall be the resettable, recording type and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.
- D. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed. Materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.
- E. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one-inch when the required slump is 3-inches or less, or if they differ by more than 2-inches when the required slump is more than 3-inches, the mixer shall not be used on the WORK unless the causative

condition is corrected and satisfactory performance is verified by additional slump tests. Mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

- F. Each batch of ready-mixed concrete delivered to the Site shall be accompanied by a delivery ticket that is furnished to the ENGINEER in accordance with the Paragraph above entitled "Delivery Tickets."
- G. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the ENGINEER.

### **PART 3 -- EXECUTION**

#### **3.1 PROPORTIONING AND MIXING**

- A. **Proportioning:** Proportioning of the mix shall conform to ACI 301.
- B. **Mixing:** Mixing shall conform to ACI 301.
- C. **Slump:** Slumps shall be as indicated.
- D. **Retempering:** Retempering of concrete or mortar that has partially hardened shall not be permitted.

#### **3.2 PREPARATION OF SURFACES FOR CONCRETING**

- A. **General:** Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Vapor Retarder Sheet
  - 1. Sheet shall be installed under on-grade building floor slabs of occupiable (non-hydraulic) structures and at other locations indicated.
  - 2. Sand base shall be at least 2-inches thick within the foundation line after moistening and compaction by mechanical means. Sand surface shall be flat and level within a tolerance of plus zero inches to minus 3/4-inch.
  - 3. Place, protect, and repair defects in sheet according to ASTM E 1643 – Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs, and the manufacturer's written instructions. Seams shall be lapped and sealed in accordance with ASTM E 1643.
  - 4. Granular material above the sheet shall be moistened and compacted to 2-inches thickness within the same flatness criteria as the sand base.

- C. **Joints in Concrete:** Construction joints are defined as concrete surfaces upon which or against which concrete is to be placed but placement of concrete has been stopped or interrupted and the ENGINEER has determined that the new concrete cannot be incorporated integrally with the concrete previously placed. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bonding. Except where the Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of laitance, loose or defective concrete, foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. Pools of water shall be removed from the surface of construction joints before the new concrete is placed.
- D. After the surfaces have been prepared, each approximately horizontal construction joint shall be covered with a 6-inch lift of a pea gravel mix. The mix shall be placed and spread uniformly. Wall concrete shall follow immediately and shall be placed upon the fresh pea gravel mix.
- E. **Placing Interruptions:** When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent WORK; provided that construction joints shall be made only where acceptable to the ENGINEER.
- F. **Embedded Items:** No concrete shall be placed until formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the ENGINEER at least 4 hours before placement of concrete. Surfaces of forms and embedded items that have become encrusted with dried grout from previous usage shall be cleaned before the surrounding or adjacent concrete is placed.
- G. Inserts or other embedded items shall conform to the requirements herein.
- H. Reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms at locations indicated on the Drawings or shown by Shop Drawings and shall be acceptable to the ENGINEER before any concrete is placed. Accuracy of placement is the responsibility of the CONTRACTOR.
- I. **Casting New Concrete Against Old:** Where concrete is to be cast against old concrete (defined as any concrete which is greater than 60 Days old), the surface of the old concrete shall be thoroughly cleaned and roughened by hydroblasting or sandblasting to expose aggregate. The joint surface shall be coated with an epoxy bonding agent unless determined otherwise by the ENGINEER. This provision shall not apply to joints where waterstop is provided.
- J. No concrete shall be placed in any structure until water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes or other means, and carried out of the forms, clear of the WORK. No concrete shall be deposited underwater nor shall the CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to review by the ENGINEER.
- K. **Corrosion Protection:** Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to

placement of concrete that there will be a minimum of 2-inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

- L. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.
- M. Anchor bolts shall be accurately set and shall be maintained in position by templates while embedded in concrete.
- N. **Cleaning:** The surfaces of metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

### 3.3 HANDLING, TRANSPORTING, AND PLACING

- A. **General:** Placing of concrete shall conform to the applicable portions of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.
- B. **Non-Conforming WORK or Materials:** Concrete which during or before placing is found not to conform to the requirements indicated herein shall be rejected and immediately removed from the WORK. Concrete that is not placed in accordance with these requirements or which is of inferior quality shall be removed and replaced.
- C. **Unauthorized Placement:** No concrete shall be placed except in the presence of a duly authorized representative of the ENGINEER. The CONTRACTOR shall notify the ENGINEER in writing at least 24 hours in advance of placement of any concrete.
- D. **Placement in Wall and Column Forms:** Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete below the ends of ducts, chutes, or buggies exceed 4-feet in walls and 8-feet in columns. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6-feet in horizontal direction. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2-feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in wall forms shall not exceed 5-feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of forms so that the concrete at the places of deposit is visible from the deck or runway.
- E. **Conveyor Belts and Chutes:** Ends of chutes, hopper gates, and other points of concrete discharge throughout the CONTRACTOR's conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the ENGINEER. Chutes longer than 50-feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. Conveyor belts and chutes shall be covered.

- F. **Placement in Slabs:** Concrete placement in sloping slabs shall proceed uniformly from the bottom of the slab to the top for the full width of the placement. As the WORK progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.
- G. **Temperature of Concrete:** The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 50 degrees F. For sections less than 12-inches thick the temperature of concrete when placed shall be not less than 55 degrees.
1. If required by ENGINEER, CONTRACTOR shall submit detailed procedures for production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot or cold weather. The submittal shall include procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
  2. CONTRACTOR shall not be entitled to additional compensation for satisfying the hot weather placement or the cold weather placement requirements below.
- H. Hot Weather Placement
1. If the temperature of the concrete is 85 degrees F or greater, the time between introducing the cement into the aggregates and discharge shall not exceed 45 minutes.
  2. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, CONTRACTOR shall employ effective means such as precooling of aggregates and using ice as mixing water or placing at night as necessary to maintain the temperature of the concrete below 90 degrees F as it is placed.
  3. During the curing period, the maximum temperature decrease measured at the surface of the concrete shall not exceed 50 degrees F in 24 hours nor 5 degrees F in one hour.
- I. Cold Weather Placement
1. Placement of concrete shall conform to ACI 306.1 - Cold Weather Concreting, and the following.
  2. Remove snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6-inches. Reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.
  3. Maintain the concrete temperature above 50 degrees F for at least 72 hours after placement.
  4. Concrete ingredients shall not be heated more than necessary to prevent the temperature of the mixed concrete, as placed, from falling below the minimum temperature criterion.



### 3.4 PUMPING OF CONCRETE

- A. **General:** If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. **Pumping Equipment:** The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, the CONTRACTOR may have a standby pump on the Site during pumping.
- C. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R – Placing Concrete by Pumping Methods.
- D. Pumping equipment and hose conduits that are not functioning properly shall be replaced.
- E. Aluminum conduits for conveying the concrete shall not be permitted.
- F. **Field Control:** Concrete samples for slump, air content, and test cylinders will be taken at the placement end of the hose.

### 3.5 ORDER OF PLACING CONCRETE

- A. The order of placing concrete in the WORK shall be acceptable to the ENGINEER. To minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 5 Days for hydraulic structures and 2 Days for all other structures before the contiguous unit or units are placed, except that the corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 10 Days for hydraulic structures and 4 Days for all other structures.
- B. The surface of the concrete shall be level whenever a run of concrete is stopped. For a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about 1/2-inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and laitance shall be removed.

### 3.6 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete. Vibrators shall be Group 3 per ACI 309 – Consolidation of Concrete, high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by the ENGINEER.
- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional

vibration over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against each surface. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms. The vibrating head shall not contact the surfaces of the forms. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

### 3.7 FINISHING CONCRETE SURFACES

- A. **General:** Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions indicated are defined as tolerances and are indicated above. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. **Formed Surfaces:** No treatment is required after form removal except for curing, repair of Defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as indicated.
  - 1. Basins and exposed walls shall be given a smooth finish as indicated below.
- C. **Unformed Surfaces:** After proper and adequate vibration and tamping, unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each operation as necessary to prevent drying shrinkage cracks. The classes of finish for unformed concrete surfaces are defined as follows:
  - 1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.
  - 2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by the ENGINEER.
  - 3. Finish U3 - After the Finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of irregularities.

4. Finish U4 - Trowel the Finish U3 surface to remove local depressions or high points. In addition, the surface shall be given a light broom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.
5. Unformed surfaces shall be finished according to the following schedule:

<b>UNFORMED SURFACE FINISH SCHEDULE</b>	
<b>Area</b>	<b>Finish</b>
Grade slabs and foundations to be covered with concrete or fill material	U1
Floors to be covered with grouted tile or topping grout	U2
Water bearing slabs with slopes 10 percent and less	U3
Water bearing slabs with slopes greater than 10 percent	U4
Slabs not water bearing	U4
Slabs to be covered with built-up roofing	U2
Interior slabs and floors to receive architectural finish	U3
Top surface of walls	U3

### 3.8 CURING AND DAMPPROOFING

- A. **General:** Concrete shall be cured for not less than 7 Days after placing, in accordance with the methods indicated below for the different parts of the WORK.

<b>Surface to be Cured or Dampproofed</b>	<b>Method</b>
Unstripped forms	1
Wall sections with forms removed	6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement and ductbank concrete and thrust blocks	3
Concrete surfaces not specifically indicated in this Paragraph	4
Floor slabs on grade in hydraulic structures	5
Slabs not on grade	6

- B. **Method 1:** Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 7 Days of placing the concrete, curing shall be continued in accordance with Method 6 below.
- C. **Method 2:** The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.
- D. **Method 3:** The surface shall be covered with moist earth not less than 4 hours nor more than 24 hours after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 Days after placement of concrete.
- E. **Method 4:** The surface shall be sprayed with a liquid curing compound.
1. Compound shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film that will seal thoroughly.
  2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7 Day curing period. If the seal is damaged or broken before expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.
  3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.
  4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Repairs to formed surfaces shall be made within the 2 hour period; provided, however, that any such repairs which cannot be made within the said 2 hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.
  5. At locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound reapplied to an area within 6-feet of the joint and to any other location where the curing membrane has been disturbed.
  6. Prior to final acceptance of the WORK, visible traces of curing compound shall be removed in such a manner that does not damage the surface finish.
- F. **Method 5:**
1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4 above. Not less than one hour nor more than 4 hours after the curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting, or polyethylene-coated burlap. The

blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 3-inches and fastened together with a waterproof cement to form a continuous watertight joint.

2. The curing blankets shall be left in place during the 7 Day curing period and shall not be removed until after concrete for adjacent WORK has been placed. If the curing blankets become torn or otherwise ineffective, the CONTRACTOR shall replace damaged sections. During the first 3 Days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets 5/8-inch minimum thickness, laid over the curing blanket. The CONTRACTOR shall add water under the curing blanket as often as necessary to maintain concrete surfaces damp.

**G. Method 6:** This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 7 Days beginning immediately after the concrete has reached final set or forms have been removed.
2. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water using nozzles that atomize the flow so that the surface is not marred or washed.
3. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent dislodging by wind or any other causes. Edges shall be continuously held in place.
4. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.
5. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, the entire concrete surface shall be wetted, and curing compound shall be immediately applied to the entire surface in accordance with Method 4 above.
6. The CONTRACTOR shall dispose of excess water from the curing operation to avoid damage to the WORK.

### 3.9 PROTECTION

- A. The CONTRACTOR shall protect concrete against injury until final acceptance.
- B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

### 3.10 CURING IN COLD WEATHER

- A. Water curing of concrete may be reduced to 6 Days during periods when the mean daily temperature in the vicinity of the Site is less than 40 degrees F; provided that during the

prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing is temporarily discontinued.

- B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50 degrees F.
- C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive Days, the required 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
- D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted.

### 3.11 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the ENGINEER. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. Repairs and replacements shall be performed promptly.
- B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of laitance and soft material, plus not less than 1/32-inch depth of the surface film from hard portions by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain such a proportion of **Atlas White** portland cement as is required to make the color of the patch match the color of the surrounding concrete.
- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross section and other imperfections having a depth greater than their least

surface dimension shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.

- D. Repairs shall be built up and shaped in such a manner that the completed WORK will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.
- E. Prior to filling any structure with water, cracks shall be "vee'd" as indicated and filled with sealant conforming to the requirements of Section 03290. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill which are not covered with a waterproofing membrane shall also have cracks repaired as indicated herein.

### 3.12 PATCHING HOLES IN CONCRETE

#### A. Patching Small Holes

- 1. Holes that are less than 12-inches in the least dimension and extend completely through concrete members shall be filled.
- 2. Small holes in members that are water-bearing or in contact with soil or other fill material shall be filled with non-shrink grout. Where a face of the member is exposed to view, the non-shrink grout shall be held back 2-inches from the finished surface. The remaining 2-inches shall then be patched according to the Article above entitled "Treatment of Surface Defects."
- 3. Small holes through other concrete members shall be filled with non-shrink grout, with exposed faces treated as above.

#### B. Patching Large Holes

- 1. Holes which are larger than 12-inches in the least dimension shall have a keyway chipped into the edge around the opening, unless a formed keyway exists. The holes shall then be filled with concrete as indicated herein.
- 2. Holes which are larger than 24-inches in the least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.
- 3. Large holes in members that are water bearing or in contact with soil or other fill shall have a hydrophilic type waterstop material placed around the perimeter of the hole in accordance with Section 03290 unless there is an existing waterstop in place.

### 3.13 CARE AND REPAIR OF CONCRETE

- A. The CONTRACTOR shall protect concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed WORK, or which departs from the established line or

grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete.

- END OF SECTION -



## SECTION 03 60 00- GROUT

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents
- B. Grout Types. The following types of grout are covered in this Section:
  - 1. Cement Grout
  - 2. Non-Shrink Grout - Class I (cement-based)
  - 3. Epoxy Anchor Grout for Adhesive Anchors
  - 4. Topping Grout and Concrete/Grout Fill

#### 1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.
  - 1. Certified testing lab reports for tests indicated herein.
  - 2. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.
  - 3. Certification that grouts used on the project contain no chlorides or other chemicals that cause corrosion.
  - 4. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. ICC/ES report shall be submitted for epoxy anchor grout for adhesive anchors.
  - 5. Manufacturer's certification that its non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
  - 6. Submit manufacturer's written warranty as indicated herein.
  - 7. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

#### 1.3 QUALITY CONTROL

- A. Field Tests
  - 1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by the ENGINEER. The specimens will be made by the ENGINEER or its representative.

2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink), at intervals during construction selected by the ENGINEER. A set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.
  3. Compression tests and fabrication of specimens for topping grout and concrete/grout fill will be performed in accordance with Section 03 30 00- Cast-in-Place Concrete, at intervals during construction selected by the ENGINEER.
  4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C 579 - Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing and Polymer Concretes, Method B, at intervals during construction selected by the ENGINEER. A set of 3 specimens will be made for testing at 7 Days and each earlier time period as appropriate.
- B. **Construction Tolerances:** Construction tolerances shall be as indicated in Section 03 30 00 - Cast-in-Place Concrete, unless indicated otherwise.
- C. **Inspection:** Special inspections as required per the IBC 2009, Chapter 17.
- 1.4 SPECIAL CORRECTION OF DEFECTS PROVISIONS
- A. Manufacturer's Warranty
1. Furnish one year warranty for WORK provided under this section.
  2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to the purchase price of products or materials.

## **PART 2 -- PRODUCTS**

### 2.1 APPLICATION

- A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not.

Application	Type of Grout
Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas.	Non-Shrink - Class I
Anchor bolts and reinforcing steel required to be set in grout that is not in high temperature or high fire risk areas.	Epoxy Anchor Grout
Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension.	Non-Shrink - Class I

Storage tanks and other non-motorized equipment and machinery under 30 horsepower	Non-Shrink - Class I
Pumps over 1000 horsepower, unless indicated otherwise	Non-Shrink Epoxy
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-Shrink - Class I (Class II where placement time exceeds 20 min.)
Toppings and concrete/grout fill less than 3-inches thick	Topping Grout
Toppings and concrete/grout fill greater than 3-inches thick	Structural Concrete per 03 30 00
Surface repairs	Cement Grout
Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material	Non-Shrink - Class I
Any application not listed above, where grout is indicated	Non-Shrink Class I, unless specifically indicated otherwise

## 2.2 CEMENT GROUT

- A. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.
- B. Cement grout materials shall be as indicated in Section 03 30 00 - Cast-in-Place Concrete.

## 2.3 NON-SHRINK GROUTS (cement-based)

- A. General
  - 1. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.
  - 2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.
  - 3. Grout shall not contain chlorides or additives that may contribute to corrosion.
  - 4. Grout shall be formulated to be used at any consistency from fluid to plastic.

5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:
  - a. Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
  - b. Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
  - c. Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
  - d. Grout shall be certified for use in freeze/thaw environments.

B. Class I Non-Shrink Grout

1. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5000 psi when mixed at a fluid consistency.
2. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.
3. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Test Method for Early Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.
4. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
5. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.
6. Class I Non-Shrink Grout shall be **Masterflow 713 Plus** by **MBT/Degussa Building Systems**, **Five Star Grout** by **Five Star Products**, **SikagROUT 212** by **Sika Corporation**, **Premier** by **L&M Construction Chemicals**; **High-Flow Grout** by **Euclid Chemical Company**, **CG 200 PC** by **Hilti**, or approved equal.

2.4 NON-SHRINK EPOXY GROUT

- A. Non-shrink epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, each premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

- B. Epoxy grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).
- C. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than 0.00003 in/in F when tested according to ASTM C 531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.
- D. The epoxy grout shall develop a minimum compressive strength of 9000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C 579, method B.
- E. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.
- F. The effective bearing area shall be a minimum of 95 percent EBA in accordance with ASTM C 1339 – Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts, for bearing area and flow.
- G. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.
- H. Non-shrink epoxy grout shall have the following minimum properties when tested at 7 Days:
  - 1. Minimum bond strength to concrete of 3000 psi per ASTM C 882 modified.
  - 2. Minimum bond strength to steel of 1700 psi per ASTM C 882 modified.
  - 3. Minimum flexural strength of 2500 psi per ASTM C 580.
  - 4. Minimum tensile strength of 2000 psi per ASTM C 307 -- Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
- I. Non-shrink epoxy grout shall be **Five Star DP Epoxy Grout** by **Five Star Products, Inc.**, **Masterflow 648 CP Plus** by **MBT/Degussa Building Systems**, **Sikadur 42 Grout-Pak** by **Sika Corporation**, or approved equal.

## 2.5 EPOXY ANCHOR GROUT

- A. Epoxy anchor grout shall conform to ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete, Type IV, Class A, B and C, Grade 3 with the exception of gel time.
- B. Heat deflection temperature per ASTM D 648 -- Test Method for Deflection Temperature of Plastics Under Flexural Load shall be a minimum 120 degrees F.
- C. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 degrees F.
- D. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

- E. Epoxy anchor grout shall be capable of being used in submersed applications once cured.
- F. Compressive strength per ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics shall be 10,000 psi minimum.
- G. Whenever possible, overhead anchors subject to vibration, anchors in fire-resistive construction or high fire risk areas, and anchors subject to working or operating temperatures above 100 degrees F shall be cast-in-place anchors. Whenever cast-in-place anchors cannot be used in these applications, use cement based non-shrink grout and oversized holes.
- H. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67 percent of the member depth.
- I. Epoxy anchor grout shall be **Epcon C6** by **ITW Ramset/Red Head**; **Power-Fast Epoxy Injection Gel** by **Powers Fasteners**; **HIT RE 500** by **Hilti**, **Sikadur AnchorFix-4**, or approved equal.

2.6 TOPPING GROUT AND CONCRETE/GROUT FILL

- A. Where fill is thicker than 3-inches, structural concrete, as indicated in Section 03 30 00 - Cast-in-Place Concrete, may be used when accepted by the ENGINEER. Omit the coarse aggregate in topping grout used in clarifiers.
- B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and be mixed as indicated. Materials and procedures indicated for normal concrete in Section 03 30 00 - Cast-in-Place Concrete, shall apply unless indicated otherwise.
- C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Topping grout in clarifiers shall contain between 750 and 800 pounds of cement per cubic yard with a maximum water cement ratio of 0.42.
- D. Coarse aggregate shall be graded as follows:

U.S. Standard Sieve Size	Percent By Weight Passing
1/2 in	100
3/8 in	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00 - Cast-in-Place Concrete, except that drying shrinkage tests are not required.
- F. Topping grout and concrete grout/fill shall contain air-entraining agent per Section 03 30 00 - Cast-in-Place Concrete.
- G. **Strength:** Minimum compressive strength of topping grout and concrete/grout fill at 28 Days shall be 4000 psi.
- H. Topping grout used in clarifiers shall contain fiber reinforcing. Fiber shall be 100 percent virgin polypropylene fibrillated fibers specifically manufactured in a blended gradation for use as concrete secondary reinforcement. Fibers shall be added at a rate of 1.5 pounds per cubic yard of concrete. Fibers shall conform to ASTM C 1116 - Fiber-Reinforced Concrete and Shotcrete, Type III.

## 2.7 CURING MATERIALS

- A. Curing materials shall be in accordance with Section 03 30 00 - Cast-in-Place Concrete and as recommended by the manufacturer of prepackaged grouts.

## 2.8 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is defined such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

## 2.9 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

## PART 3 -- EXECUTION

### 3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Grout shall be stored in accordance with manufacturer's recommendations.

### 3.2 GENERAL

- A. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the ENGINEER.
- B. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.



- C. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 30 00 - Cast-in-Place Concrete. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.
- D. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.
- E. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.
- F. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

### 3.3 GROUTING PROCEDURES

- A. **General:** Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Equipment, Tank, and Pipe Supports. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.
  - 1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout or other thickness if indicated.
  - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by the ENGINEER, alternate grouting methods shall be submitted for acceptance by the ENGINEER.
  - 3. Concrete equipment pads for equipment bases that will be epoxy-grouted shall be sized so that, when the equipment base is fully grouted, the epoxy grout is stopped not less than 4-inches from the edge of the pad.
- C. Drilled Anchors and Reinforcing Bars
  - 1. General
    - a. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 Day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.
    - b. The CONTRACTOR shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify the

ENGINEER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.

2. Epoxy Adhesive Anchors

- a. Grout shall be proportioned and mixed with automatic equipment.
- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICC/ES report, but shall not be less than 8 diameters for threaded rod or 12 diameters for reinforcing or smooth bars.
- c. Holes shall be dry.

3. Cement Based Non-Shrink Grout

- a. In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.
- b. Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO/ES report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.
- c. When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.
- d. Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
- e. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

D. Topping Grout and Concrete/Grout Fill

1. Mechanical, electrical, and finish WORK shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively where accepted by the ENGINEER, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.
2. The minimum thickness of grout topping and concrete/grout fill shall be one-inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per the International Concrete Repair Institute (ICRI) -- Technical

Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping or fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the ENGINEER, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

#### 3.4 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

#### 3.5 CURING

- A. Cement based grouts shall be cured per Section 03 30 00 - Cast-in-Place Concrete and per the manufacturer's recommendations.

- END OF SECTION -

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## SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide structural steel framing and appurtenant metal parts required for permanent connection of the structural steel system, complete and in place, in accordance with the Contract Documents.

#### 1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. References herein to "Building Code" shall mean the International Building Code (IBC) of the International Code Council (ICC). The edition of the codes adopted as of the date of award of this contract shall apply to the WORK herein.

- B. Federal Specifications and Commercial Standards

AISC	Code of Standard Practice for Steel Buildings and Bridges
AISC	Structural Steel Buildings-Allowable Stress Design and Plastic Design
AISC	Allowable Stress Design Specifications for Structural Joints Using ASTM A325 and A490 Bolts approved by the Research Council on Structural Connections of the Engineering Foundation
ASTM A 36	Structural Steel
ASTM A 53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 307	Carbon Steel Bolts and Studs
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
AWS D1.1	Structural Welding Code – Steel

#### 1.3 CONTRACTOR SUBMITTALS

- A. Submit in accordance with Section 01 33 00 – Contractor Submittals.

- B. Shop Drawings shall conform to AISC recommendations and specifications and shall show all holes, etc. required for other work. Drawings shall include complete details showing members and their connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams showing the sequence of erection.
- C. Testing laboratory certifications for shop and field welders shall be submitted in triplicate directly to the OWNER with copies to the CONTRACTOR and others as required.

**PART 2 -- PRODUCTS**

2.1 MATERIALS

A. Structural steel

Wide Flange Shapes	ASTM A 992
Other Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless noted otherwise
HSS	ASTM A 500 Grade B

- B. Bolts for connections shall be ASTM A 325, unless indicated otherwise. Bolts used to connect dissimilar metals shall be ASTM A 193 and A 194, Type 316 stainless steel.
- C. Welded anchor studs shall be headed concrete anchor studs (HAS), or deformed bar anchors (DBA), or threaded studs (TAS), as indicated on the Drawings and as supplied by **Nelson Stud Welding Company**, Lorain, OH; or equal.
- D. Structural steel for outdoor applications and for mechanical equipment shall be coated in accordance with Section 09 96 00 - Protective Coating. Items included in this item include:
  - 1. Travelling bridge and bridge components.
  - 2. Fish feeder system modifications.
- E. Structural steel for buildings and architectural applications shall be coated in accordance with Section 09 90 00 – Painting. Items included in this item include:
  - 1. Building framing components.
  - 2. Structural roof deck.
  - 3. Architectural steel components.

- F. Steel members in contact with aluminum shall be galvanized per Section 05 50 00 - Miscellaneous Metalwork, unless indicated otherwise.
- G. Structural members shall be furnished full length without splices unless otherwise indicated or approved by the ENGINEER.

## 2.2 INSPECTION AND TESTING

- A. Shop inspection may be undertaken by the OWNER at its own expense. The CONTRACTOR shall give ample notice to the OWNER prior to the beginning of any fabrication so that inspection may be provided. The CONTRACTOR shall furnish facilities for the inspection of materials and workmanship in the shop, and inspectors shall be allowed free access to the necessary parts of the WORK. Inspectors shall have the authority to reject any materials or WORK that does not meet requirements. Inspection at the shop is intended as a means of facilitating the WORK and avoiding errors, but it is expressly understood that it will in no way relieve the CONTRACTOR from responsibility for proper materials or workmanship under this Specification.
- B. The OWNER may engage inspectors to inspect welded connections and high-strength bolted connections, and to perform tests and prepare test reports.
  - 1. Ten percent of all butt and bevel welds which extend continuously for 24-inches or less may be completely tested in accordance with AWS D1.1, Part E, Radiographic Testing of Welds, Chapter 6. Butt and bevel welds that extend continuously for more than 24-inches will be spot tested at intervals not exceeding 36-inches.
  - 2. Defective welds shall be corrected or redone and retested at the CONTRACTOR's expense and to the satisfaction of the welding inspector.
  - 3. The CONTRACTOR shall test to failure 3 bolts from each heat lot of bolts furnished to the job to verify compliance with this Specification. The testing laboratory shall be approved by the OWNER, and test reports shall be furnished to the OWNER in accordance with Section 01 33 00 – Contractor Submittals. In addition, high-strength bolts shall be inspected using one of the methods set forth in the AISC Specification "Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. The costs for initial testing will be paid by the OWNER. However, the CONTRACTOR shall pay testing costs for any additional testing and investigation on WORK that proves to be defective. The CONTRACTOR shall supply material for testing at no cost to the OWNER and shall assist the OWNER in obtaining material for test samples.

## PART 3 -- EXECUTION

### 3.1 MEASUREMENT

- A. The CONTRACTOR shall verify dimensions and shall make any field measurements necessary and shall be fully responsible for accuracy and layout of WORK. The CONTRACTOR shall review the Drawings, and any discrepancies shall be reported to the OWNER for clarification prior to starting fabrication.

### 3.2 FABRICATION

- A. Structural steel shall be fabricated in accordance with the Drawings, AISC Specifications, and the Shop Drawings.
- B. Materials shall be properly marked and match-marked for field assembly.
- C. Where finishing is required, assembly shall be completed including bolting and welding of units, before start of finishing operations.

### 3.3 CONNECTIONS

- A. Shop and field connections shall be bolted or welded as indicated. Connections shall develop full strength of members joined and shall conform to AISC standard connections.
- B. Unless otherwise indicated, welds shall conform to AISC LRFD Specification for Structural Steel Buildings.

### 3.4 WELDED CONSTRUCTION

- A. The CONTRACTOR shall comply with the current AWS D1.1 Code for procedures, appearance, and quality of welds and welders, and methods used in correcting Defective WORK. Welded architectural metal that is exposed to view shall have welds ground smooth. Shielded metal arc welding method or gas metal arc welding methods shall be used for welding structural steel.
- B. Unless otherwise indicated, butt and bevel welds shall be complete penetration.

### 3.5 HOLES FOR OTHER WORK

- A. Holes shall be provided as necessary or as indicated for securing other WORK to structural steel framing, and for the passage of other WORK through steel framing members. No torch cut holes will be permitted.

### 3.6 SHOP PAINT PRIMER

- A. Shop paint primer shall be applied in accordance with Section 09 90 00 - Painting or Section 09 96 00 – Protective Coating. Omit shop-applied primer at field weld locations, for the portion of a member to be embedded in concrete, and where galvanizing with no further coating is required.

### 3.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Structural members shall be loaded in such a manner that they may be transported and unloaded without being excessively stressed, deformed, or otherwise damaged.
- B. Structural steel members and packaged materials shall be protected from corrosion and deterioration. Material shall be stored in a dry area and shall not be placed in direct contact with the ground. Materials shall not be placed on the structure in a manner that



might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

### 3.8 ERECTION

- A. The CONTRACTOR shall comply with the AISC Specifications and Code of Standard Practice, and with indicated requirements.
- B. High-strength bolts shall be installed in accordance with the AISC Specification for Structural Joints Using ASTM A 325 Bolts. The connections shall be the bearing type, unless indicated otherwise.
- C. Anchor bolts and other connectors required for securing structural steel to in-place WORK and templates and other devices for presetting bolts and other anchors to accurate locations shall be furnished by the CONTRACTOR.
- D. The CONTRACTOR shall be responsible for designing and installing any temporary bracing required for the safe erection of structural steel members.

### 3.9 SETTING BASES AND BEARING PLATES

- A. Prior to the placement of non-shrink grout beneath base and bearing plates, the bottom surface of the plates shall be cleaned of all bond-reducing materials, and concrete and masonry bearing surface shall also be cleaned of all bond-reducing materials and be roughened to improve bonding.
- B. Loose and attached base plates and bearing plates for structural members shall be set on wedges, leveling nuts, or other adjustable devices.
- C. Anchor bolts shall be tightened after the supported members have been positioned and plumbed and the non-shrink grout has attained its indicated strength.
- D. Base plates shall be grouted in accordance with Section 03 60 00 - Grouting to assure full uniform bearing. Grouting shall be done prior to placing loads on the structure.

### 3.10 FIELD ASSEMBLY

- A. Structural frames shall be set accurately to the lines and elevations indicated. The various members shall be aligned and adjusted to form a part of a complete frame or structure before permanently fastening. Bearing surfaces and other surfaces that will be in permanent contact shall be cleaned before assembly. Necessary adjustments to compensate for discrepancies in elevations and alignments shall be performed.
- B. Individual members of the structure shall be leveled and plumbed within AISC tolerances.
- C. Required leveling and plumbing measurements shall be established on the mean operating temperature of the structure.

### 3.11 MISFITS AT BOLTED CONNECTIONS

- A. Where misfits in bolting are encountered, the OWNER shall be immediately notified. The CONTRACTOR shall submit a method to remedy the misfit for review by the OWNER. The OWNER will determine whether the remedy is acceptable or if the member must be refabricated.
- B. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins.
- C. Correction of misfits is part of the WORK.

### 3.12 GAS CUTTING

- A. Gas cutting torches shall not be used in the field for correcting fabrication errors in the structural framing, except when approved by the OWNER. Gas-cut sections shall be finished equal to a sheared appearance.

### 3.13 TOUCH-UP PAINTING

- A. Immediately after erection, field welds, bolted connections, and abraded areas shall be cleaned of the shop paint primer. Touch-up paint primer applied by brush or spray shall be the same thickness and material as used for the shop coat. Galvanized surfaces that have been field welded or damaged shall be repaired in accordance with Section 05 50 00.
- B. Finish coating of structural steel shall be as indicated in Section 09 96 00.

- END OF SECTION -

## SECTION 05 30 00 - METAL DECKING

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide steel decking and accessory items, complete and in place, in accordance with the Contract Documents.

#### 1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Specifications and Commercial Standards

AISI Design of Cold - Formed Steel Structural Members.

SDI Design Manual for Composite Decks, Form Decks, and Roof Decks.

ASTM A 446 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

ASTM A 653 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.

ASTM A 611 Steel, Sheet, Carbon, Cold-Rolled, Structural Quality

AWS D1.3 Structural Welding Code-Sheet Steel

- B. ICBO/ES Research Reports for each type of metal decking used in the WORK.

#### 1.3 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 - Contractor Submittals.

- B. Prior to the commencement of any WORK, the CONTRACTOR shall submit to the ENGINEER an affidavit furnished by the deck manufacturer certifying to the yield strength. The CONTRACTOR shall submit gauge and section properties of the metal deck. The CONTRACTOR shall also furnish the diaphragm shear values for the deck using the welding pattern and/or shear capacity indicated. Failure to conform to this requirement shall be justification for rejection of the material.

- C. Submit a layout drawing showing the location of deck sheets, end laps, side laps, types and locations of welds and details of accessories.

- D. Submit an ICBO Research Report for each type of metal decking used in the WORK.

#### 1.4 MATERIAL STORAGE

- A. Decking stored at the Site before installation shall be stacked on the ground on platforms or pallets and be covered with tarpaulins or other weatherproof covering.

## PART 2 -- PRODUCTS

### 2.1 STEEL DECK

- A. Unless indicated otherwise, metal deck shall be manufactured from steel conforming to ASTM A 611, Grades C, D, or E; or A 446, Grades A, B, C, D, E, or F, or equal, having a minimum yield strength of 33,000 psi. The maximum design working stress in the deck shall not exceed the product of 0.6 times the yield strength.
- B. The metal deck structural properties shall be as indicated. The moment of inertia and section modulus of the metal deck unit shall be computed in accordance with the Steel Deck Institute specifications, and in accordance with the American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."
- C. Steel decking shall be galvanized and shall conform to ASTM A 653 and to the applicable requirements of Section 05 50 00 - Miscellaneous Metalwork. Steel deck shall be free of oil, grease, and dirt before dipping.
- D. Steel deck shall be finished in accordance with Section 09 96 00 - Protective Coating. Deck shall be free of oil, grease and dirt before coating application.
- E. The metal deck shall have sheet length that covers 3 or more spans.
- F. The metal deck sheets shall be formed at the longitudinal sides in such a manner that they will overlap and/or interlock. Where the end of sheets overlap, they shall be die-formed in such a manner that the sheet in the next row telescopes and snugly overlaps the sheet laid previously.
- G. Plates needed to connect decking to supports or to maintain deck continuity shall be 14 gauge galvanized sheet.
- H. Structural steel shapes, including angles and inserts, shall be in accordance with Section 05 12 00 - Structural Steel Framing.

### 2.2 MANUFACTURERS

- A. The metal decking shall be manufactured by **Verco Manufacturing Company**, Phoenix, Arizona; **ASC Pacific Inc.**, Tacoma, Washington; **Vulcraft Nucor Corporation Inc.**; or equal.

## PART 3 -- EXECUTION

### 3.1 INSTALLATION REQUIREMENTS

- A. The CONTRACTOR shall inspect supporting members for correct layout and alignment, and shall not proceed with installation until defects are corrected and supporting members are completely installed and secured.
- B. Metal deck sheets and accessories shall be placed in accordance with the manufacturer's recommendations and the Shop Drawings. Roofs having a slope of 1/4-inch per foot or more shall be installed starting at the low side, to ensure that end laps are shingle fashion.

- C. Metal deck sheets shall be positioned on supporting steel framework and adjusted to final position with ends bearing a minimum of 2-inches on supporting members. Units shall be placed end to end, with ribs aligned over the entire length of the run before being permanently fastened.
- D. Special care shall be exercised not to damage or overload the deck during installation. The deck shall not be used for storage or as working platforms until permanently secured in position. Construction loads shall not exceed the deck carrying capacity, as recommended by the manufacturer.
- E. Openings in the deck shall be cut and fitted neatly and shall be reinforced with structural steel members to distribute the load.
- F. Where concrete fill is required, deck shall be installed with closure plates and other accessories as needed to prevent loss of water, cement, and fines during placing and consolidation of the concrete.
- G. Edges of any cut openings or any minor surface damage areas shall be repaired in accordance with applicable requirements of the Sections 09 96 00 and 05 50 00.
- H. After installation, surfaces shall be cleaned and left free of grime and dirt. The CONTRACTOR shall remove unused materials, tools, scaffolding, and debris from the premises and leave the area broom clean.

### 3.2 WELDING

- A. Care shall be exercised in the selection of electrodes and amperage to provide positive welds and to prevent high amperage blowholes. Welds shall be made from the top side of the deck immediately after alignment.
- B. The metal deck shall be welded to supporting members with 1/2-inch effective diameter puddle welds spaced at 12-inches on center at members parallel to the ribs and at every rib valley at members perpendicular to the ribs, unless otherwise indicated. Welding washers shall be used when welding steel deck of less than 0.028-inch thickness. Welding washers shall not be used when welding steel deck of 0.028-inches or greater.
- C. Side laps shall be welded with 1-1/2 inch long top seam welds, spaced at 12-inches on center unless indicated otherwise.
- D. Welds shall be free of sharp points or edges. Welds shall be cleaned immediately by chipping or wire brushing and shall be coated with a zinc dust type primer paint.
- E. Welding shall conform to the applicable requirements of AISC "Light Gauge Steel Design." Welders shall be AWS certified.

- END OF SECTION -

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## SECTION 05 50 00 - MISCELLANEOUS METALWORK

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide miscellaneous metalwork and appurtenances, complete and in place, as indicated in accordance with the Contract Documents.

#### 1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3) (Ships) Aluminum Planks. (6063-T6)

MIL-A-907E Antiseize Thread Compound, High Temperature

B. Codes

OSHA 1917.118 Fixed Ladders

C. Commercial Standards

AA-M32C22A41 Aluminum Assn.

AASHTO HS-20 Truck Loading

AISC Manual of Steel Construction

AISI Design of Light Gauge, Cold-Formed Steel Structural Members

ANSI / AWS D1.1 Structural Welding Code - Steel

ANSI / AWS D1.2 Structural Welding Code - Aluminum

ANSI / AWS QC1 Qualification and Certification of Welding Inspectors

ASTM A 36 Carbon Structural Steel

ASTM A 48 Gray Iron Castings

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A 193 Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service

ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ANSI / AWS D1.1	Structural Welding Code - Steel
ANSI / AWS D1.2	Structural Welding Code - Aluminum
ANSI / AWS QC1	Qualification and Certification of Welding Inspectors

### 1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of Section 01 33 00 – Contractor Submittals.

**B. Shop Drawings:**

1. Shop Drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the WORK.
2. Shop Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.
3. Grating
  - a. Submit layout drawings for grating, showing the direction of span, type and depth of grating, size and shape of grating panels, support seat angle and ledger details, and details of grating hold down fasteners.
  - b. Submit load and deflection tables for each style and depth of grating used.
4. Anchors
  - a. Submit an ICC-ES report listing the ultimate load capacity in tension and shear for each size and type of concrete anchor.
  - b. Submit manufacturer's recommended installation instructions and procedures for adhesive anchors.



- c. Upon review by the ENGINEER, these instructions shall be followed specifically.
- d. No substitution for the indicated adhesive anchors will be considered unless accompanied with ICC-ES report verifying strength and material equivalency, including temperature at which load capacity is reduced to 90 percent of that determined at 75 degrees F.

1.4 QUALITY CONTROL

- A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.
- B. Welding shall be inspected by an inspector qualified in accordance with AWS requirements and approved by the ENGINEER.

**PART 2 -- PRODUCTS**

2.1 GENERAL REQUIREMENTS

A. **Steel**

Wide Flange Shapes	ASTM A 992
Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless indicated otherwise
HSS	ASTM A 500 Grade B

B. Corrosion Protection

- 1. Unless otherwise indicated, fabricated steel metalwork which will be used in a corrosive environment and/or will be submerged in water or wastewater shall be coated in accordance with the requirements of Section 09 96 00 – Protective Coating, and shall not be galvanized prior to coating.
- 2. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.

C. Stainless Steel

- 1. Unless otherwise indicated, stainless steel metalwork and bolts shall be fabricated from Type 316 stainless steel.

D. Aluminum

- 1. Unless otherwise indicated, aluminum metalwork shall be fabricated from Alloy 6061-T6.

2. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with the requirements of Section 09 96 00 – Protective Coating.

E. Cast Iron

1. Unless otherwise indicated, iron castings shall conform to the requirements of ASTM A 48, Class 50B, or better.

## 2.2 ALUMINUM RAILINGS

A. General

1. Aluminum handrails and railings shall be component systems, complete with anchors, attachments, balusters, brackets, caps, fasteners, gates (swing with self-latching hardware or be removable), posts, sleeves, trim, and any other related items as required or necessary for a complete installation.
2. Gates and removable rail sections shall be complete with hardware such as self-closing hinges, self-latching latches, hasps, and the like.
3. Railings shall conform to Building Code and OSHA requirements, General Industry Occupational Safety and Health Standards (29CFR1910).

B. Materials. Materials shall conform to the following requirements:

1. Aluminum
  - a. Aluminum shall be U.S. Alloy 6063 T-5 or T-6.
  - b. Aluminum pipe rail shall not be less than 1.5-inch diameter Schedule 40 pipe.
2. When in contact with concrete surfaces, protective coating System 108 (Aluminum Metal Isolation), as defined in Section 09 96 00 – Protective Coating, shall be provided for electrolysis protection.
3. Sleeves shall be of galvanized steel or heavy duty PVC when embedded in concrete.
4. Grout for handrail posts shall consist of an inorganic, non-shrink, non-metallic premixed grout in accordance with the requirements of Section 03 60 00 – Grout.
5. Fasteners, screws, and bolts shall be concealed and shall be fabricated from stainless steel or aluminum.
6. Aluminum welding rods shall be of a type recommended by the aluminum manufacturer for anodized finished products.
7. Kickplates shall be provided on railings and not set in curbs.

- C. Anodized Finish. Pipe railing systems, including handrails, safety railings, tube caps, and other miscellaneous parts of the rails, shall be provided with a clear anodized finish, AA-M32C22A41.

## 2.3 STEEL PIPE HANDRAILS

- A. Steel pipe handrails, including brackets and related hardware which may be partially or wholly submerged or which are located inside a hydraulic structure, shall be fabricated entirely of Type 316 stainless steel.
- B. Other steel pipe handrails shall be standard 1.5-inch black steel pipe made up by welding, and shall be hot-dip galvanized after fabrication.

## 2.4 METAL STAIRS

### A. Metal Stairs

1. Metal stairs shall be composed of steel or aluminum stringers and supports, shall be fabricated in accordance with the standard practice of the National Association of Ornamental Metal Manufacturers, and shall be as indicated.
2. Steel stair members shall be hot-dip galvanized after fabrication.

## 2.5 GRATING STAIR TREADS

- A. Grating stair treads shall be designed to support a live load of 100 psf or a concentrated load at mid-span of 300 pounds, whichever creates the higher stress.
- B. The maximum deflection due to the uniform live load shall be as required for metal grating, below.
- C. Grating stair treads shall be provided with an integral non-slip nosing.

## 2.6 SAFETY STAIR NOSINGS

- A. Safety stair nosing shall be provided on concrete stairs and other locations as indicated.
- B. The nosing shall be 3 inches wide and fabricated from extruded aluminum with cast-in abrasive strips and integral extruded anchors.
- C. The color of the cast abrasive shall be as selected by the ENGINEER from among the manufacturer's standard colors.
- D. The nosing shall be Amstep Products Style 231-A, Grating Pacific XRS-3, Robertson Grating Products Type 9511, or equal.

## 2.7 ALTERNATING TREAD STAIRS

- A. Alternating tread stairs shall have a series of steps at 56 degrees from the horizontal.

- B. The stairs shall be equipped with handrails designed to provide adequate handhold in order to avoid falling, and a handrail shall be provided on both sides of the stair.
- C. The stairs shall provide a minimum of 17 inches and a maximum of 24 inches of width between the handrails.
- D. Treads shall have a minimum depth of 8-1/2 inches and a minimum width of 7 inches.
- E. Stairs shall have a minimum tread run of 5 inches and a maximum rise to the next alternating tread surface of 9-1/2 inches.
- F. Tread run and rise shall be consistent throughout the stair.
- G. The initial tread of the stair shall begin at the same elevation as the platform or landing.
- H. Alternating tread stairs shall be designed for a concentrated load of 600 lb. on the treads, and a 200-lb. load applied in any direction at any point on the handrail.
- I. Treads and platforms shall be provided with a non-slip surface.
- J. Steel Alternating Tread Stairs
  - 1. Steel alternating tread stairs shall be composed of steel treads, landings, stringers, and handrails.
  - 2. Steel stair members shall be hot-dip galvanized after fabrication.

## 2.8 RECESSED FLOOR GRID

- A. The floor grid shall consist of single- or multi-tread extrusions interlocked together to form finished mat sections.
- B. Tread rails shall be fabricated from aluminum, spaced 1.5 inches on-center, and shall run counter to the traffic flow.
- C. The floor grid shall be designed for a minimum 300 psf uniform load.
- D. The floor grid shall be removable and replaceable without requiring disassembly of the entire grid and without damage to the grid.
- E. Frame
  - 1. The recessed frame shall be of a cast-in type, with anchors spaced at a minimum of 24 inches on-center.
  - 2. The frame shall be fabricated from aluminum and where in contact with concrete shall be coated in accordance with the requirements of Section 09 96 00 - Protective Coating.

F. Tread Surface

1. The tread surface shall be composed of a continuous crosshatched vinyl insert.
2. The color of the inserts shall be as selected by the ENGINEER from among the manufacturer's full range of custom colors.

G. Manufacturers. The floor grid shall be Balco, Inc. FG or FG3 Series, Perfec Grate by Reese Enterprises, or equal.

2.9 LADDERS

A. 250 lb load rating, constructed of the following materials:

1. Ladders which may be partially or wholly submerged or which are located inside a hydraulic structure shall be fabricated entirely of Type 316 stainless steel.
2. Other ladders shall be fabricated from aluminum, Unless noted otherwise on drawings.

B. Pop-Up Extension

1. Every ladder that does not have an exterior handhold shall be equipped with a pop-up extension.
2. The pop-up extension device shall be manufactured of the same material and finish as the ladder, and shall be provided with a telescoping tubular section that locks automatically when fully extended.
3. Upward and downward improvement shall be controlled by stainless steel spring balancing mechanisms.
4. The units shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

2.10 METAL GRATING

A. General

1. Metal grating shall be of the indicated design, size, and type.
2. Grating shall be supported around an opening by support members.
3. Where grating is supported on concrete, unless otherwise indicated provide embedded support angles that match the grating material and are mitered and welded at their corners.
4. Banding
  - a. The grating shall be completely banded at edges and cutouts.
  - b. The banding material and cross-section shall be equivalent to the bearing bars.

- c. The banding shall be welded to each cut bearing bar.
5. The grating pieces shall be fastened to each support in 2 locations.
6. Where grating forms the landing at the top of a stairway, the edge of the grating that forms the top riser shall have an integral non-slip nosing with a width equal to that of the stairway.
7. Where the grating depth is not indicated, provide grating within allowable stress levels and which shall not exceed a deflection of 1/4 inch or the span divided by 180, whichever is less.
8. Design Loading
  - a. For standard duty plank and safety grating, the loading to be used for determining stresses and deflections shall be the uniform live load of the adjacent floor or 100 psf, whichever is greater, or a concentrated load of 600 pounds.
  - b. For heavy duty grating, the loading used for determining stresses and deflections shall be in accordance with AASHTO HS-20.

B. Material

1. Except where indicated otherwise, bar grating shall be fabricated entirely of:
  - a. galvanized steel
2. Safety grating shall be fabricated from galvanized steel.
3. Plank grating shall be fabricated from galvanized steel.
4. Grating that may be partially or wholly submerged shall be fabricated entirely of Type 316 stainless steel.

C. Standard-Duty Grating

1. No single piece of grating shall weigh more than 80 pounds, unless indicated otherwise.
2. Standard duty grating shall be composed of serrated bar grating.
3. Cross bars shall be welded or mechanically locked tightly into position such that there is no movement between the bearing and cross bars.

D. Safety Grating

1. Safety grating shall be fabricated from sheet metal punched into an open serrated diamond pattern and be formed into plank sections.
2. The open diamond shapes shall be approximately 1.875 inches by 11/16-inch in size.

3. Safety grating shall be **Grip Strut** by **Metal Products Division, United States Gypsum Company**, **Deck Span** by **IKG Industries**, or equal.

E. Heavy-Duty Grating

1. Heavy-duty grating shall be fabricated from welded steel, galvanized after fabrication.
2. Crossbars shall be welded in position.

F. Plank Grating

1. Plank grating shall be extruded in 6-inch widths with a minimum of 6 integral one-bar type bearing bars per plank.
2. The top surface shall be solid with raised ribs, unless indicated otherwise.
3. Where punched grating is required, the top surface shall be provided with a pattern of 3-inch by 19/32-inch rectangular openings spaced at 4 inches on-center.
4. The planks shall have a continuous tongue-and-groove type interlock at each side, except that interlocking planks shall be arranged such that any 4-foot wide section may be removed independently from the other grating sections.
5. Plank grating shall be provided with a clear anodized finish, except that punched grating may have a standard mill finish.

2.11 CHECKERED PLATE

- A. Checkered plate shall be provided with a pattern of raised lugs on one face, and shall be smooth on the opposite face.
- B. Lugs
  1. Lugs shall be a minimum of one inch in length and raised a minimum of 1/2 inch above the surface.
  2. The lugs shall be located in a pattern in which the lugs are oriented at 90 degrees from the adjacent lugs in 2 orthogonal directions.
  3. The rows of lugs shall be oriented at 45 degrees from the edges of the plates.
- C. Where no material is indicated, the plates shall be fabricated from aluminum.
- D. Unless indicated otherwise, the minimum plate thickness shall be as required to limit deflection resulting from a live load of 100 psf to 1/4 inch, or the span divided by 240, whichever is less.

## 2.12 HATCHES

- A. Where access hatches are mounted on a floor slab (including top slabs that are not covered with a roofing membrane) or on a concrete curb, the hatch shall be flush-type as indicated.
- B. Hatches mounted on a roof surface that has a membrane or other roofing material covering it shall be of the integral raised curb-type in accordance with the requirements of the Contract Drawings.
- C. Hatches shall be fabricated from aluminum 5086 H34, 6063-T5 or 6061-T6, unless otherwise indicated.
- D. Hatch hardware shall be fabricated from Type 316 stainless steel, and shall be of the gutter-type.
- E. The design live load shall be a minimum of 300 psf, unless indicated otherwise.
- F. Configuration
  - 1. Hatch opening sizes, number and swing direction of door leaves, and locations shall be as indicated.
  - 2. Indicated sizes are for the clear opening.
  - 3. Where the number of leaves is not indicated, openings larger than 42 inches in either direction shall be provided with double-leaf doors.
  - 4. Unless indicated otherwise, hinges shall be located on the longer dimension side.
  - 5. Unless indicated otherwise, ladder hatches shall be a minimum of 30 inches wide by 36 inches long, with the ladder centered on the shorter dimension and the door hinge opposite the ladder.
- G. Door leaves shall be fabricated from a minimum of 1/4-inch thick checkered-pattern plate.
- H. Channel frames shall be fabricated from a minimum 1/4-inch material with an anchor flange around the perimeter.
- I. Hatches shall be provided with an automatic hold-open arm with release handle.
- J. Hatches shall be designed for easy opening from both inside and outside.
- K. Hatches shall be designed to be water-tight and shall be equipped with a joint gutter and a moat-type edge drain.
- L. A minimum 1.5 inch diameter drain connection shall be provided, located by the manufacturer.
- M. Pump Station Hatches



1. Hatches for pump stations shall include a **Unistrut**, or equal, channel around the frame perimeter.
  2. The face of the channel shall be flush with the face of the frame, and shall be compatible with the upper guide rail bracket of the submersible wastewater pump.
- N. Security. Hatches shall be provided with a recessed hasp for a padlock covered by a hinged lid that is flush with the surface.
- O. Hatches shall be **Bilco Type J** or **JD**, **Babcock-Davis Type B-FGA**, or equal.

## 2.13 IRON CASTINGS

### A. General

1. Iron castings shall be of uniform quality, free from blowholes, porosity, hard spots, shrinkage, distortion, or other defects.
2. The castings shall be smooth and well cleaned by shotblasting.
3. Covers and grates shall fit together evenly, such that the cover fits flush with the surrounding finished surface and such that the cover does not rock or rattle when a loading is applied.
4. Round covers and frames shall be provided with machined bearing surfaces.

### B. Loads. Covers and grates with matching frames shall be designed to support the following loadings:

1. Where located within a structure, the design loading shall match that required for the adjacent floor area, or, if no floor loading is indicated, a minimum of 300 pounds per square foot.
2. Exterior covers and grates shall be designed for AASHTO HS-20 loading unless indicated otherwise.

## 2.14 MANHOLE RUNGS

### A. General. Rungs shall meet ASTM C 478 - Precast Reinforced Concrete Manhole Sections and the following requirements:

1. Rungs shall be spaced not less than 10 inches apart nor more than 14 inches apart, as measured between centerlines of the rungs.
2. Rungs shall be parallel, level, and uniformly spaced.
3. The rungs shall be shaped such that a person's foot cannot slide off the end of the rung.
4. Rungs shall be surfaced to prevent injury from punctures or lacerations, and to prevent snagging of clothing.

5. The minimum perpendicular clearance between rungs and any obstruction behind the ladder shall be 6 inches.
  6. The minimum width of rungs shall be 14 inches.
- B. Submit certified test results in accordance with ASTM C 497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile, Section 10, for the following loads:
1. The horizontal pull-out load shall be 400 pounds.
  2. The vertical load shall be 800 pounds.
- C. Material
1. Rungs shall be fabricated from co-polymer polypropylene that encapsulates a minimum 1/2-inch grade 60 steel reinforcing rod.
  2. The co-polymer polypropylene shall meet ASTM D 4101, Type PP200B33430.

## 2.15 BOLTS AND ANCHORS

### A. Standard Service (Non-Corrosive Application)

1. Unless otherwise indicated, bolts, anchor bolts, washers, and nuts shall be fabricated from carbon steel as indicated, and hot dip galvanized after fabrication.
2. Threads on galvanized bolts and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.
3. Except as otherwise indicated, steel for bolt material, anchor bolts, and cap screws shall be in accordance with the following requirements:
  - a. Structural Connections: ASTM A 307, Grade A or B, hot-dip galvanized
  - b. Anchor Bolts: ASTM A 307, Grade A or B, or ASTM A 36, hot-dip galvanized
  - c. High-Strength Bolts, where indicated: ASTM A 325
  - d. Pipe and Equipment Flange Bolts: ASTM A 193, Grade B-7

### B. Corrosive Service

1. Bolts, nuts, and washers in the locations listed below shall be fabricated from Type 316 stainless steel as indicated below, or as indicated otherwise on the Contract Drawings.
  - a. Buried locations
  - b. Submerged locations

- c. Locations subject to seasonal or occasional flooding
  - d. Inside hydraulic structures below the top of the structure
  - e. Inside buried vaults, manholes, and structures that do not drain through a gravity sewer or to a sump with a pump
  - f. Chemical handling areas
  - g. Inside trenches, containment walls, and curbed areas
  - h. Locations indicated or designated by the ENGINEER to be provided with corrosion resistant steel bolts
2. Stainless Steel Nuts on SS Bolts. Unless otherwise indicated, stainless steel bolts, anchor bolts, nuts, and washers shall be fabricated from Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.
- C. Anti-seize Lubricant Coating
- 1. Threads on stainless steel bolts shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, meeting government specification MIL-A-907E.
  - 2. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.
  - 3. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.
  - 4. Antiseize lubricant shall be "PURE WHITE" by **Anti-Seize Technology**, Franklin Park, IL, 60131, **AS-470** by **Dixon Ticonderoga Company**, Lakehurst, NJ, 08733, or equal.
- D. Bolt Requirements
- 1. The bolt and nut material shall be free-cutting steel.
  - 2. The nuts shall be capable of developing the full strength of the bolts.
  - 3. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.
  - 4. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.
  - 5. Bolts and nuts shall be installed with washers fabricated from material matching the base material of bolts, except that hardened washers for high-strength bolts shall conform to the requirements of the AISC Specification.
  - 6. Lock washers fabricated from material matching the bolts shall be installed where indicated.

7. The length of each bolt shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

## 2.16 Drilled Anchors in Concrete and Masonry

### A. General

1. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors.
2. No substitutions will be considered unless accompanied with an ICBO report verifying strength and material equivalency.
3. Expanding type anchors are not permitted unless specifically indicated otherwise in the Contract Documents.

### B. Epoxy Anchors

1. Epoxy adhesive anchors are required for drilled anchors for outdoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars.
2. Epoxy shall be in accordance with the requirements of Section 03 60 00 – Grout.
3. Threaded rod shall be galvanized for general purpose applications and fabricated from Type 316 stainless steel for use in corrosive applications.
4. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100 degrees F or higher than the limiting temperature recommended by the manufacturer, whichever is lower.
5. Epoxy anchors shall not be used where anchors are subject to vibration or fire.
6. Embedment depth shall be as the manufacturer recommends for the load to be supported.
7. Unless otherwise indicated, glass capsule, polyester resin adhesive anchors will be permitted in locations not included above, and shall be **Hilti HVA, Cobra Anchors**, or equal.
8. Threaded rod shall be fabricated from galvanized steel.

### C. Non-Shrink Grouted Anchors

1. Anchors, if indicated or permitted, shall be grouted with a non-shrink cementitious grout in accordance with the manufacturer's recommendations.
2. Embedment depth shall be as the manufacturer recommends for the load to be supported.

3. Non-shrink grout material shall be Class B or C in accordance with Section 03 60 00 – Grout.

D. Expanding -Type Anchors

1. Expanding-type anchors, if indicated or permitted, shall be fabricated from galvanized steel, shall be of the expansion type, and shall be **ITW Ramset/Redhead Trubolt** anchors, **McCullock Industries Kwick-Bolt**, or equal.
2. Lead caulking anchors will not be permitted.
3. Size shall be as indicated.
4. Embedment depth shall be as the manufacturer recommends for the load to be supported.
5. Expansion-type anchors that are to be embedded in grout may be fabricated from steel.
6. Non-embedded buried or submerged anchors shall be fabricated from stainless steel.

2.17 POWDER-DRIVEN PINS

- A. Powder-driven pins for installation in concrete or steel shall be fabricated from heat-treated steel alloy.
- B. If the pins are not inherently sufficiently corrosion-resistant for the conditions to which they will be exposed, they shall be protected in an acceptable manner.
- C. Pins shall have capped or threaded heads capable of transmitting the loads the shanks are required to support.
- D. Pins that are connected to steel shall be provided with longitudinal serrations around the circumference of the shank.

2.18 IMPACT ANCHORS

- A. Impact anchors shall be an expansion-type anchor in which a nail-type pin is driven to produce the expansive force.
- B. The pin shall be provided with a zinc sleeve with a mushroom-style head and stainless steel nail pin.
- C. Anchors shall be **Metal Hit Anchors**, manufactured by **Hilti, Inc.**, **Rawl Zamac Nailin**, manufactured by the **Rawlplug Company**, or equal.

## PART 3 -- EXECUTION

### 3.1 FABRICATION AND INSTALLATION REQUIREMENTS

#### A. Fabrication and Erection

1. Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

#### B. Aluminum Railings

1. Aluminum railing fabrication and installation shall be performed by craftsmen experienced in the fabrication of architectural metalwork.
2. Exposed surfaces shall be free from defects or other surface blemishes.
3. Dimensions and conditions shall be verified in the field.
4. Joints, junctions, miters, and butting sections shall be precision fitted with no gaps occurring between sections, and with surfaces flush and aligned.
5. Electrolysis protection of materials shall be provided.

#### C. Hatch Drains. Unless otherwise indicated, the CONTRACTOR shall provide a 1/2-inch, galvanized steel drain line to the nearest surface drain location for floor or roof hatches.

#### D. Powder-Driven Pins

1. Powder-driven pins shall be installed by a craftsperson certified by the manufacturer as being qualified to install the manufacturer's pins.
2. Pins shall be driven in one initial movement by an instantaneous force that has been carefully selected to attain the required penetration.
3. Driven pins shall conform to the following requirements where "D" is equal to the pin shank diameter:

Material Penetrated by Pin	Material Minimum Thickness	Pin Shank Penetration in Supporting Material	Min. Space from Pin's CL to Edge of Penetrated Material	Min. Pin Spacing
Concrete	16D	6D minimum	14D	20D
Steel	1/4-inch	Steel thickness	4D	7D

## 3.2 WELDING

### A. Methods & Qualifications

1. Welding shall be performed by the metal-arc method or gas-shielded arc method as described in the American Welding Society "Welding Handbook" as supplemented by other pertinent standards of the AWS.
2. The qualification of the welders shall be in accordance with the AWS Standards.

### B. Quality

1. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained in order to minimize distortion and for control of dimensions.
2. Weld reinforcement shall be as indicated by the AWS Code.
3. Upon completion of welding, remove weld splatter, flux, slag, and burrs left by attachments.
4. Welds shall be repaired in order to produce a workmanlike appearance, with uniform weld contours and dimensions.
5. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32 inch on the flat.

## 3.3 GALVANIZING

A. Structural steel plates shapes, bars, and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the requirements of ASTM A 123.

B. Any galvanized part that becomes warped during the galvanizing operation shall be straightened.

C. Bolts, anchor bolts, nuts, and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the requirements of ASTM A153.

### D. Field Repairs

1. Field repairs to damaged galvanizing shall be performed by preparing the surface and applying a coating.
2. Surface preparation shall consist of removing oil, grease, soil, and soluble material by cleaning with water and detergent (SSPC SP1) followed by brush-off blast cleaning (SSPC SP7) over an area extending at least 4 inches into the undamaged area.
3. The coating shall be applied to at least 3 mils dry film thickness, and shall be **Zinc-Clad XI** by **Sherwin-Williams**, **Galvax** by **Alvin Products**, **Galvite** by **ZRC Worldwide**, or equal.

### 3.4 DRILLED ANCHORS

- A. Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions and ICC-ES AC308 for adhesive anchors and ICC-ES AC193 for mechanical anchors.
- B. Holes shall be roughened with a brush on a power drill, and then cleaned and dried.
- C. Drilled anchors shall not be installed until the concrete has reached the required 28-day compressive strength.
- D. Adhesive anchors shall not be loaded until the adhesive has reached its indicated strength in accordance with the manufacturer's instructions.

- END OF SECTION -



## SECTION 06 10 00 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Wood blocking, panels, and nailers.
2. Wood furring, equipment supports and grounds.
3. Sheathing (plywood and glass-mat gypsum).
4. Air infiltration barrier/building paper.

B. Related Sections include the following:

1. Division 6 "plastic-laminate-faced architectural cabinets" for finished woodwork and millwork.
2. Division 9 Section "Gypsum Board Assemblies" for metal stud walls requiring sheathing or backing.

#### 1.2 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.

#### 1.3 SUBMITTALS

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

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials by pressure process comply with requirements. Include physical properties of treated materials, for products with a flame spread index of 25 or less when tested according to ASTM E 84.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
4. Include product data for sheathing.
5. Include product data for air infiltration barrier/building paper.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
- C. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings. Keep materials under cover and dry. Protect from damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Plywood Sheathing:
    - a. Any member of APA.
  - 2. Glass-Mat Gypsum Sheathing Board:
    - a. G-P Gypsum Corporation.
  - 3. Air-Infiltration Barriers/Building Paper:
    - a. Amoco Foam Products Co.
    - b. Anthony Industries, Inc.; Simplex Products Division.
    - c. Atlas Building Products
    - d. Celotex Corporation (The); Building Products Division.
    - e. DuPont Company; Fibers Department.
    - f. Parsec, Inc.
    - g. Raven Industries, Inc.
    - h. Reemay, Inc.

- i. Sto-Cote Products, Inc.

## 2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.
  - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
  - 5. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood or products exhibiting a flame spread index of 25 or less when tested according to ASTM E 84.
  - 2. Use treatment that does not promote corrosion of metal fasteners.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
  - 4. Grounds.
  - 5. Backing Panels

- B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 15 percent maximum moisture content and any of the following species:
  - 1. Mixed southern pine; SPIB.
  - 2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
  - 3. Western woods; WCLIB or WWPA.
- C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
  - 1. Hem-fir or Hem-fir (north), Standard or 3 Common grade; NLGA, WCLIB, or WWPA.
  - 2. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

## 2.5 WOOD-BASED STRUCTURAL-USE PANELS

- A. Structural-Use Panel Standards: Provide either all-veneer, mat formed, or composite panels complying with DOC PS 2 (Exposure-1), "performance Standard for Wood-Based Structural-Use Panels", unless otherwise indicated for interior applications. Provide plywood panels complying with DOC PS 1 (exterior), "U.S. Product Standard for Construction and Industrial Plywood", where plywood is indicated for exterior wall or roof locations.
- B. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.

## 2.6 STRUCTURAL-USE PANELS FOR BACKING

- A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32-inch thick.

## 2.7 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA C2 lumber and AWPA C9 plywood, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).
  - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and the following:
    - a. Chromated copper arsenate (CCA).
    - b. Ammoniacal copper zinc arsenate (ACZA).
    - c. Ammoniacal, or amine, copper quat (ACQ).
    - d. Copper bis (dimethyldithiocarbamate) (CDDC).

- e. Ammoniacal copper citrate (CC).
  - f. Copper azole, Type A (CBA-A).
  - g. Oxine copper (copper-8-quinolinolate) in a light petroleum solvent.
- B. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- C. Application: Treat items indicated on Drawings, and the following:
- 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood floor plates that are installed over concrete slabs directly in contact with earth.

## 2.8 GYPSUM SHEATHING

- A. Glass-Mat Gypsum Sheathing Board: Glass faced front and back, water-resistant-core gypsum sheathing board complying with ASTM C 1177/C and 1177/M, ASTM D 3273, ASTM E 136 and as follows:
- 1. Type and Thickness: Type X, 5/8 inch thick.
  - 2. Product: Subject to compliance with requirements, provide "DensGlass Gold" by Georgia-Pacific Corporation.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening substrate panel to metal studs. Fasteners shall be driven flush with the panel surface (not countersunk) into the framing system.

## 2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 653/A 653M, G60 coating designation.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.

- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.10 MISCELLANEOUS MATERIALS

- A. Building Paper: Asphalt-saturated organic felt complying with ASTM D 226, Type I (No. 15 asphalt felt), unperforated.
- B. Sheathing Tape: Pressure-sensitive plastic tape for sealing joints and penetrations in gypsum sheathing and recommended by sheathing manufacturer for use with type of sheathing required.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Apply field treatment complying with AWPA M4 to cut surfaces of fire-treated lumber.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. CABO NER-272 for power-driven fasteners, P-nails, and allied fasteners.
  - 2. Published requirements of metal framing anchor manufacturer.
  - 3. Table 2304.6.1, "Fastening Schedule" in the International Building Code, unless otherwise indicated.

### 3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 INSTALLATION OF STRUCTURAL-USE PANELS

- A. General: Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide" Residential & Commercial," for types of structural-uses panels and applications indicated.
  - 1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Sheathing: Screw to framing.
    - a. Space panels 1/8 inch at edges and ends.
  - 2. Plywood Backing Panels: Nail or screw to supports.

### 3.4 GYPSUM SHEATHING

- A. Install 48-by-96-inch and longer sheathing vertically with long edges parallel to, and centered over, studs. Install solid metal stud blocking where end joints do not occur over framing. Fit units tightly against each other. Fasteners shall be driven flush with the panel surface (not countersunk) into the framing system.
  - 1. Fasten Methods: Screw to framing at 8" o.c. in field and perimeter.

### 3.5 BUILDING PAPER APPLICATION

- A. Apply building paper horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with galvanized staples or roofing nails as required to hold building paper tight to substrate. Cover upstanding flashing with 4-inch overlap.

### 3.6 SHEATHING TAPE APPLICATION

- A. Apply sheathing tape at items penetrating gypsum sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION 06 10 00



## SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Plastic laminate cabinets.
2. Plastic-laminate countertops.
3. Interior standing and running trim.
4. Thermoset decorative overlay cabinet interiors.
5. Stainless steel countertops and corner guards.

B. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 9 Section "Painting" for field finishing of interior architectural woodwork.
3. Division 5 Section "Metal Fabrications" for sheet metal shelving where indicated.

#### 1.2 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

#### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.

- C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Plastic laminates.
  - 2. Thermoset decorative overlays.
- D. Samples for verification purposes of the following:
  - 1. Wood veneer stained and finished.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.7 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Red Oak, plain sawn.
- C. Wood Species for Opaque Finish: Cedar or redwood at Hatchery Building. Any closed-grain hardwood and Shop and Storage Buildings.
- D. Wood Products: Comply with the following:
  1. Hardboard: AHA A135.4.
  2. Medium-Density Fiberboard: ANSI A208.2, Grade MD-Exterior Glue.
  3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  4. Hardwood Plywood and Face Veneers: HPVA HP-1.
- E. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
  1. Manufacturer: Subject to compliance with requirements, provide thermally fused melamine by the following:
    - a. Pionite Melamine Decorative Surfaces.
    - b. Formica Corporation.
    - c. Wilsonart International; Div. of Premark International, Inc.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
  - a. Formica Corporation.
  - b. Wilsonart International; Div. of Premark International, Inc.
  - c. Nevamar Corp.
- G. Adhesive for Bonding Plastic Laminate: Contact cement.
- H. Metal Fabrication and Materials;
  1. Provide AISI Type 302 or 304, hardest workable temper, with No. 2B, bright cold rolled unpolished directional satin finish, 14 gauge. Install on countertops where indicated.
  2. Provide AISI Type 304, 16 gauge surface mount corner guards where indicated, with 1-1/2 inch wing by 4-foot height as manufactured by InPro Corporation (800) 222-5556. Surface mount option includes cement-on or screw-on.

## 2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Concealed Hinges: European type as follows:
  1. 120 to 125 Degrees of Opening: Blum 125 Series Hinge with mounting plate or Salice 120 Series Hinge with mounting plate.
- D. Wire Pulls: Back mounted, 4 inches long, 2-1/2 inches deep, and 5/16 inches in diameter.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.
  1. Knappe and Vogt #255 ALM or bore and pin system for cabinet interiors.
  2. Knappe and Vogt #83 Series Oversized Standards, 14 gauge, 24-inch with #183 Series Flanged Bracket System, 16 gage, incorporating 18-inch deep right, left, and center flanged brackets, for metal storage shelving where indicated.
- G. Shelf Rests: BHMA A156.9, B04013.
  1. Knappe and Vogt #256S, ALM or locking, adjustable, metal shelf pins.

- H. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
  - 1. Box Drawer Slides: 100 lbf: Knappe and Vogt #8400.
  - 2. File Drawer Slides: 200 lbf: Knappe & Vogt #8800.
- I. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
- J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 626.
- K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
  - 1. Satin Stainless Steel: BHMA 626.

## 2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

## 2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- D. Complete fabrication, including assembly, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

F. Cabinet Component Thickness and Materials:

1. Ends, Divisions, Bottoms, Tops: 3/4 inch panel product.

2. Rails: 3/4 inch edge-banded panel product.

3. Shelves: 3/4 inch thick for spans up to 36 inches and one inch thick for spans 36 to 48 inches and where indicated. Install mid-support over 48 inches.

4. Backs: 1/4 inch nominal panel product.

5. Doors: 3/4 inch with PVC edges and faced panel product.

6. Drawer Sides, Backs, and Subfronts: 1/2 inch panel product.

7. Drawer Bottoms: 1/4 inch nominal panel product.

8. Drawer Front: 3/4 inch PVC edged - banded panel product.

## 2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Custom.

C. Wood Species and Cut: Oak, plain sliced.

D. For trim items wider than available lumber, use veneered construction. Do not glue for width.

E. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

F. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

G. Profiles: As indicated on drawings.

1. Countertop Front Edge: 2-inch by 2-inch stock.

2. Window Sill and Stoop: 3/4-inch stock by width indicated.

## 2.6 THERMOSET DECORATIVE OVERLAY CABINETS – PL2

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

- B. Grade: Custom.
- C. AWI Type of Cabinet Construction: Flush overlay.
- D. Cladding for Exposed Surfaces: Thermoset decorative overlay complying with the following requirements:
  - 1. Horizontal Surfaces Other Than Tops: Thermoset decorative overlay.
  - 2. Vertical Surfaces: Thermoset decorative overlay.
  - 3. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish. Additional lead time and minimum quantity purchase may be necessary.
- E. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative overlay.
  - 2. Drawer Sides and Backs: Thermoset decorative overlay.
  - 3. Drawer Bottoms: Thermoset decorative overlay.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Face: Wilsonart: "Sunstone."
  - 2. Standard white melamine faces for interior.
- G. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

## 2.7 PLASTIC-LAMINATE COUNTERTOPS – PL1

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. Grade: Custom.
- C. High-Pressure Decorative Laminate Grade: HGS.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Scheduled Color and Pattern: (Countertops)
    - a. Wilsonart: "Antique Glass."
- E. Edge Treatment: Square edge, unless detailed otherwise.
- F. Core Material: Particleboard.

- G. Core Material at Sinks: Particleboard made with exterior glue.

## 2.8 WOOD TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWI Section 700 requirements.
- B. Grade: Custom
- C. Wood Species and Cut: Red Oak, plain sliced.
- D. Shop Finishing:
  - 1. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
    - a. Grade: Provide finishes of same grades as items to be finished.
  - 2. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
  - 3. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
    - a. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.
  - 4. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523:
    - a. Grade: Custom
    - b. AWI Finish System TR-2: Catalyzed lacquer.
    - c. Staining: Match approved sample color.
    - d. Wash Coat for Stained Finish: Apply a vinyl wash coat to woodwork made from closed-grain wood before staining and finishing.
    - e. Sheen: Satin, 30-50 gloss units.

## 2.9 SHELVING

- A. Quality Standard: Comply with AWI 300 requirements.
- B. Grade: Custom
- C. Clad with thermally fused melamine and PVC edge - banding.



- D. Field painted where indicated on drawings.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  - 3. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

- G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
  - 1. Fill gaps, if any, with plastic wood filler, sand smooth, and finish same as adjacent wood, if finished.
  - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 41 16

## SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes cold-applied asphalt emulsion dampproofing. Dampproofing is not identified in the Drawings for clarity but is required at exterior surface of all underground perimeter foundation walls, from 2" below finish grade to top of footing, extend over top of footing, and down a minimum of 6 inches over outside face of footing.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product specified include data substantiating that materials comply with specified requirements for each dampproofing material specified. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.
- B. Installer Qualifications: Engage an experienced installer who has completed bituminous dampproofing work similar in material, design, and extent to that indicated for Project and that has resulted in construction with a record of successful in-service performance.

#### 1.4 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

### PART 2 - PRODUCTS

#### 2.1 DAMPPROOFING MATERIALS

- A. Asphalt Emulsion: Asphalt and water emulsion coating compounded to penetrate substrate and to build to moisture resistant coating.
- B. Provide semifibrated type semimastic asbestos free emulsion ASTM D1227, Type II.
- C. 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. Celotex Corporation.

2. GAF Building Materials Corporation.
3. GS Roofing Products Company, Inc.
4. Karnak Chemical Corp.
5. Koppers Company Inc.
6. Manville Building Materials Corporation.
7. Owens-Corning Fiberglas Corporation.
8. Tamko Corporation.
9. Tremko, Inc.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for surface smoothness and other conditions affecting performance of work.
  1. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.
- B. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

### 3.3 APPLICATION, GENERAL

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
  1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
  2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

### 3.4 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 11 13

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## SECTION 07 19 00 - WATER REPELLENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes clear water-repellent and water-based high-build acrylic coatings. Water repellents are minimally indicated on the Drawings for clarity but are required at the following surfaces when these surfaces are exposed to view:
  - 1. Exterior concrete masonry units, unpainted, to receive clear water repellent.
- B. Related Sections include the following:
  - 1. Division 3 Sections for concrete work including floor sealers and curing agents.
  - 2. Division 4 Sections for concrete unit masonry.
  - 3. Division 7 Section "Joint Sealants" for joint sealants.
  - 4. Division 9 Section "Painting" for paints and coatings.

#### 1.2 SUBMITTALS

- A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
  - 1. Submit manufacturer's color chart indicating full range of standard colors for acrylic wall coating.

#### 1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products. Applicator shall have not less than 3 years of successful experience in application of water repellents of types required on substrates similar to those of this Project.

#### 1.4 PROJECT CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:
  - 1. Ambient temperature is less than 40 deg F.
  - 2. Concrete surfaces and mortar have cured for less than 28 days.

3. Rain or temperatures below 40 deg F are predicted within 24 hours.
4. Application is earlier than 24 hours after surfaces have been wet.
5. Substrate is frozen or surface temperature is less than 40 deg F.
6. Windy condition exists that may cause water repellent or coatings to be blown onto vegetation or surfaces not intended to be coated.

## 1.5 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within 5 years from date of Substantial Completion. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch wide, fire, vandalism, or abuse by maintenance equipment.

## PART 2 - PRODUCTS

### 2.1 CLEAR PENETRATING WATER REPELLENT

- A. Manufacturers shall be limited the following:
  1. Sureklean weather seal blok-guard and graffiti control; ProSoCo, Inc.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
  1. Masonry: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents and wall coatings. Clean masonry per ASTM D 5703.
    - a. High pressure water blast.
- B. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent and wall coatings. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent and wall coatings being deposited on surfaces. Cover live plants and grass.



- C. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

### 3.2 APPLICATION - WATER REPELLENT

- A. Apply a heavy-saturation spray coating of water and graffiti repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.
- C. Provide written verification to Architect that two separate coatings were applied and witnessed by project superintendent.

### 3.3 CLEANING

- A. Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 19 00

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## SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following sheet metal flashing and trim including, but not limited to, the following:
  - 1. Manufactured reglets and counterflashing.
  - 2. Formed flashing and trim.
- B. Related Sections include the following:
  - 1. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
  - 1. Details for forming sheet metal flashing and trim, including profiles, shapes, seams and dimensions.
  - 2. Details for fastening, joining, supporting and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
- C. Initial Color Samples: Provide color charts illustrating full line of manufacturer's colors for prefinished metal items.
- D. Samples: For each type of exposed prefinished item; 4" square for sheet product, 8" long for trim items.

#### 1.4 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

- B. Preinstallation Conference: Attend any preinstallation meetings scheduled for aluminum storefront or roofing work. Review methods and procedures related to sheet metal flashing and trim.

## 1.5 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

## PART 2 - PRODUCTS

### 2.1 SHEET METALS

- A. Prefinished, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; commercial quality with 0.20% copper, 24 gauge unless otherwise indicated.
  - 2. Exposed Finishes: Architect will select from manufacturer's full line of colors and will have the option to select more than one color.
  - 3. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. Finish shall be Kynar 500 fluorocarbon coating.
- B. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

### 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

### 2.3 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing

indicated with factory- mitered and factory-welded corners and junctions. Provide end caps to the profile of the counterflashing where exposed or abutting another material.

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. Cheney Flashing Company, Inc.
  - b. Fry Reglet Corporation.
  - c. Heckmann Building Products Inc.
  - d. Hickman, W. P. Company.
  - e. Keystone Flashing Company, Inc.
  - f. Sandell Manufacturing Company, Inc.
2. Material: Galvanized steel, 0.0217 inch thick, pre-finished.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

## 2.4 FABRICATION

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficiently to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
- C. Fabricate sheet metal flashing and trim without oil canning, buckling and tool marks, and true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams SMACNA Figure No. 3-2, Alternate 3 unless otherwise indicated. Tin edges to be seamed, form

seams, and solder. Rivet joints for additional strength where required. Install sealant on each side of seam cover.

- E. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of Work.
  - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual". Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
  - 1. Coat side of lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

- C. Install exposed sheet metal flashing and trim without oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds and sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- F. Bed flanges of work in a thick coat of roofing cement where required for waterproof performance.
- G. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
- H. Fasteners: Unless otherwise required by the manufacturer, use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
  - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
- I. Reglets: Install reglets to receive counterflashing. Coordinate installation with Division 3 and 4 as applicable. Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.
- J. Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches o.c. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.
- K. Counterflashing: Coordinate installation of counterflashing with installation of roofing base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches minimum over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant.
- L. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

### 3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering, or that might cause corrosion of metal or deterioration of finishes.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including

removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures. Ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION 07 62 00



## SECTION 07 84 13 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Penetrations in fire-resistance-rated walls.
- B. Related Sections:
  - 1. Division 07 Section "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
  - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For qualified Installer.
- D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

- B. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    - a. Classification markings on penetration firestopping correspond to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."
- D. Preinstallation Conference: Conduct conference at Project site.

## 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.6 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

## PART 2 - PRODUCTS

### 2.1 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. Grace Construction Products.

2. Hilti, Inc.
3. 3M Fire Protection Products.
4. Tremco, Inc.; Tremco Fire Protection Systems Group.
5. USG Corporation.

## 2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg2.49 Pa.
  1. Fire-resistance-rated walls include fire walls fire-barrier walls smoke-barrier walls and fire partitions.
  2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg2.49 Pa.
  1. Horizontal assemblies include floors floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
  2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
  1. L-Rating: Not exceeding 5.0 cfm/sq. ft. 0.025 cu. m/s per sq. m of penetration opening at 0.30-inch wg 74.7 Pa at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
  - a. Slag-wool-fiber or rock-wool-fiber insulation.
  - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
  - c. Fire-rated form board.
  - d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches 150 mm of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

## SECTION 07 92 00 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes joint sealants for the following applications:
1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and Expansion Joints in Unit Masonry.
    - c. Joints between different materials listed above.
    - d. Perimeter joints between materials listed above and frames of doors windows and louvers.
    - e. Other joints as indicated.
  2. Exterior joints in the following horizontal traffic surfaces:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Joints between different materials listed above.
    - c. Fuel-resistant joints.
    - d. Exterior control and expansion joints.
    - e. Other joints as indicated.
  3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Tile control and expansion joints.
    - d. Vertical joints on exposed surfaces of walls and partitions.
    - e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - g. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

- a. Isolation joints in cast-in-place concrete slabs.
- b. Control and expansion joints in tile flooring.
- c. Other joints as indicated.

B. Related Sections include the following:

1. Division 3 Section "Concrete Joint Sealants" for sealing joints in pavements, walkways, and curbing not specified in this Section.
2. Division 7 Section "Firestopping Joint Systems" for sealing joints in fire-resistance-rated construction.
3. Division 7 Section "Flashing and Sheet Metal" for sealing joints in metal flashing and roofing conditions.
4. Division 8 Section "Glazing" for glazing sealants.
5. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
6. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants for exterior applications that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.
- C. Provide sealants that comply with the specifications and are suitable for use and materials indicated.

## 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated, including instructions for joint preparation and joint sealer application.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.



- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

## 1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Single-Component Nonsag Polysulfide Sealant (ES-1):
  - 1. Products:

- a. Pacific Polymers, Inc.; Elastoseal 230 Type I (Gun Grade).
  - b. Polymeric Systems Inc.; PSI-7000.
  - c. Tremco; Dymeric 240 fc.
2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 25.
  4. Use Related to Exposure: NT (nontraffic).
  5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
- D. Single-Component Pourable Neutral-Curing Silicone Sealant (ES-2):
1. Products:
    - a. Dow Corning Corporation; 890-SL.
    - b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
  2. Type and Grade: S (single component) and P (pourable).
  3. Class: 100/50.
  4. Use Related to Exposure: NT and T (traffic).
  5. Uses Related to Joint Substrates: O, as applicable to joint substrates indicated.
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant (ES-3):
1. Products:
    - a. Pecora Corporation; 898.
    - b. Tremco; Tremsil 600 White.
    - c. Sonneborn Building Products; OmniPlus.
  2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 25.
  4. Use Related to Exposure: NT (nontraffic).
  5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
- F. Single-Component Nonsag Urethane Sealant (ES-4):

1. Products:
  - a. Sika Corporation, Inc.; Sikaflex - 1a.
  - b. Sika Corporation, Inc.; Sikaflex - 15LM.
  - c. Sonneborn, Division of ChemRex Inc.; Ultra.
  - d. Sonneborn, Division of ChemRex Inc.; NP 1.
  - e. Tremco; Vulkem 116.
2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

G. Single-Component Nonsag Urethane Sealant (ES-5):

1. Products:
  - a. Bostik Findley; Chem-Calk 900.
  - b. Bostik Findley; Chem-Calk 915.
  - c. Bostik Findley; Chem-Calk 916 Textured.
  - d. Bostik Findley; Chem-Calk 2639.
  - e. Pecora Corporation; Dynatrol I-XL.
  - f. Polymeric Systems Inc.; Flexiprene 1000.
  - g. Polymeric Systems Inc.; PSI-901.
  - h. Schnee-Morehead, Inc.; Permthane SM7100.
  - i. Schnee-Morehead, Inc.; Permthane SM7108.
  - j. Schnee-Morehead, Inc.; Permthane SM7110.
  - k. Tremco; DyMonic.
  - l. Tremco; Vulkem 921.
  - m. Tremco; Vulkem 931.
2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 50.
  4. Use Related to Exposure: NT (nontraffic).
  5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
- H. Single-Component Pourable Urethane Sealant (ES-6):
1. Products:
    - a. Sika Corporation, Inc.; Sikaflex - 1CSL.
    - b. Sonneborn, Division of ChemRex Inc.; SL 1.
    - c. Tremco; Vulkem Nova 300 SSL.
  2. Type and Grade: S (single component) and P (pourable).
  3. Class: 50.
  4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
  5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
- I. Single-Component Pourable Urethane Sealant (ES-7):
- a. Bostik Findley; Chem-Calk 950.
  - b. Pecora Corporation; Urexpan NR-201.
  - c. Polymeric Systems Inc.; Flexiprene 952.
  - d. Schnee-Morehead, Inc.; Permthane SM7101.
  - e. Tremco; Tremflex S/L.
  - f. Tremco; Vulkem 45.
2. Type and Grade: S (single component) and P (pourable).
  3. Class: 25.
  4. Use Related to Exposure: T (traffic).
  5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
- J. Multicomponent Pourable Urethane Sealant (ES-8):
1. Available Products:

- a. Pecora Corporation; Dynatrol II-SG.
  - b. Sika Corporation, Inc.; Sikaflex-2c SL.
  - c. Sonneborn, Division of ChemRex Inc.; SL 2 or NP2 – Two Component.
- 2. Type and Grade: M (multicomponent) and P (pourable).
  - 3. Class: 25.
  - 4. Uses related to Exposure: T (traffic) and NT (nontraffic).
  - 5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
    - a. Use O Joint Substrates: Exterior and interior joints in horizontal surfaces of concrete.
- K. Two-Part, Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements relative to formulation and with ASTM C 920 for Type, Grade, Class, and Uses indicated (ES-9).
- 1. Products:
    - a. "Vulkem 202," Mameco International, Inc.
    - b. "SEALTIGHT GARDOX," W.R. Meadows, Inc.
    - c. "Urexpan NR-300," Pecora Corp.
    - d. "Sonomeric 2," Sonneborn Building Products Div., ChemRex, Inc.
  - 2. Type and Grade: M (machine application/fast curing) and P (pourable) for joints in horizontal surfaces.
  - 3. Class: 25.
  - 4. Use Related to Exposure: T (traffic).
  - 5. Uses Related to Joint Substrates: Uses M and, as applicable to joint substrates of concrete paving subject to fuel exposure, O.

#### 2.4 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF (ES-10).
- B. Products:
  - 1. Bostik Findley; Chem-Calk 600.
  - 2. Pecora Corporation; AC-20+.

3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.

## 2.5 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. Products:
  - a. Dow Corning Corporation; 123 Silicone Seal.
  - b. GE Silicones; UltraSpan US1100.
  - c. Pecora Corporation; Sil-Span.
  - d. Tremco; Spectrem Ez Seal.

B. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:

1. Products:
  - a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
  - b. illbruck Sealant Systems, Inc.; Wilseal 600.
  - c. Polytite Manufacturing Corporation; Polytite B.
  - d. Polytite Manufacturing Corporation; Polytite Standard.
  - e. Sandell Manufacturing Co., Inc.; Polyseal.
2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

## 2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant

manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
  - a. Concrete.
  - b. Masonry.
  - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
  - a. Metal.
  - b. Glass.
  - c. Porcelain enamel.
  - d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.



- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
- H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.
- I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
  2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.

3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

- J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.6 JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application JS-1: Exterior and interior horizontal nontraffic construction joints in cast-in-place concrete.
1. Joint Sealant: Singlecomponent nonsag urethane sealant ES-6.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- B. Joint-Sealant Application JS-2: Exterior and interior horizontal traffic and contraction joints in cast-in-place concrete slabs.
1. Joint Sealant: Multicomponent pourable urethane sealant ES-8.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- C. Joint-Sealant Application SJ-3: Exterior and interior horizontal traffic joints, isolation joints, and contraction joints in cast-in-place concrete slabs requiring fuel resistance. (Install at Storages 106 and 107, Shop Area 105, and exterior concrete aprons.)
1. Joint Sealant: Multicomponent pourable urethane sealant ES-9.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- D. Joint-Sealant Application JS-4: Exterior vertical control and expansion joints in concrete masonry units.
1. Joint Sealant: Singlecomponent nonsag urethane sealant ES-4.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- E. Joint-Sealant Application JS-5: Exterior perimeter joints between concrete masonry units, and frames of doors, windows and louvers.
1. Joint Sealant: Singlecomponent nonsag urethane sealant ES-4.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- F. Joint-Sealant Application JS-6: Exterior joints between unit masonry assemblies, metal panel assemblies, and other surfaces.
1. Joint Sealant: Singlecomponent nonsag urethane sealant ES-4.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- G. Joint-Sealant Application JS-7: Interior perimeter joints of exterior openings.
1. Joint Sealant: Latex sealant ES-10.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- H. Joint-Sealant Application JS-8: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant ES-3.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- I. Joint-Sealant Application JS-9: Perimeter joints between interior wall and floor surfaces and frames of interior doors and windows.
1. Joint Sealant: Latex sealant ES-10.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.
- J. Joint-Sealant Application JS-10: Interior control, expansion, and isolation joints in horizontal traffic surfaces of concrete flooring.
1. Joint Sealant: Multicomponent pourable urethane sealant ES-8.
  2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

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## SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Steel doors; standard sizes and over-sized.
2. Steel door frames.
3. Sidelight frames.
4. Borrowed-light frames.
5. Fire-rated door and frame assemblies.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for installing anchors and grouting frames in masonry construction.
2. Division 8 Section "Door Hardware" for door hardware and weather stripping.
3. Division 8 Section "Glazing" for glass in glazed openings in doors and frames.
4. Division 9 Section "Painting" for field painting factory-primed doors and frames.

#### 1.2 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Shop Drawings: Show the following:

1. Dimensioned elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Coordination of glazing frames and stops with glass and glazing requirements.

C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

### 1.3 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- B. If packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.
- C. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Steel Doors and Frames:
    - a. Ceco Door Products; a United Dominion Company.
    - b. Curries Company.
    - c. Pioneer Industries Inc.
    - d. Republic Builders Products.
    - e. Steelcraft; a division of Ingersoll-Rand.

### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

## 2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
  - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 18 – gage.
- C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
  - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 16 – gage.
- D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated; factory installed.

## 2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.053-inch-(16 gauge) thick steel sheet for:
  - 1. Door openings no wider than 48 inches.
  - 2. Level 2 steel doors.
  - 3. Level 3 steel doors.
- C. Frames of 0.067"-thick (14 gauge) steel sheets for:
  - 1. Door frames wider than 48".
  - 2. Over-sized doors.
- D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- E. Plaster Guards: Provide 0.016-inch-thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- F. Supports and Anchors: Fabricated from not less than 0.042-inch-(18 gauge)thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors for Over-Sized Doors: As required by manufacturer to properly support the door, based on the wall assembly.
- G. Inserts, Bolts and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153, Class C or D as applicable.
- H. Head Reinforcement for Frames More Than 48" Wide: Minimum 0.093-inch-thick, steel channel or angle stiffener.
- I. Floor Anchors: Formed from same material as frames, not less than 0.067 inch thick, and as follows:
  1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
- J. Special Features:
  1. Grouting of Frames: Fill solidly with sand - cement grout during CMU block wall construction.

## 2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects, warp or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch-thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
  1. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from minimum 0.042"-thick cold-rolled steel sheet.
- D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
  1. Thermal insulated exterior cores to be polystyrene.
  2. Interior doors to be Kraft honeycomb core.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.



- G. Single-Acting, Door-Edge Profile: Beveled edge.
- H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
  - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.24 or better.
- L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
  - 1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
  - 2. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
  - 3. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- M. Frame Construction: Fabricate frames to shape shown. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 1. For interior and exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
  - 2. Provide welded frames with temporary spreader bars.
  - 3. Head Reinforcement: For frames more than 48 inches wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- N. Glazing Stops: Manufacturer's standard, formed from 0.032-inch-thick steel sheet.
  - 1. Provide nonremovable stops on outside of exterior doors and on the "public" side of interior doors for glass, louvers, and other panels in doors.
  - 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

## 2.6 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria. Priming to include galvanized surfaces.
- B. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
- C. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of steel doors and frames.
  - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of steel frame connections before frame installation.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to shop drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  - 1. Except for frames located at in-place masonry walls or gypsum board partitions, place frames before construction of enclosing walls and ceilings.
  - 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry T-shaped anchors.
  - 3. In wood-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
  - 4. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
  - 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
- D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with steel door and frame manufacturer's written instructions.

### 3.4 ADJUSTING AND CLEANING

- A. Clean grout and other bonding material off steel doors and frames immediately after installation.
- B. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- C. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.
- D. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition at Substantial Completion.

END OF SECTION 08 11 13

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## SECTION 08 31 13 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Non-rated ceiling access doors and frames.
- B. Related Sections include the following:
  - 1. Division 46 Sections "Duct Accessories" for heating and air-conditioning duct access doors.
- C. Provide non-rated security access doors where required for access to mechanical and/or electrical equipment that would otherwise be concealed by non-rated gypsum drywall and/or masonry construction. Review mechanical, plumbing and electrical for locations.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.
- B. Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.
- B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

#### 1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Access Doors:
    - a. Acudor Products, Inc.
    - b. Cesco Products.
    - c. Curries Company.
    - d. Jensen Industries.
    - e. J. L. Industries, Inc.
    - f. Larsen's Manufacturing Company.
    - g. Milcor Limited Partnership.
    - h. Nystrom Building Products Co.
    - i. Precision Plumbing Products, Inc.
    - j. Williams Bros. Corporation of America (The).

### 2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.
- C. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

### 2.3 PAINT

- A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."
- B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish

paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

## 2.4 ACCESS DOORS AND FRAMES

- A. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.
  - 1. Locations: Gypsum board ceiling surfaces where indicated. (Administration Area)
  - 2. Door: Minimum 0.060-inch-thick (16 gage) sheet metal, set flush with exposed face flange of frame.
  - 3. Frame: Minimum 0.060-inch-thick (16 gage) sheet metal with 1-inch-wide, surface-mounted trim.
  - 4. Hinges: Continuous piano hinge.
  - 5. Latch: Screwdriver-operated cam latch.

## 2.5 FABRICATION

- A. General: Provide access door assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.7 STEEL FINISHES

- A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- B. Apply shop primer to uncoated surfaces of metal fabrications. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
1. Field paint to match ceiling or wall color.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

#### 3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13



## SECTION 08 36 13 - SECTIONAL DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes electrically operated sectional doors.
- B. Related Sections:
  - 1. Division 26 Sections for electrical service and connections for powered operators and accessories.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.
- B. Structural Performance: Exterior sectional doors shall withstand the effects of gravity loads, and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components. Deflection of door in horizontal position (open) shall not exceed 1/120 of the door width.
- C. Air Infiltration: Maximum rate not more than indicated when tested according to ASTM E 283.
  - 1. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph.
- D. Operation Cycles: Provide sectional door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

#### 1.4 SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory. Include the following:
  - 1. Construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
  - 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Maintenance Data: For sectional doors to include in maintenance manuals.
- D. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain sectional doors from single source from single manufacturer.
  - 1. Obtain operators and controls from sectional door manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Standard for Sectional Doors: Fabricate sectional doors to comply with DASMA 102 unless otherwise indicated.
- E. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
  - b. Faulty operation of hardware.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
  - d. Delamination of exterior or interior facing materials.
2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 STEEL DOOR SECTIONS

- A. Exterior Section Faces and Frames: Fabricate from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated zinc coating and thickness.
  1. Fabricate section faces from single sheets to provide sections not more than 24 inches high and of indicated thickness. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.
  2. For insulated doors, provide sections with continuous thermal-break construction, separating the exterior and interior faces of door.
- B. Section Ends and Intermediate Stiles: Enclose open ends of sections with channel end stiles formed from galvanized-steel sheet not less than 0.064-inch- nominal coated thickness and welded to door section. Provide intermediate stiles formed from not less than 0.064-inch- thick galvanized-steel sheet, cut to door section profile, and welded in place. Space stiles not more than 48 inches apart.
- C. Reinforce bottom section with a continuous channel or angle conforming to bottom-section profile.
- D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized-steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place. Ensure that reinforcement does not obstruct vision lites.
- E. Provide reinforcement for hardware attachment.
- F. Foamed-in-Place Thermal Insulation: Insulate interior of steel sections with door manufacturer's standard CFC-free polyurethane insulation, foamed in place to completely fill interior of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following interior facing material, with no exposed insulation:
  1. Interior Facing Material: Zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, with indicated thickness.

- G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.

## 2.2 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jams when door unit is closed.
- B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.
  - 1. Horizontal Track Assembly: Track with continuous reinforcing angle attached to track and supported at points from curve in track to end of track by laterally braced attachments to overhead structural members.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

## 2.3 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors over 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track and 2-inch- diameter roller tires for 2-inch- wide track.
- D. Push/Pull Handles: For push-up or emergency-operated doors, provide galvanized-steel lifting handles on each side of door.

## 2.4 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded deadbolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

## 2.5 COUNTERBALANCE MECHANISM

- A. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from steel-spring wire complying with ASTM A 229/A 229M, mounted on torsion shaft made of steel tube or solid steel. Provide springs designed for number of operation cycles indicated.
- B. Cable Drums and Shaft for Doors: Cast-aluminum or gray-iron casting cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- C. Cables: Galvanized-steel lifting cables with cable safety factor of at least 5 to 1.
- D. Cable Safety Device: Include a spring-loaded steel or spring-loaded bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either lifting cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
- F. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

## 2.6 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
  - 1. Comply with NFPA 70.
  - 2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6; with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

- C. Door-Operator Type: Unit consisting of electric motor, gears, pulleys, belts, sprockets, chains, and controls needed to operate door and meet required usage classification.
  - 1. Jackshaft, Side Mounted: Jackshaft operator mounted on the inside front wall on right or left side of door and connected to torsion shaft with an adjustable coupling or drive chain.
  
- D. Electric Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 11 Section "Common Motor Requirements for Equipment" unless otherwise indicated.
  - 1. Electrical Characteristics:
    - a. Phase: Single phase.
    - b. Volts: 120V.
    - c. Hertz: 60.
  - 2. Motor Type and Controller: Reversible motor and controller (disconnect switch) for motor exposure indicated.
  - 3. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
  - 4. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
  - 5. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
  - 6. Use adjustable motor-mounting bases for belt-driven operators.
  - 7. Motor controller shall be able to accept owner access control system inputs for remote door operation.
  
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
  
- F. Obstruction Detection Device: Equip motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.
  - 1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
  
- G. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
  - 1. Interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

- H. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

## 2.7 DOOR ASSEMBLY

- A. Steel Sectional Door: Sectional door formed with hinged sections.
  - 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:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation Series 599 Extra Heavy Duty Doors Electrically Operated.
    - a. Amarr Garage Doors.
    - b. Arm-R-Lite.
    - c. C.H.I. Overhead Doors.
    - d. Clopay Building Products; a Griffon company.
    - e. Fimbel Architectural Door Specialties.
    - f. General American Door Company.
    - g. Haas Door; a Nofziger company.
    - h. Martin Door Manufacturing.
    - i. Raynor.
    - j. Rite-Hite Corporation.
    - k. Wayne-Dalton Corp.
    - l. Windsor Republic Doors.
- B. Operation Cycles: Not less than 10,000.
- C. Installed R-Value: 17.5 deg F x h x sq. ft./Btu.
- D. Steel Sections: Zinc-coated (galvanized) steel sheet with G60 zinc coating.
  - 1. Section Thickness: 2 inches.
  - 2. Exterior-Face, Steel Sheet Thickness: 0.016 inch nominal coated thickness.
    - a. Surface: Flat.
  - 3. Insulation: Foamed in place.
  - 4. Interior Facing Material: Zinc-coated (galvanized) steel sheet of manufacturer's recommended thickness to meet performance requirements nominal coated thickness.
- E. Track Configuration: Standard-lift track.
- F. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- G. Roller-Tire Material: Manufacturer's standard.

H. Electric Door Operator:

1. Usage Classification: Heavy duty, 60 to 90 cycles per hour.
2. Operator Type: Jackshaft, side mounted.
3. Motor Exposure: Interior, clean, and dry.
4. Emergency Manual Operation: Chain type.
5. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
  - a. Sensor Edge Bulb Color: Black.
6. Remote-Control Station: Interior.
7. Owner Access Control System: Exterior.

I. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color and gloss as selected by Architect from manufacturer's full range.

## 2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.9 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

## 2.10 DOOR OPERATION SCHEDULE

- A. Doors shall be operated by push button controls and by remote operation as noted:
  1. Motor operation with Pushbutton controls labeled "open," "close," and "stop."
  2. Motor operation with Owner Access Control System to open the door.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine Substrates, areas, and conditions, with Installer present, for compliance with requirements for Substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Tracks:
  - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
  - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
  - 3. Repair galvanized coating on tracks according to ASTM A 780.
- C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

### 3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weathertight fit around entire perimeter.

- D. Align and adjust motors, pulleys, belts, sprockets, chains, and controls according to manufacturer's written instructions.
- E. Touch-up Painting: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 083613

## **SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.
  - a. Glazing is retained mechanically with gaskets on four sides.
2. Exterior and interior manual-swing aluminum doors.
3. Interior pivoting operable windows.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this Section.
3. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this Section.

#### **1.2 PERFORMANCE REQUIREMENTS**

A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Dimensional tolerances of building frame and other adjacent construction.
4. Failure includes the following:
  - a. Deflection exceeding specified limits.
  - b. Thermal stresses transferred to building structure.
  - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
  - d. Noise or vibration created by wind and thermal and structural movements.

- e. Loosening or weakening of fasteners, attachments, and other components.
  - f. Sealant failure.
- B. Structural Loads:
- 1. Wind Loads: As indicated on Drawings.
  - 2. Seismic Loads: As indicated on Drawings.
- C. Deflection of Framing Members:
- 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
- 1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft..
- G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 8.00 lbf/sq. f.t as defined in AAMA501.

- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

### 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
- C. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

### 1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Products of this section are to be produced by a single manufacturer capable of showing prior production of units similar to those required.
- B. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
  - 1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and ICC/ANSI A117.1.

### 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.6 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water leakage through fixed glazing and framing areas.
  2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 2 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Basis-of-Design Product: The design for aluminum-framed systems is based on Kawneers 451T Series. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. Arch Aluminum & Glass Co., Inc.
  2. CMI Architectural Products, Inc.
  3. Commercial Architectural Products, Inc.
  4. EFCO Corporation.
  5. Kawneer.
  6. Pittco Architectural Metals, Inc.
  7. Tubelite Inc.

8. United States Aluminum.
9. Vistawall Architectural Products.
10. YKK AP America Inc.

## 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  1. Sheet and Plate: ASTM B 209.
  2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
- B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
  1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
- C. Thermal Flashing: Kawneer 451T-037 or equal.

## 2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  1. Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
  2. Reinforce members as required to receive fastener threads.

- D. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.
- E. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.
- F. Interior framing need not be thermally broken.

## 2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 8 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

## 2.5 DOORS

- A. Doors: Manufacturer's standard glazed doors, for manual swing operation.
  - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.
    - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
  - 2. Door Design: Wide stile; 5-inch nominal width.
    - a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
  - 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
    - a. Provide nonremovable glazing stops on outside of door.

## 2.6 DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.
  - 1. Opening-Force Requirements:
    - a. Accessible Interior Doors: Not more than 5 lbf.



- B. Scheduled Door Hardware: Provide door hardware according to the Door Hardware Schedule at the end of Part 3.
  - 1. Named Manufacturer's Products: Product designation and hardware manufacturer are listed in the Door Hardware Schedule at the end of Part 3 to establish minimum requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware.
    - a. Named products are basis-of-design products. Provide named hardware manufacturer's products or comparable products that are equivalent in function and quality and that are recommended and supplied by entrance system manufacturer.
  - 2. References to BHMA Standards: Provide products complying with standards referenced in this Article and with requirements for description, quality, type, and function listed in the Door Hardware Schedule at the end of Part 3.
- C. Pivot Hinges:
  - 1. Standard: BHMA A156.4, Grade 1.
  - 2. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.
- D. Locking Devices, General: Do not require use of key, tool, or special knowledge for operation.
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
- F. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
  - 1. Standard: BHMA A156.3, Grade 1.
- G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- H. Operating Trim: BHMA A156.6.
- I. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use, and adjustable to meet field conditions and requirements for opening force.
  - 1. Standard: BHMA A156.4, Grade 1.
- J. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- K. Weather Stripping: Manufacturer's standard replaceable components.

1. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- L. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- M. Thresholds: Raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (13 mm).
1. Standard: BHMA A156.21.
- N. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
  2. Reinforce members as required to receive fastener threads.
- O. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.
- 2.7 OPERABLE WINDOWS:
- A. Provide pivoting in-swinging operable windows matching aluminum storefront framing. Install manufacturer's standard lockable cam lock device and insect screens.
- 2.8 ACCESSORY MATERIALS
- A. Insulating Materials: As specified in Division 7 Section "Building Insulation."
- B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- 2.9 FABRICATION
- A. Form aluminum shapes before finishing.
- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
  2. Accurately fitted joints with ends coped or mitered.
  3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
  4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  6. Provisions for field replacement of glazing from exterior.
  7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).
- D. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.
  2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single door frames and two silencers on head of frames for pairs of doors.
- E. Doors: Reinforce doors as required for installing hardware.
1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised in to door edge.
  2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.10 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm. or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

#### B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

#### C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

#### D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

#### E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

#### F. Install glazing as specified in Division 8 Section "Glazing."

#### G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

#### H. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

- I. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
  - 1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
  - 2. Alignment:
    - a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
  - 3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

### 3.3 CLEANING

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation, complying with requirements contained in the "Glass and Glazing" section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

### 3.4 ADJUSTING

- A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

### 3.5 PROTECTION

- A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

### 3.6 DOOR HARDWARE SCHEDULE

CYLINDERS:

L1 Best Corporation; Best Cylinder 1E72 with construction and permanent cores, permanent core will be supplied by Owner.

PIVOTS:

H-1 KAWNEER  
Single acting top, intermediate and bottom offset pivots.

EXIT DEVICE:

ED1 KAWNEER  
1786 Rim Exit Device.

CLOSER:

C1 LCN  
4041-SP-CUSH-4040-18

PUSH/PULL: KAWNEER  
P1 CP-II & CO-9

THRESHOLD: KAWNEER  
T1 Offset pivot for overhead closure.

WEATHERSEAL: KAWNEER  
W1 Single Acting: SEALAIR® weathering system in the door and frame consisting of a dense, bulb polymeric material, which remains resilient and retains its weathering ability under temperature extremes, complete with EPDM blade gasket sweep strip applied to the bottom door rail with concealed fasteners.

STOP/HOLDER: IVES  
HS1 407 Convex bumper

**HARDWARE SCHEDULE**

OPENING NUMBER	CYLINDER	HINGE	EXIT DEVICE	FLUSH BOLT	CLOSER	STOP/HOLDER	PUSH	PULL	KICKPLATES	WEATHERSEAL	THRESHOLDS	MISCELLANEOUS OR REMARKS
104B	L1	H1	ED1	—	C1	—	—	P1	—	W1	T1	
104A	—	H1	—	—	C1	—	P1	P1	—	—	—	
108	L1	H1	ED1	—	C1	—	—	P1	—	W1	T1	
110C	L1	H1	ED1	—	C1	—	—	P1	—	W1	TI	
114B	L1	H1	ED1	—	C1	—	—	P1	—	W1	TI	
114A	—	H1	—	—	C1	—	P1	P1	—	—	—	

END OF SECTION 08 41 13

## SECTION 08 71 00 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:

- 1. Commercial door hardware for the following:
  - a. Swinging doors.
  - b. Fire-rated swinging doors.
  - c. Other doors to the extent indicated.
- 2. Cylinders for doors specified in other Sections.
- 3. Electrified door hardware.

- B. Related Sections include the following:

- 1. Division 08 Section "Hollow Metal Doors and Frames"
- 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts"
- 3. Division 08 Section "Flush Wood Doors"
- 4. Division 08 Section "Overhead Coiling Doors"
- 5. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
- 6. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.
- 7. Division 28 Section "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion detection system.
- 8. Division 28 Section "Fire Detection and Alarm" for connections to building fire alarm system.

- C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

- 1. Thresholds, weather stripping, and cylinders for locks specified in other Sections.

#### 1.3 PRICING AND PAYMENT PROCEDURES

A. Alternates

1. Provide base bid hardware as scheduled. Provide alternate pricing to convert scheduled base bid products to the alternate products approved in this section.

1.4 REFERENCED STANDARDS

A. Provide hardware in accordance with the following standards in addition to those specified in Division 01 Section "References".

1. American National Standards Institute (ANSI), A117.1: Accessible and Usable Buildings and Facilities, edition as adopted by local Authority Having Jurisdiction (AHJ).
2. Builders Hardware Manufacturer's Association (BHMA)
  - a. ANSI/BHMA A156.2: Bored and Preamsembled Locks and Latches, 2011 edition
  - b. ANSI/BHMA A156.3: Exit Devices, 2008 edition
  - c. ANSI/BHMA A156.4: Door Controls - Closers, 2008 edition
  - d. ANSI/BHMA A156.18: Materials and Finishes, 2006 edition
3. Door and Hardware Institute (DHI)
  - a. Recommended Locations for Architectural Hardware for Flush Wood Doors, 1993 edition
  - b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames, 2004 edition
  - c. Installation Guide for Doors and Hardware, 1994 edition
  - d. Keying Systems and Nomenclature, 2003 edition
  - e. Sequence and Format for the Hardware Schedule, 2001 edition
4. National Fire Protection Association (NFPA)
  - a. NFPA 70: National Electrical Code, edition as adopted by local AHJ.
  - b. NFPA 80: Standard for Fire Doors and Other Opening Protectives, edition as adopted by local AHJ.
  - c. NFPA 252: Standard Methods of Fire Tests of Door Assemblies, edition as adopted by local AHJ.

1.5 SUBMITTALS

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
  1. Wiring Diagrams: Power, signal, and control wiring. Include the following:



- a. System schematic.
    - b. Point-to-point wiring diagram.
    - c. Riser diagram.
    - d. Elevation of each door.
  2. Detail interface between electrified door hardware and fire alarm, access control, security, building control system.
  3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets, if requested.
1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Qualification Data: For Installer
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, and closers as requested.
- F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- G. Warranty: Special warranty specified in this Section.
- H. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
  2. Content: Include the following information:
    - a. Identification number, location, hand, fire rating, and material of each door and frame.
    - b. Type, style, function, size, quantity, and finish of each door hardware item.
    - c. Complete designations of every item required for each door or opening including name and manufacturer.
    - d. Fastenings and other pertinent information.
    - e. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - f. Explanation of abbreviations, symbols, and codes contained in schedule.

- g. Mounting locations for door hardware.
  - h. Door and frame sizes and materials.
  - i. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
    - 1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
  - j. List of related door devices specified in other Sections for each door and frame.
3. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
- I. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
  - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
  - 2. Installer shall have warehousing facilities in Project's vicinity.
  - 3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  - 4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 and UBC Standard 7-2.
  1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.
- E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's Security Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  2. Preliminary key system schematic diagram.
  3. Requirements for key control system.
  4. Address for delivery of keys.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to Owner's Representative by registered mail or overnight package service.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of recessed hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Coordinate with aluminum entrance door supplier for door hardware installation.
- D. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: Three (3) years from date of Substantial Completion, except as follows:
    - a. Continuous Hinges: Lifetime of Building
    - b. Grade 1 Cylindrical Locks: Five (5) years from date of Substantial Completion.
    - c. Exit Devices: Three (3) years from date of Substantial Completion.
    - d. Manual Closers: Thirty (30) years from date of Substantial Completion.
    - e. Electrified Hardware Items: One (1) year from date of Substantial Completion.

#### 1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation.

Provide parts and supplies same as those used in the manufacture and installation of original products.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- |                                  |  |
|----------------------------------|--|
| 1. Hinges:                       | Ives, Hager, Stanley, McKinney, Bommer   |
| 2. Continuous Hinges:            | Ives, Stanley, Hager, Select, McKinney, Pemko  |
| 3. Operating Door Trim:          | Ives, Rockwood, Hager, Trimco  |
| 4. Electric Strikes:             | HES , Von Duprin, Foldger Adams  |
| 5. Locks and Latches:            | Best, Schlage, Falcon, Sargent   |
| 6. Cylinders and Cores:          | Best ,Schlage, Falcon, Sargent   |
| 7. Exit Devices:                 | Von Duprin, Falcon, Sargent  |
| 8. Mechanical Door Closers:      | LCN, Sargent, Falcon, Stanley  |
| 9. Accessories and Trim:         | Ives, Rockwood, Hager, Trimco  |
| 10. Overhead Stops and Holders:  | Glynn Johnson, Rixson, ABH   |
| 11. Saddle and Panic Thresholds: | Zero, National Guard, Pemko  |
| 12. Weather Strip and Gasket:    | Zero, National Guard, Pemko  |
| 13. Miscellaneous Hardware:      | Ives, Rockwood, Hager, Trimco  |
| 14. Electronic Accessories       | Schlage Electronics / Von Duprin, Securitron, Security Door Controls, Precision, Sargent |
| 15. Emergency Access Key Box:    | Knox, Inc  |
| 16. Key Cabinet:                 | Lund Equipment   |

### 2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

### 2.3 MATERIALS AND FABRICATION

A. General

1. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.
  - a. Manufacturer's identification will be permitted on rim of lock cylinders only.
2. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
3. Provide hardware manufactured to conform to published templates generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

B. Fasteners

1. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish stainless steel (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
2. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Use through bolts only as indicated in this section unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.4 HINGES

A. Acceptable Products:

- |              |        |         |
|--------------|--------|---------|
| 1. Ives:     | 5BB1   | 5BB1HW  |
| 2. Hager:    | BB1279 | BB1168  |
| 3. Stanley:  | FBB179 | FBB168  |
| 4. McKinney: | TB2714 | T4B3386 |
| 5. Bommer:   | BB5000 | BB5004  |

B. Requirements:

1. Quantity: Provide the following, unless otherwise indicated:
  - a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
2. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

3. Hinge Weight: As indicated in hardware sets.
4. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - a. Exterior Hinges: Stainless steel with stainless-steel pin.
  - b. Interior Hinges: Steel with steel pin.
  - c. Hinges for Fire-Rated Assemblies: Steel with steel pin.
5. Hinge Options: Where indicated in door hardware sets or on Drawings:
  - a. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
  - b. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out-swinging doors.
  - c. Corners: Square.
6. Fasteners: Comply with the following:
  - a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - b. Wood Screws: For wood doors and frames.
  - c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

## 2.5 CONTINUOUS HINGES

### A. Acceptable Products:

- |    |           |           |
|----|-----------|-----------|
| 1. | Ives:     | 112HD     |
| 2. | Stanley:  | 661HD     |
| 3. | Hager:    | 780-112HD |
| 4. | Select:   | SL11HD    |
| 5. | McKinney: | MCK-12HD  |
| 6. | Pemko:    | FMSLFHD   |

### B. Requirements:

1. Geared Continuous Hinges: Shall utilize a single gear section for the door leaf and a separate gear section for the frame side of the door. Provide full mortise or surface applied hinge as scheduled in each set. Geared hinges are to be UL 10C tested and approved for 90 minutes.

## 2.6 OPERATING DOOR TRIM

### A. Door Bolts

1. Acceptable Products:
 

		FB358/FB45	
a.	Ives:	8	DP1/DP2
b.	Rockwood:	557/555	570

- c. Hager: 283D/282D 280X
- d. Trimco: 3915/3917 3910/3911

2. Requirements:

- a. Provide bolt model recommended by manufacturer for door material type.
- b. Provide 1 inch throw stainless steel bolt with 12 inch length unless otherwise scheduled in the sets.
- c. Provide a dust proof strike for bottom bolt at all locations where there is not a threshold.

B. Coordinators

1. Acceptable Products:

- a. Ives: COR x FL MB
- b. Rockwood: 1600 Series 1601 Series
- c. Hager: 297 Series 297 Series
- d. Trimco: 3094 3095

2. Requirements:

- a. Provide bar type coordinator and filler bar of size as recommended by manufacturer for each opening.
- b. Provide mounting brackets as required for soffit mounted hardware to be compatible with coordinator.

C. Push Plates, Pull Plates, and Pulls

1. Acceptable Products:

- a. Ives: 8200 8305 8190 9190
- b. Rockwood: 70C 111x70 BF157 BF15747  
C
- c. Hager: 30S 31J 12 159D/V/B
- d. Trimco: 1001 1018 1191 1730

2. Requirements:

- a. Push Plate: Provide 6 inch by 16 inch by .050 inch push plate constructed of stainless steel. Bevel all four edges.
- b. Pull Plate: Provide 4 inch by 16 inch by .050 inch push plate constructed of stainless steel, bevel all four edges. Provide 10 inch center to center (CTC) pull constructed of stainless steel with a diameter of 1 inch.
- c. Offset Pull: Provide 10 inch center to center (CTC) pull with a 4 inch offset constructed of stainless steel with a diameter of 1 inch.
- d. Push bar: Push bar shall be constructed of stainless steel with a diameter of 1 inch.



- e. Push/Pull Bar: Provide 10 inch center to center (CTC) pull with a 4 inch offset and door pull equal to door width less 3 inches. Push/pull bar shall be constructed of stainless steel with a diameter of 1 inch.

## 2.7 ELECTRIC STRIKES

### A. Acceptable Products:

		6300	5100
1.	Von Duprin:	Series	Series
2.	HES:	9000	8000
		Series	Series

### B. Requirements:

1. Provide electric strikes that are continuous duty rated without the use of external rectifiers.
2. Provide electric strikes with function (fail safe, fail secure) and power requirements as scheduled.

## 2.8 LOCKS AND LATCHES

### A. General:

1. Lock Chassis: Shall be made from steel, with locking spindles of stainless steel.
2. Latch Bolt: Shall be constructed of stainless steel with 3/4 inch throw on mortise locks and 1/2 inch throw otherwise. Latch to be deadlocking on keyed functions.
3. Lever Trim: Shall be pressure cast brass, bronze, zinc, or steel with wrought rose design. Levers are to be solid with no voids or plastic inserts.
4. Fire Rating: Lock shall be listed for up to 3 hours.
5. Strike Plates: Provide ANSI 4-7/8 inch strike plates. At pairs of doors, provide strike with 7/8 inch flat lip. At single doors, provide round-lipped strike with lip length as required to minimally clear jamb and trim. Provide dust box at each strike location.

### B. Grade 1 Bored Locks

#### 1. Acceptable Products:

##### a. Base Bid:

- 1) Falcon: T Series, Dane Lever

##### b. Alternate Bid:

- 1) Schlage: ND Series, Rhodes Lever
- 2) Best: 9K Series, 15D Lever
- 3) Sargent: 10 Line, LL Lever

#### 2. Requirements:

- a. ANSI Grade: BHMA/ANSI A156.2, Series 4000, Grade 1.
- b. Door Prep: Provide lockset to install using a standard ANSI 161 door preparation.
- c. Anti-Rotation Plate: Provide lockset with a mechanically interlocked anti-rotation plate. Anti-Rotation teeth or "bite tabs" are not acceptable. Locks without any rotation prevention devices are not acceptable.
- d. Lever Return Springs: Provide each lever with two compression type return springs that are easily accessible without dismantling the lock chassis. Locks utilizing tension or torsion lever return springs are unacceptable. Locks with internal springs that require dismantling the lock chassis are unacceptable.
- e. Lever Spindles: Provide lock with either milled or 1-piece deep drawn spindles. 2-piece interlocking stamped spindles are not acceptable.
- f. Multi-Functionality: Provide modular lockset with capability to convert to a new lock function by changing key cams.
- g. Vandal Resistant Lever: Where scheduled, provide lockset with lever that freely rotates even when locked to resist vandalism and abuse.

C. Deadbolts

1. Requirements:

- a. Provide deadbolts by same manufacturer as the provided locksets.
- b. Provide chassis type, function, and grade as scheduled.

2.9 CYLINDERS AND CORES

A. Acceptable Products:

- a. Base Bid:
  - 1) Falcon
- b. Alternate Bid:
  - 1) Schlage
  - 2) Best
  - 3) Sargent

B. Requirements:

- 1. Small Format Interchangeable Cylinders: Provide cylinders of quantity and type and with the appropriate cam/tailpiece to be compatible with the locking hardware provided. Provide cylinder housings ready to accept 7-pin, Small Format Interchangeable Cores (SFIC).
  - a. Keyed Temporary Cores: Provide each cylinder housing and/or lock lever with keyed construction core during the construction period. Cores will remain property of the contractor and will be returned upon installation of owner's permanent key system.

- b. Permanent Cores: Provide factory keyed cores that are utility patented. Provide cores with a factory-restricted keyway. Ship cores directly to owner's representative. At substantial completion, accompany the owner's representative while replacing temporary construction cores with the owner's permanent key system.
2. Keys: Provide cylinder manufacturer's standard keys. Keys shall be shipped separate from cores directly to owner's representative. For estimating purposes, provide keys in the following quantities:
- a. Construction Control Keys: 2 each
  - b. Construction Change Keys: 12 each
  - c. Permanent Control Keys: 2 each
  - d. Split Key Voiding Keys: 2 each
  - e. Permanent Master Keys: 2 each
  - f. Permanent Change Keys: 4 per core

## 2.10 EXIT DEVICES

### A. Acceptable Products:

- 1. Von Duprin: 98/35A Series

### B. Requirements:

- 1. ANSI Grade: BHMA/ANSI A156.3, Grade 1.
- 2. Device Construction:
  - a. Exit device(s) shall have a mechanism case constructed of extruded aluminum or wrought stainless steel, base plates constructed of cold rolled or cast steel, push pad of extruded aluminum with stainless steel covering or wrought stainless steel, and end caps with flush mounted design. Where required by stile width, provide narrow-stile type device.
  - b. Latchbolt: Provide Pullman-type deadlocking latch bolts constructed of stainless steel. Where specified provide high security Pullman-type latchbolt that collapses to be square faced under high pull forces.
  - c. Dogging Mechanism: where dogging or latch-retraction options are not specifically scheduled for non-fire rated doors, provide device with a hex-key activated hook-type dogging mechanism constructed of steel.
  - d. Plastic or nylon used for the push pad, or parts in the dogging mechanism or latchbolt mechanism are unacceptable.
  - e. Sound Dampening: Device shall be provided with factory-installed sound dampening materials.
  - f. Provide device type, function, and trim style as indicated in hardware schedules.

3. Where exit device(s) are provided for fire rated door, provide with fire listing and label indicating "Fire Exit Hardware". If device is mounted on wood doors, provide sex nuts and bolts.
4. Provide shim kits, filler plates, and other accessories as required for each opening.
5. Unless otherwise indicated in the sets, provide device with roller-type strike.
6. Where scheduled, provide removable mullions by same manufacturer as provided exit devices. Provide mullion stabilizers, key removable option, strike preps, and fire rating as indicated in sets.
7. Concealed vertical exit devices shall be a cable-actuated concealed vertical latch system available in two-point and less bottom latch (LBL) configurations. Vertical rods are not acceptable.
  - a. Cable shall include color-coded stainless steel with polytetrafluoroethylene (Teflon®) liner and stainless steel core wire. Latches and center slides are color coded to aid in installation. Conduit and core wire ends snap into latch and center slides without the use of tools. Latchbolts and blocking cams shall be manufactured from sintered metal low carbon copper-infiltrated steel, with a molybdenum disulfide coating for low friction and consistent performance.
  - b. Top latchbolt shall have a minimum 0.382 inch and greater than 90 degree engagement with strike to prevent door and frame separation under high static load. Bottom latchbolt, when used, shall have a minimum of 0.44 inch engagement with strike.
  - c. Product cycle life shall exceed 1,000,000 cycles.
  - d. Latch release does not require separate trigger mechanism.
  - e. Top and bottom latch must operate independently of each other. Top latch will fully engage top strike even when bottom latch is compromised.
  - f. Cable and latching system shall have the ability to:
    - 1) Be assembled as a complete assembly and function prior to being installed in the door.
    - 2) Install into the door as a one-piece single assembly
    - 3) Be installed independently of device installation and function on door even prior to device and trim installation.
    - 4) Connect to the exit device at a single attachment point.
    - 5) Adjust bottom latch height from a single point, after the system is installed and connected to exit device, while the door is hanging
    - 6) Alter latch position up and down within two-inches without additional adjustment.
    - 7) Ability to remove the system while door is hanging.
    - 8) Configure latchbolt mounting: double or single tab mount for steel doors, and wood doors, face mount for aluminum doors, eliminating requirement of tabs.
    - 9) Provide adjustable exit device to latch center line adjustment. Ensures double tab mounting option for top latch, regardless of exit device centerline.

## 2.11 MECHANICAL DOOR CLOSERS

### A. General:

1. Valves: Closers shall have separate valves for latch speed, main speed, and back check. Valves shall be staked to prevent accidental removal.
2. Provide the appropriate closer body, handing, and brackets to mount closer inside the building on the least-public side of the door.
  - a. Where closers are to be mounted parallel arm, provide with heavy duty, fully forged arms.
  - b. Where closers are to be mounted regular arm and the opening can otherwise be opened to 180 degrees, provide closer with the appropriate special templating to allow 180 degree door swing. Where a special template is not available for 180 degree swing, provide closer arm with integrated stop.
3. Integrated Stop Closer Arms: Where a closer with integrated stop is required, provide the appropriate closer and arm as follows:
  - a. Parallel arm with spring-cushioned stop arm: Provide where door is otherwise able to open to 95 degrees and requires a parallel arm mount closer.
  - b. Parallel arm with dead stop arm: Provide where door is obstructed from opening to 95 degrees and requires a parallel arm mount closer.
  - c. Regular arm with push side surface-mounted overhead stop: Provide where door closer should mount on pull side of door.
4. Hold Open Arms: Provide closer arms with mechanical hold-opens as scheduled.
5. Provide closers with any special templates, brackets, plates, or other accessories required for interface with header, door, wall, and other hardware. Provide closers with screw packs containing thru-bolts, machine screws, and wood screws.
6. Closers shall be provided with all-weather fluid and shall not require readjustment from 120 degrees F to -30 degrees F. Fluid shall be non-flaming and shall not fuel door or floor covering fires. Upon request, provide data indicating thermal properties of fluid.
7. Closers shall close and latch door when adjusted to meet accessibility requirements for door opening force: 8.5 lbs at exterior doors, 5 lbs at interior doors, and 15 lbs at labeled fire doors.

### B. Standard Duty Door Closers:

1. Acceptable Products:
  - a. Base Bid:
    - 1) LCN: 4011/4111/4040XP
  - b. Alternate Bid:

- |    |                 |               |
|----|-----------------|---------------|
| 1) | Falcon:         | SC71          |
| 2) | Sargent:        | 281/351       |
| 3) | Corbin Russwin: | DC8000/D-4550 |

2. Requirements:

- a. ANSI Grade: BHMA/ANSI A156.4, Grade 1.
- b. Closer Construction: Closer shall have cast iron or aluminum alloy body with 1-1/4 inch steel piston, double heat treated pinion, 5/8 inch bearing journals, and full complement needle or caged ball bearings. Closer shall be adjustable from sizes 1 through 6.

2.12 ARCHITECTURAL DOOR TRIM

A. Protection Plates and Edge Guards

1. Acceptable Products:

- |    |           |             |
|----|-----------|-------------|
| a. | Ives:     | 8400 Series |
| b. | Rockwood: | K1050       |
| c. | Hager:    | 194S        |
| d. | Trimco:   | K Series    |

2. Requirements:

- a. Provide .050 inch thick stainless steel protection plates with height as scheduled. Plate shall have four beveled edges and countersunk screws. Provide plate with width as follows:
  - 1) Pairs of Doors: Provide plate to be 1 inch less door width.
  - 2) Single Doors: Provide plate to be 2 inches less door width on push side, pull side mounted plates to be 1 inch less door width.
  - 3) Where Specified with Edge Guards: Provide plate to be 2 inches less door width.

B. Door Stops and Holders

1. Acceptable Products:

- |    |           |        |       |
|----|-----------|--------|-------|
| a. | Ives:     | WS407  | WS439 |
| b. | Rockwood: | 405/40 | 441H  |
|    |           | 6      |       |
| c. | Hager:    | 236W   | 242F  |
| d. | Trimco:   | 1270   | W1211 |

2. Requirements:

- a. Provide stops and holders as indicated in the HW sets.

- b. Where wall bumpers are scheduled, provide concave rubber bumper where the adjacent lever trim incorporates a push-button. Otherwise, provide convex rubber bumpers.

## 2.13 OVERHEAD STOPS AND HOLDERS

### A. Acceptable Products:

- |                     |             |             |
|---------------------|-------------|-------------|
| 1. Glynn Johnson:   | 100 Series  | 90 Series   |
| 2. Rixson-Firemark: | 6 Series    | 9 Series    |
| 3. ABH:             | 1000 Series | 9000 Series |

### B. Requirements:

1. Provide overhead stops and holders as scheduled, sized per manufacturer's recommendations based on door width.
2. Provide concealed overhead stops with adjustable jamb bracket.
3. Where possible without conflicting with other hardware, mount surface overhead stops on least public side of door.
4. Provide stops with any special templates, brackets, plates, or other accessories required for interface with header, door, wall, and other hardware.

## 2.14 SADDLE AND PANIC THRESHOLDS

### A. Acceptable Products:

- |                        |       |
|------------------------|-------|
| 1. Zero International: | 655A  |
| 2. National Guard:     | 425HD |
| 3. Pemko:              | 1715A |

### B. Requirements:

1. Saddle thresholds: Provide with length equal to the width of the opening.
2. Provide stainless steel machine screws and lead anchors for each threshold.

## 2.15 WEATHERSTRIP AND GASKET

### A. General:

1. Provide weather strip and gasketing as scheduled.
2. Size weather strip and gasket to provide a continuous seal around opening and at meeting stiles.

### B. Perimeter Seals

1. Acceptable Products:

- a. Zero: 429A 188S-BK
- b. National Guard: 700SA 5050B
- c. Pemko: 2891AS S88D

C. Astragals, Meeting Stiles, and Mullion Seals

1. Acceptable Products:

- a. Zero: 43S  
P 8780N
- b. National Guard: 139 5100  
A
- c. Pemko: 357 5100SB  
C

2. Requirements

- a. Where overlapping astragals are scheduled on exterior doors, provide with thru-bolts.
- b. Where overlapping astragals are scheduled on out-swinging doors, provide for mounting on the pull-side of the active leaf. Otherwise, provide for mounting on the push-side of the inactive leaf.

D. Door Bottoms

1. Acceptable Products:

- a. Zero: 39A 8198AA
- b. National Guard: 200NA C627A
- c. Pemko: 3452CNB 3452CN  
B

2.16 MISCELLANEOUS HARDWARE

A. Silencers

1. Acceptable Products:

- a. Ives: SR64
- b. Rockwood: 608
- c. Hager: 307D
- d. Trimco: 1229A

2. Requirements:

- a. Where indicated on single openings, provide 3 each rubber silencers on lock jamb.
- b. Where indicated on paired openings, provide 2 each rubber silencers on header.



## 2.17 ELECTRONIC ACCESSORIES

### A. Door Contacts

#### 1. Acceptable Products:

- a. Schlage Electronics: 679-05
- b. Securitron: DPS Series
- c. Security Door Controls: MC-4

#### 2. Requirements:

- a. Provide concealed, edge-mounted door contacts as appropriate for door/frame material.

## 2.18 HIGH SECURITY EMERGENCY KEY BOX

### A. Acceptable Products:

- 1. Knox, Inc. 3200 Series x RMK

### B. Requirements:

- 1. Provide recess-mounted emergency key box as approved by the local fire jurisdiction. Key box to be master-keyed as dictated by local fire jurisdiction.

## 2.19 KEY CONTROL CABINET

### A. Acceptable Products:

- 1. Lund, Inc. 1200 Series

### B. Requirements:

- 1. Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet.
- 2. Provide complete cross-index system set up by Owner, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
- 3. Provide hinged-panel type cabinet for wall mounting with capacity for 250 unique keys.

## 2.20 FINISHES

- A. Match items to the manufacturer's standard color and texture finish for the latch and locksets (or push-pull units if no latch or locksets).

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
- D. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.
  - 1. Brushed Chrome and/or Stainless Steel Appearance
    - a. Brushed Stainless Steel, no coating: ANSI 630.
    - b. Satin Chrome, Clear Coated: ANSI 626, ANSI 652.
    - c. Powder Coated Aluminum finish: ANSI 689.
    - d. Saddle and Panic Thresholds: Mill Aluminum finish.
    - e. Weatherstrip and Gasket: Clear Anodized Aluminum finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

### 3.3 INSTALLATION

- A. Pre-installation conference shall be conducted prior to installation of hardware at Project site. Meet with the, Owner, Contractor, installer, and manufacturer's representatives. A separate pre-installation conference shall be conducted prior to the

installation of electronic security hardware with the electrical contractor Review catalogs, brochures, templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation, and coordination with other work. Notify participants at least ten, 10 working days before conference.

- B. Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. All installers to attend review meetings with the hardware distributor.
- C. Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.
- D. Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops/holders. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.
- E. Counter sink through bolt of door pull under push plate during installation.
- F. Mounting Heights: Mount door hardware units at heights indicated, as follows, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
  - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- G. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- H. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

### 3.4 FIELD QUALITY CONTROL

- A. Architectural Hardware Consultant: Architect shall engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
- B. Architectural Hardware Consultant shall inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.8 DOOR HARDWARE SETS

- A. The following schedule of hardware sets shall be considered a guide and the supplier is cautioned to refer to general conditions, special conditions, and the full requirements

of this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

- B. Where items of hardware are not definitely or correctly specified and are required for completion of the Work, a written statement of such omission, error, conflict, or other discrepancy shall be sent to the Architect, prior to date specified for receipt of bids, for clarification by addendum.
- C. Adjustments to the Contract Sum will not be allowed for omissions or items of hardware not clarified prior to bid opening.

**HW SET NO: 01**

DOOR NUMBER: (Includes but is not limited to the following doors)

001B	001C	001E	001F	002C	003B
108B	S03				
1 EA	CYLINDER HOUSING	AS REQ'D BY DOOR MFG			FAL
1 EA	SFIC CORE	C607			626 FAL
1 EA	DOOR POSITION SWITCH	BY DOOR MFG (WHERE REQ'D)		↗	B/O
	REMAINING HARDWARE	BY DOOR MFG			B/O

DOOR POSITION IS MONITORED THROUGH ACCESS CONTROL SYSTEM.

**HW SET NO: 02**

DOOR NUMBER: (Includes but is not limited to the following doors)

004	007A	009A		
5 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP		630 IVE
1 EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	↗	630 IVE
1 EA	PANIC HARDWARE	9849-EO		626 VON
1 EA	ELEC PANIC HARDWARE	E-FSE-9875-L-E996-06		626 VON
1 EA	MORTISE CYLINDER	C987		626 FAL
1 EA	SFIC CORE	C607		626 FAL
1 EA	COORDINATOR	COR X FL		628 IVE
2 EA	MOUNTING BRACKET	MB		689 IVE
2 EA	SURFACE CLOSER	4111 AVB SHCUSH MC		689 LCN
2 EA	CUSH SHOE SUPPORT	4110-30		689 LCN
1 EA	SEAL	429A		AL ZER
1 EA	SECURITY ASTRAGAL	43SP		600 ZER
2 EA	DOOR SWEEP	8198AA		AL ZER
1 EA	THRESHOLD	655A MSLA-10		AL ZER
1 EA	RAIN DRIP	142A		A ZER
1 EA	CREDENTIAL READER	BY OTHERS	↗	B/O

2 EA	DOOR CONTACT POWER SUPPLY	679-05HM & RELAYS BY OTHERS	↗ ↗	BLK B/O	SCE B/O
------	------------------------------	--------------------------------	--------	------------	------------

USER PRESENTS CREDENTIAL, ELECTRIFIED LEVER RELEASES, USER OPENS DOOR TO ENTER. DOOR POSITION IS MONITORED THROUGH ACCESS CONTROL SYSTEM.

**HW SET NO: 03**

DOOR NUMBER: (Includes but is not limited to the following doors)  
008

5 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1 EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	↗	630	IVE
2 EA	MANUAL FLUSH BOLT	FB458		626	IVE
1 EA	DUST PROOF STRIKE	DP2		626	IVE
1 EA	EU STOREROOM LOCK	T881BB7 DANE		626	FAL
1 EA	SURFACE CLOSER	4111 AVB SHCUSH MC (ACTIVE LEAF ONLY)		689	LCN
1 EA	CUSH SHOE SUPPORT	4110-30		689	LCN
1 EA	SEAL	429A		AL	ZER
1 EA	SECURITY ASTRAGAL	43SP		600	ZER
2 EA	DOOR SWEEP	8198AA		AL	ZER
1 EA	THRESHOLD	655A MSLA-10		AL	ZER
1 EA	RAIN DRIP	142A		A	ZER
1 EA	CREDENTIAL READER	BY OTHERS	↗		B/O
2 EA	DOOR CONTACT POWER SUPPLY	679-05HM & RELAYS BY OTHERS	↗ ↗	BLK	SCE B/O

DOOR POSITION IS MONITORED THROUGH ACCESS CONTROL SYSTEM.

**HW SET NO: 04**

DOOR NUMBER: (Includes but is not limited to the following doors)  
001A                      001D                      001G

2 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1 EA	ELECTRIC HW HINGE	5BB1HW 4.5 X 4.5 TW8	↗	630	IVE
1 EA	ELEC PANIC HARDWARE	RX-98-L-NL-06	↗	626	VON
1 EA	RIM HOUSING	C953		626	FAL
1 EA	SFIC CORE	C607		626	FAL
1 EA	ELECTRIC STRIKE	6300 FSE	↗	630	VON
1 EA	SURFACE CLOSER	4111 AVB SCUSH MC		689	LCN
1 EA	CUSH SHOE SUPPORT	4110-30		689	LCN
1 EA	SEAL	429A		AL	ZER
1 EA	DOOR SWEEP	8198AA		AL	ZER
1 EA	THRESHOLD	655A MSLA-10		AL	ZER

1 EA	RAIN DRIP	142A		A	ZER
1 EA	CREDENTIAL READER	BY OTHERS	↗		B/O
1 EA	DOOR CONTACT	679-05HM	↗	BLK	SCE
	POWER SUPPLY	& RELAYS BY OTHERS	↗		B/O

CARD IN. USER PRESENTS CREDENTIAL, ELECTRIC STRIKE KEEPER RELEASES, USER OPENS DOOR TO ENTER. DOOR POSITION IS MONITORED BY SECURITY SYSTEM. REQUEST TO EXIT IS IN EXIT DEVICE PUSH BAR.

**HW SET NO: 05**

DOOR NUMBER: (Includes but is not limited to the following doors)

002A	003A	110B	S01		
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1 EA	STOREROOM LOCK	T581BB7 DANE		626	FAL
1 EA	ELECTRIC STRIKE	5100-3FP FSE	↗	689	VON
1 EA	LOCK GUARD	LG14		630	IVE
1 EA	SURFACE CLOSER	4111 AVB SCUSH MC		689	LCN
1 EA	CUSH SHOE	4110-30		689	LCN
	SUPPORT				
1 EA	SEAL	429A		AL	ZER
1 EA	DOOR SWEEP	8198AA		AL	ZER
1 EA	THRESHOLD	655A MSLA-10		AL	ZER
1 EA	RAIN DRIP	142A		A	ZER
1 EA	CREDENTIAL READER	BY OTHERS	↗		B/O
1 EA	DOOR CONTACT	679-05HM	↗	BLK	SCE
	POWER SUPPLY	& RELAYS BY OTHERS	↗		B/O

CARD IN. USER PRESENTS CREDENTIAL, ELECTRIC STRIKE KEEPER RELEASES, USER OPENS DOOR TO ENTER. DOOR POSITION IS MONITORED THROUGH ACCESS CONTROL SYSTEM.

**HW SET NO: 06**

DOOR NUMBER: (Includes but is not limited to the following doors)

109	110A				
3 EA	HINGE	5BB1 4.5 X 4.5 NRP		630	IVE
1 EA	PUSH PLATE	8200 4" X 16"		630	IVE
1 EA	PULL PLATE	8305 10" 4" X 16"		630	IVE
1 EA	REGULAR ARM	4011		689	LCN
	CLOSER				
1 EA	KICK PLATE	8400 10" X 2" LDW B4E		630	IVE
1 EA	FLOOR STOP	FS439		630	IVE
3 EA	SILENCER	SR64/SR65		GY	IVE

**HW SET NO: 07**

DOOR NUMBER: (Includes but is not limited to the following doors)

106

107

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	PUSH PLATE	8200 4" X 16"	630	IVE
1 EA	PULL PLATE	8305 10" 4" X 16"	630	IVE
1 EA	REGULAR ARM CLOSER	4011	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 08**

DOOR NUMBER: (Includes but is not limited to the following doors)

102A

103

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	PASSAGE SET	T101S DANE	626	FAL
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 09**

DOOR NUMBER: (Includes but is not limited to the following doors)

105

S02

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	PRIVACY LOCK W/ INDICATOR	T301S DANE	626	FAL
1 EA	SURFACE CLOSER	4031 RW/PA WMS	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 SET	SEALS	188S	BLK	ZER
1 EA	COAT AND HAT HOOK	507	626	IVE

**HW SET NO: 10**

DOOR NUMBER: (Includes but is not limited to the following doors)

006

6 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	MANUAL FLUSH BOLT (TOP)	FB458	626	IVE
1 EA	ENTRY / OFFICE LOCK	T521BB7 DANE	626	FAL
2 EA	WALL STOP	WS406/407CCV	630	IVE
2 EA	SILENCER	SR64/SR65	GY	IVE



**HW SET NO: 11**

DOOR NUMBER: (Includes but is not limited to the following doors)

002B                    108A                    112

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	ENTRY / OFFICE LOCK	T521BB7 DANE	626	FAL
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 12**

DOOR NUMBER: (Includes but is not limited to the following doors)

005

3 EA	HW HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1 EA	ENTRY / OFFICE LOCK	T521BB7 DANE	626	FAL
1 EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1 EA	CUSH SHOE SUPPORT	4110-30	689	LCN
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 13**

DOOR NUMBER: (Includes but is not limited to the following doors)

101B                    104

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	STOREROOM LOCK	T581BB7 DANE	626	FAL
1 EA	ELECTRIC STRIKE	5100-3FP FSE	↗ 689	VON
1 EA	LOCK GUARD	LG14	630	IVE
1 EA	SURFACE CLOSER	4111 EDA MC	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 SET	SEAL	8303AA	AL	ZER
1 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER
1 EA	CREDENTIAL READER	BY OTHERS	↗	B/O
	POWER SUPPLY	& RELAYS BY OTHERS	↗	B/O

CARD IN. USER PRESENTS CREDENTIAL, ELECTRIC STRIKE KEEPER RELEASES, USER OPENS DOOR TO ENTER. DOOR POSITION IS MONITORED BY SECURITY SYSTEM.

**HW SET NO: 14**

DOOR NUMBER: (Includes but is not limited to the following doors)

101C

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	ENTRY / OFFICE LOCK	T521BB7 DANE	626	FAL

1 EA	OH STOP	450S	630	GLY
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 15**

DOOR NUMBER: (Includes but is not limited to the following doors)  
010

6 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	MANUAL FLUSH BOLT	FB458 (TOP)	626	IVE
1 EA	STOREROOM LOCK	T581BB7 DANE	626	FAL
2 EA	WALL STOP	WS406/407CCV	630	IVE
2 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 16**

DOOR NUMBER: (Includes but is not limited to the following doors)  
007C                      102B

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	STOREROOM LOCK	T581BB7 DANE	626	FAL
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 17**

DOOR NUMBER: (Includes but is not limited to the following doors)  
007B

3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	PANIC HARDWARE	98-L-06	626	VON
1 EA	RIM HOUSING	C953	626	FAL
1 EA	SFIC CORE	C607	626	FAL
1 EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1 EA	CUSH SHOE SUPPORT	4110-30	689	LCN
3 EA	SILENCER	SR64/SR65	GY	IVE

**HW SET NO: 18**

DOOR NUMBER: (Includes but is not limited to the following doors)  
009B

3 EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1 EA	STOREROOM LOCK	T581BB7 DANE	626	FAL
1 EA	REGULAR ARM CLOSER	4011	689	LCN

1 EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 SET	SEAL	8303AA	AL	ZER

**HW SET NO: A**

DOOR NUMBER: (Includes but is not limited to the following doors)  
100

1 EA	CONT. HINGE	112HD TW8	↗ 628	IVE
1 EA	ELEC PANIC HARDWARE	RX-98-NL-OP-110MD	↗ 626	VON
1 EA	RIM HOUSING	C953	626	FAL
1 EA	SFIC CORE	C607	626	FAL
1 EA	ELECTRIC STRIKE	6300 FSE	↗ 630	VON
1 EA	90 DEG OFFSET PULL	8190HD 10" L	630	IVE
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	SURFACE CLOSER	4040XP EDAW/62G	689	LCN
1 EA	PA MOUNTING PLATE	4040-18PA	689	LCN
1 EA	PERIMETER SEALS	MFG STD	AL	B/O
1 EA	THRESHOLD	MFG STD	AL	B/O
1 EA	CREDENTIAL READER	BY OTHERS	↗	B/O
1 EA	DOOR CONTACT POWER SUPPLY	679-05HM & RELAYS BY OTHERS	↗ BLK ☐	SCE B/O

CARD IN. USER PRESENTS CREDENTIAL, ELECTRIC STRIKE KEEPER RELEASES, USER OPENS DOOR TO ENTER. REX IS IN EXIT DEVICE PUSH BAR. DOOR POSITION IS MONITORED BY SECURITY SYSTEM.

**HW SET NO: B**

DOOR NUMBER: (Includes but is not limited to the following doors)  
101A

1 EA	CONTINUOUS HINGE	112HD	CPC	IVE
1 SET	PUSH/PULL BAR	9190HD-10"-STD	630	IVE
1 EA	OH STOP	100S ADJ	630	GLY
1 EA	SURFACE CLOSER	4040XP EDAW/62G	689	LCN
1 EA	PA MOUNTING PLATE	4040-18PA	689	LCN
1 EA	PERIMETER SEALS	MFG STD	AL	B/O

**END OF SECTION**

## SECTION 08 80 00 - GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Windows.
  - 2. Doors.
  - 3. Interior borrowed lites.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
  - 1. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
- B. Glass Design: Glass thickness indicated are minimums. Minimum glass thickness for exterior lites shall not be less than 1/4".
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.3 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For each type of glass, except for clear single-pane units, in the form of 12-inch-square samples.
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements, submitted with close-out submittals.
- D. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Glazing Standards: Comply with recommendations of Flat Glass Marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this Section or other referenced standards.
- B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.
- C. Source Limitations for Glass: Obtain glass from one manufacturer for each kind and condition of glass indicated.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- F. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
  - 1. Subject to compliance with requirements, permanently mark safety glass on each individual window pane with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- G. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

## 1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate, f.o.b. the nearest shipping point to Project site, within warranty period of 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated-glass units that deteriorate, f.o.b. the nearest shipping point to Project site, within warranty period of 5 years from the date of Substantial Completion.
- D. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate, f.o.b. the nearest shipping point to Project site, within warranty period of 10 years from the date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products by one of the following:
  - 1. Manufacturers of Clear and Tinted Float Glass:
    - a. AFG Industries, Inc.
    - b. Ford Glass Division.
    - c. Guardian Industries Corp.
    - d. LOF Glass, Inc.
    - e. PPG Industries, Inc.
    - f. Pilkington Building Products
    - g. Saint-Gobain/Euroglass.
  - 2. Manufacturers of Wire Glass:
    - a. AFG Industries, Inc.
    - b. Guardian Industries Corp.

- c. Hordis Brothers, Inc.
  - d. Pilkington Sales (North America) Limited.
3. Manufacturers of Heat-Treated Glass:
- a. AFG Industries, Inc.
  - b. Cardinal IG.
  - c. Environmental Glass Products.
  - d. Falconer Glass Industries.
  - e. Ford Glass Division.
  - f. Guardian Industries Corp.
  - g. Hordis Brothers, Inc.
  - h. LOF Glass, Inc.
  - i. PPG Industries, Inc.
  - j. Saint-Gobain/Euroglass.
  - k. Spectrum Glass Prod. Div., H.H. Robertson Co.
  - l. Viracon, Inc.
4. Manufacturers of Insulating Glass:
- a. Advanced Coating Technology.
  - b. AFG Industries, Inc.
  - c. Cardinal IG.
  - d. Environmental Glass Products.
  - e. Falconer Glass Industries.
  - f. Ford Glass Division.
  - g. Guardian Industries Corp.
  - h. Hordis Brothers, Inc.
  - i. Independent Insulating Glass.
  - j. PPG Industries.



- k. Pilkington Building Products
- l. Spectrum Glass Prod. Div., H.H. Robertson Co.
- m. Viracon, Inc.

## 2.2 PRIMARY FLOAT GLASS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); Class 1 (clear).

## 2.3 HEAT-TREATED FLOAT GLASS

- A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
  - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
  - 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  - 3. For uncoated glass, comply with requirements for Condition A.
  - 4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
  - 5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- B. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.
- C. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

## 2.4 WIRED GLASS

- A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 1/4" thick; of form and mesh pattern indicated below:
  - 1. Polished Wired Glass: Form 1 (wired, polished both sides), Mesh m2 (square).

## 2.5 INSULATING GLASS

- A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements for individual glass panes as specified in this Section and as follows:
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.
- B. Glazing Type: Solar Control Low-E Insulating-Glass Units:
1. Basis-of-Design Product: PPG "Solarban 60 Atlantica Coated Low-E-Glass" (formerly Solargreen) or a comparable product.
  2. Overall Unit Thickness and Thickness of Each Lite: 1 inch and 1/4 inch.
  3. Interspace Content: Air.
  4. Indoor Lite: Class 1 (clear) float glass.
  5. Outdoor Lite: Class 2 (tinted) float glass.
  6. Low-E Coating: Sputtered on second or third surface to meet performance levels indicated below.
  7. Visible Light Transmittance: 52 percent minimum.
  8. Winter Nighttime U-Factor: 0.29 maximum.
  9. Summer Daytime U-Factor: 0.28 maximum.
  10. Solar Heat Gain Coefficient: 0.30 maximum.
  11. Shading Coefficient: 0.35 percent maximum.
  12. Outdoor Reflectance: 0.10 percent.
- C. Sealing System: Dual seal with manufacturers standard sealants.
- D. Spacer Specifications: Manufacturer's standard spacer material and construction, 1/2" air space thickness.
- E. Corner Construction: Manufacturer's standard corner construction.

## 2.6 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene.
  - 2. EPDM.
  - 3. Silicone.
  - 4. Thermoplastic polyolefin rubber.
  - 5. Any material indicated above.
- B. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Performed Butyl-Polyisobutylene Glazing Tape Without Spacer Rod:
    - a. "Chem-Tape 40"; Bostik Construction Products Div.
    - b. "Extru-Seal"; Pecora Corp.
    - c. "PTI 303" Glazing Tape; Protective Treatments, Inc.
    - d. "Tremco 440 Tape"; Tremco Inc.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of size, shape and with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of size and hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

## 2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

### 3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

### 3.6 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

### 3.7 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 08 80 00

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## SECTION 08 91 00 - LOUVERS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Louvers, frames, and accessories.

#### 1.2 RELATED SECTIONS

- A. Section 07 92 00 - Joint Sealants.
- B. Section 09 91 00 - Painting and Coating: Field painting.
- C. Refer to mechanical drawings for sizes and locations.

#### 1.3 REFERENCES

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2007.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices; Air Movement and Control Association International, Inc.; 2007.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2006a.
- E. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2006.

#### 1.4 SUBMITTALS

- A. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- B. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.
- C. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of experience.

## 1.6 WARRANTY

- A. Provide twenty year manufacturer warranty against distortion, metal degradation, and failure of connections.
  - 1. Finish: Include coverage against degradation of exterior finish.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Carnes, Model FPCB is used as the standard for design. Other available manufacturers are as follows:
  - 1. The Airolite Company: [www.airolite.com](http://www.airolite.com).
  - 2. American Warming and Ventilating: [www.awv.com](http://www.awv.com).
  - 3. Construction Specialties, Inc: [www.c-sgroup.com](http://www.c-sgroup.com).
  - 4. Substitutions: As approved by Architect.

### 2.2 LOUVERS

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories.
  - 1. Wind Load Resistance: Design to resist positive and negative wind load as required by code without damage or permanent deformation.
  - 2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
  - 3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
  - 4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Stationary Louvers: Horizontal blade, formed galvanized steel sheet construction, with concealed intermediate mullions.
  - 1. Free Area: 50 percent, minimum.
  - 2. Blades: Drainable, zig-zag, sight-proof.

3. Frame: 4 inches deep; corner joints mitered and mechanically fastened.
4. Metal Thickness: Frame 0.06 inch; blades 0.06 inch.
5. Finish: Fluoropolymer coating, finished after fabrication.
6. Color: As selected from manufacturer's standard colors.

## 2.3 MATERIALS

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M, with G90/Z275 coating.
- B. Insect Screen: 18 x 16 size aluminum mesh.
- C. Polyvinylidene Fluoride Coating: Minimum 70 percent Kynar 500/Hylar 500 resin, louver manufacturer's standard finish, complying with AAMA 2604.

## 2.4 ACCESSORIES

- A. Screens: Frame of same material as louver, with reinforced, mitered, and welded corners.
- B. Fasteners and Anchors: Stainless steel.
- C. Flashings: Of same material as louver frame, to required shape, single length in one piece per location.
- D. Sealant: As specified in Section 07 92 00.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verify that prepared openings are ready to receive work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated on shop drawings.

### 3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Install louvers level and plumb.
- C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- D. Secure louver frames in openings with concealed fasteners.
- E. Install perimeter sealant and backing rod in accordance with Section 07 90 05.

3.3 CLEANING

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

- END OF SECTION -

## SECTION 09 29 00 – GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Interior gypsum board.
2. Sound attenuation insulation.

- B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.2 INTERIOR GYPSUM BOARD

- 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. American Gypsum.
  2. CertainTeed Corp.
  3. Georgia-Pacific Gypsum LLC.
  4. Lafarge North America Inc.
  5. National Gypsum Company.
  6. PABCO Gypsum.
  7. Temple-Inland.
  8. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.
- C. Gypsum Ceiling Board Type X: ASTM C 1396/C 1396M.
  1. Thickness: 5/8" inch.
  2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  1. Core: 5/8 inch, Type X.
  2. Long Edges: Tapered.
  3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.3 TRIM ACCESSORIES

### A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. L-Bead: L-shaped; exposed long flange receives joint compound.
  - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - e. Expansion (control) joint.

## 2.4 JOINT TREATMENT MATERIALS

### A. General: Comply with ASTM C 475/C 475M.

### B. Joint Tape:

1. Interior Gypsum Board: Paper.

### C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
  - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound drying-type, all-purpose compound high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

## 2.5 AUXILIARY MATERIALS

### A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- E. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.



- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
  - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
  - 2. Fasten with corrosion-resistant screws.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: Where exposed to view.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

### 3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

## SECTION 09 30 13 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Porcelain tile.
- 2. Cleavage membrane.
- 3. Metal edge strips.
- 4. Shower assembly.

- B. Related Requirements:

- 1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

#### 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification:
  - 1. Manufacturer's standard size samples of each type and composition of tile and for each color and finish required tagged with material symbol to match types as noted in 2.3.
  - 2. Each type of trim and accessory: Product info sheet indicating specific model/color.
  - 3. Metal edge strips: Product info sheet indicating specific model/finish.
  - 4. Grout: Colored reference folder and product info sheet indicating specific type.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Maintenance Data: Include maintenance manuals specified in Division 1.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer has completed similar installations and is experienced in use of materials specified herein and is familiar with large and special format tile installation.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Uncoupling membrane.
  - 2. Metal edge strips.

#### 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
  - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

## 2.3 TILE PRODUCTS

### A. Ceramic Tile:

- 1. CT1:
- 2. CT2:

- a.

- 3. CT3:
- 4. CT4:

## 2.4 SETTING MATERIALS

- A. Uncoupling Membrane Medium Bed Mortar: Meeting ANSI A118.4 and A118.11.
  - 1. Product: TEC, TA-337/338 Uncoupling Membrane Mortar.

## 2.5 UNCOUPLING MEMBRANE

- A. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch nominal thickness.
  - 1. Product: Schluter Systems L.P.; DITRA.

## 2.6 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6.
  - 1. Prepackaged dry gout mix composed of portland cement, graded aggregate and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.
    - a. Dry Polymer Additive: Ethylene vinyl acetate.
    - b. Color: Color to be selected from manufacturer's full range of colors.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide Tech Power Grout product with color, crack, mold and mildew resistant and permanent stain resistant properties or comparable product by one of the following:
  - a. Custom Building Products.
  - b. Laticrete International, Inc.
  - c. MAPEI Corporation.
  - d. TEC; H. B. Fuller Construction Products Inc.

## 2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle shaped, height to match tile and setting-bed thickness designed specifically for flooring applications; ASTM A 666, 300 Series exposed-edge material.
  1. Finish: Clear anodized aluminum.
  2. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter Systems L.P. and/or Ceramic Tool Company. Products for the following locations:
    - a. Floor Transition Tile to Concrete: Ceramic Tool Company CTC Ramp XLK.
    - b. Shower Curb Outside Corners: Schluter: Rodec.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

## 2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed comply with surface finish requirements in ANSI A108.01 for installations indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors consisting of tiles 8 by 8 inches or larger.
    - b. Tile floors consisting of rib-backed tiles.



- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Porcelain Tile: 1/8 inch.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

### 3.4 FLOOR INSTALLATION METHODS

- A. Floor Tile Installation F128: Thin-set tile on uncoupling membrane. Placement and offset of tile joints should be 1/3 or 33% of the tile length; see TCA/ANSI guideline and manufacturer's installation recommendations
  - 1. Tile Type: Porcelain tile.
  - 2. Thin-Set Mortar: Latex-portland cement mortar.

3. Grout: Polymer-modified unsanded grout.
4. Uncoupling Membrane: Corrugated polyethylene.

### 3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  1. Remove grout residue from tile as soon as possible.
  2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

## SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes acoustical panels, exposed suspension systems and edge trim system and accessories for ceilings.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated, including fascia trim with each type required clearly identified.
- B. Maintenance Data: For finishes; include in maintenance manuals.

#### 1.3 QUALITY ASSURANCE

- A. Install Qualifications: Engage an experienced installer who has successfully completed acoustical ceilings similar in material, design and extent to those indicated for Project.
- B. Source Limitations:
  - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
  - 2. Suspension System (includes trim): Obtain each type through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Surface-Burning Characteristics: Provide acoustical panels with surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 50 or less.
    - b. Flame Spread: 25 or less.
- D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions. The seismic design category is indicated on the Architectural and Structural Drawings.

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels of intended use.

#### 1.5 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. Acoustical Ceiling Panels: Full-size panels equal to 5% of quantity installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Non-Fire-Resistance-Rated Wide-Face Double-Web Steel Suspension Systems:
    - a. Armstrong World Industries, Inc.
    - b. Chicago Metallic Corporation.
    - c. National Rolling Mills, Inc.
    - d. USG Interiors, Inc.

#### 2.2 ACOUSTICAL PANELS

- A. ACP1 Design Standard:
  - 1. Armstrong Cortega #769 or USG Radar (2' x 4' x 5/8"), square edge.
  - 2. Color/Light Reflectance Coefficient: White/LR 0.75 to 0.85.
  - 3. Noise Reduction Coefficient: NRC 0.50-0.60.
  - 4. Ceiling Sound Transmission Class: CSTC 35-39.
  - 5. Grid Profile: Armstrong Standard (15/16") white.

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications and finishes indicated that comply with applicable requirements in ASTM C 635. Flanges to be 15/16" wide.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated, in manufacturer's standard white color.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. At a minimum, wire shall be 12-gauge, Class 1 zinc coating, soft temper.
- D. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- E. Main beam and cross tee intersections and splices must have connection strengths of at least 60 pounds in compression and in tension.

## 2.4 METAL WALL MOLDINGS AND TRIM

- A. Wall Moldings and Trim: Metal or extruded aluminum of types and profiles indicated from manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.
- B. Edge Trim System: Metal trim systems consisting of straight and curved metal pans to match radii per Drawings. Attachment with mounting clips to snap and lock against hem of trim. Screw attach to intersecting suspension system member.
- C. Finishes and Colors: Factory finished in baked enamel paint.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans. At locations with cubicle curtain track, coordinate grid layout to accommodate track locations.

### 3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636, UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
1. Seismic Design Category C: Projects indicated as such shall be installed as a "free-floating" ceiling in accordance with U.B.C. Standard 25-2 and Chapter 25 of the 1997 Uniform Building Code.
    - a. Maximum Ceiling Weight: The actual weight of the ceiling system, including grid, panels, light fixtures, and air terminals is to be no more than 2.5 psf. All other services must be supported independently from the ceiling system.
- B. Suspend ceiling hangers from building's structural members and as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns completed within 3". Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures. Do not secure hangers to wood roof deck.
  5. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install wall moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels, and at locations to receive decorative fascia.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
1. The terminal ends of the grid must rest on the wall molding with at least 3/8" clearance from the wall and at least 3/8" perch on the molding.
  2. Perimeter attachment of grid to wall molding is not permitted.
  3. Perimeter components must have spacer bars, or some other suitable system, to prevent spreading.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders to provide a neat, precise fit.
1. Install hold-down clips in vestibule and lobby areas and as indicated, in areas required to resist tile uplift upon exterior door operation, by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
  2. All ceiling penetrations are to be treated as perimeter closures and must allow the minimum 3/8" clearance by use of suitable escutcheons or closure details.
- F. Light Fixtures: Fixtures weighing 56 pounds or less must have two 12-gage wires attached at diagonal corners, and these wires must be slack. Fixtures weighting in excess of 56 pounds must be independently supported from the building structure.
- G. Partitions: The ceiling system shall not be used to support walls or partitions. Any attachment mechanism must allow the ceiling to move 3/8" in any direction.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

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## SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Resilient wall base.
  - 2. Flooring accessories.
- B. Related Sections include the following:
  - 1. Division 9 Section "Resilient Floor Tile".

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: In manufacturer's standard size, but not less than 12 inches long, of each resilient product color, texture, and pattern required.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Fire-Test-Response Characteristics:
  - 1. Provide resilient stair accessories with a critical radiant flux classification of Class I, not less than 0.45 W/sq. cm, as determined by testing identical products per ASTM E 648 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Provide products with smoke density of 450 or less when tested per ASTM E 662.

#### 1.4 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products for at least 48 hours before installation, during installation and 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

- D. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.
- E. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

#### 1.5 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. Furnish not less than 10 linear feet for every 100 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed:
  - 1. Johnsonite.
  - 2. Roppe Corporation.

#### 2.2 COLORS AND PATTERNS

- A. Colors and Patterns:
  - 1. To be selected from manufacturer's full range of colors.

#### 2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
- B. Type (Material Requirement): TP (rubber, thermoplastic).
- C. Group (Manufacturing Method): I (solid, homogeneous).
- D. Style: Cove, with top-set toe at resilient tile and concrete floor areas.
- E. Minimum Thickness: 1/8".
- F. Height: 4 inches typical at locations noted on plan and 6 inches in toilet rooms without tile.
- G. Lengths: Coils in manufacturer's standard length.
- H. Outside Corners: Job formed.
- I. Inside Corners: Job formed or premolded.

J. Surface: Smooth.

## 2.4 RESILIENT MOLDING ACCESSORY

A. Description: Reducer strip for resilient floor covering and joiner for resilient tile by one of the following:

1. Johnsonite.
2. Roppe Corporation.

B. Material: Metal.

C. Profile and Dimensions: As indicated or pre-approved.

D. Color: As selected from manufacturer's full range of BHMA A156.18 compliant metal finishes.

## 2.5 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless longer conditioning period is recommended by manufacturer. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

### 3.3 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop or sponge surfaces to remove marks and soil.
    - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion. Clean products according to manufacturer's written recommendations.

END OF SECTION 09 65 13

## SECTION 09 65 19 - RESILIENT TILE FLOORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid vinyl floor tile in Lobby.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of floor tile indicated.
- C. Samples for Verification: Standard chain set size, 4-inch by 6-inch minimum units of each color and pattern of floor tile required.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish one box for every 25 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

## 1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

## 2.2 FLOOR TILE (TO COME IN 100% SUBMITTAL)

### 2.3 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 2.4 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
  - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
    - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

### 2.5 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay tiles with mixed blend of 4-inch wide and 6-inch wide planks.
- D. Layout shall be such that there shall be no more than (2) 6" wide planks set adjacent to each other and no more than (3) 4" wide planks set adjacent to each other.
- E. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- F. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

## 2.6 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
1. Remove adhesive and other blemishes from exposed surfaces.
  2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519



## SECTION 09 91 13 - EXTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior substrates.
  - 1. Concrete masonry units (CMU).
  - 2. Steel.
  - 3. Galvanized metal.
- B. Related Requirements:
  - 1. Section 051200 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
  - 2. Section 099123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. VOC content.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. 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. Benjamin Moore & Co.
  - 2. Columbia Paint & Coatings.
  - 3. Kelly-Moore Paints.
  - 4. Kwal Paint.
  - 5. PPG Architectural Finishes, Inc.
  - 6. Pratt & Lambert.
  - 7. Sherwin-Williams Company (The).

#### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- C. Colors: As indicated in a color schedule.

D. Exterior Paint Systems (EPS)

1. Ferrous Metal:

- a. 1<sup>st</sup> Coat: Sherwin Williams Pro-Cryl Universal Primer 4 mil dry film
- b. 2<sup>nd</sup> Coat: Sherwin Williams Sher Cryl HPA (B66-350) 4 mil dry film
- c. 3<sup>rd</sup> Coat Sherwin Williams Sher Cryl HPA (B66-350) 4 mil dry film

2. Zinc Coated Metal:

- a. 1<sup>st</sup> Coat: Clean with 'MEK'
- b. 2<sup>nd</sup> Coat: Sherwin Williams Sher Cryl (B66-350) 4 mil dry film
- c. 3<sup>rd</sup> Coat: Sherwin Williams Sher Cryl (B66-350) 4 mil dry film

3. Concrete Masonry Units (use epoxy where indicated):

- a. 1<sup>st</sup> Coat Sherwin Williams heavy-duty block filler, 15 mil dry film
- b. 2<sup>nd</sup> Coat Sherwin Williams Sher Cryl HPA (B66-350) 4 mil dry film
- c. 3<sup>rd</sup> Coat Sherwin Williams Sher Cryl HPA (B66-350) 4 mil dry film

4. Bollards and trash enclosure gates – Sherwin Williams Sher Cryl B66-350 series formulation

5. Exposed PVC Pipe (for UV exposure protection):

- a. 1<sup>st</sup> Coat Sherman Williams Macropoxy 646 B58, 4 mil dry film
- b. 2<sup>nd</sup> Coat Sherwin Williams Hi-Solids Polyurethane, 3 mil dry film

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Masonry (Clay and CMU): 12 percent.
  2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer[.]
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- H. Exposed Plastic Pipe Substrates: SSPC-1, then abrade lightly with medium grain garnet paper.
- I. Wood Substrates:
  - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 13

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## SECTION 09 91 23 - INTERIOR PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates.
  - 1. Steel.
  - 2. Galvanized metal.
  - 3. Wood.
  - 4. Gypsum board.
- B. Related Requirements:
  - 1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
  - 2. Section 09 91 13 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Label each Sample for location and application area.
- C. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
  - 2. VOC content.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

#### 1.5 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Benjamin Moore & Co.
  - 2. Columbia Paint & Coatings.
  - 3. Kelly-Moore Paints.
  - 4. Kwal Paint.
  - 5. PPG Architectural Finishes, Inc.
  - 6. Pratt & Lambert.
  - 7. Sherwin-Williams Company (The).

#### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 1. Flat Paints and Coatings: 50 g/L.



2. Nonflat Paints and Coatings: 150 g/L.
  3. Dry-Fog Coatings: 400 g/L.
  4. Primers, Sealers, and Undercoaters: 200 g/L.
  5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  7. Pretreatment Wash Primers: 420 g/L.
  8. Floor Coatings: 100 g/L.
  9. Shellacs, Clear: 730 g/L.
  10. Shellacs, Pigmented: 550 g/L.
- C. Colors: As indicated in a color schedule.
- D. Interior Paint Systems (IPS):
1. Gypsum Drywall System (Ceilings/Soffits):
    - a. 1st Coat: Sherwin Williams Pro Mar 200 Interior Latex Primer 1.5 mil dry film.
    - b. 2nd Coat: Sherwin Williams Duration, 3 mil dry film with latex satin finish.
    - c. 3rd Coat: Sherwin Williams Duration, 3 mil dry film with latex satin finish.
  2. Gypsum Drywall System (Walls)
    - a. 1st Coat: Sherwin Williams Pro Mar 200 Interior Latex Primer 1.5 mil dry film.
    - b. 2nd Coat: Sherwin Williams Duration, 3 mil dry film with latex satin finish.
    - c. 3rd Coat: Sherwin Williams Duration, 3 mil dry film with latex satin finish
  3. Gypsum Drywall System (Epoxy)
    - a. 1<sup>st</sup> Coat: Sherwin Williams Drywall Primer
    - b. 2<sup>nd</sup> Coat: Sherwin Williams Pro Industrial Hi-Bild Waterbased Catalyzed Epoxy.
    - c. 3<sup>rd</sup> Coat: Sherwin Williams Pro Industrial Hi-Bild Waterbased Catalyzed Epoxy.
  4. Ferrous Metal:
    - a. 1<sup>st</sup> Coat: MPI 79, E1 range (min.), 1.5 mil dry film. (primer only required on non-primered metal).
    - b. 2<sup>nd</sup> Coat: MPI 47, E2 range (min.), 1.5 mil dry film with semigloss sheen.
    - c. 3<sup>rd</sup> Coat: MPI 47, E2 range (min.), 1.5 mil dry film with semigloss sheen.
  5. Zinc Coated Metal:
    - a. 1<sup>st</sup> Coat: MPI 25 followed by MPI 80, E2 range (min.)
    - b. 2<sup>nd</sup> Coat: MPI 47, E2 range (min.), 1.5 mil dry film
    - c. 3<sup>rd</sup> Coat: MPI 47, E2 range (min.), 1.5 mil dry film

## 2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  2. Testing agency will perform tests for compliance with product requirements.
  3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
  2. Masonry (Clay and CMU): 12 percent.
  3. Wood: 15 percent.
  4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- G. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
  - 1. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.5 INTERIOR PAINTING SCHEDULE

- A. Colors and finishes:
  - 1. P1 (basis of design):
    - a. Manufacturer: Sherwin Williams:
    - b. Color:
    - c. Location: General Wall; As shown on drawings.
  - 2. P2 (basis of design):
    - a. Manufacturer: Sherwin Williams:
    - b. Color:
    - c. Location: Hollow Metal Frames; As shown in drawings.
  - 3. P3 (basis for design):
    - a. Manufacturer: Sherwin Williams:
    - b. Color:
    - c. Location: Interior metal doors as noted in drawings.
  - 4. P4 (basis for design):

- a. Manufacturer: Sherwin Williams.
  - b. Color:
  - c. Location:
5. P5 (basis for design):
- a. Manufacturer: Sherwin Williams.
  - b. Color:
  - c. Location: Accent as shown on drawings.
6. P6 (basis for design):
- a. Manufacturer: Sherwin Williams.
  - b. Color:
  - c. Location: Accent as shown on drawings.

END OF SECTION 09 91 23

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## SECTION 101400 - SIGNS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Interior signs.
2. Signage accessories.

B. Related Sections include the following:

1. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
2. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
3. Division 16 Section "Interior Lighting" for illuminated exit signs.

#### 1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, installation instructions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods.
- C. Samples for Initial Selection: Illustrating manufacturer's full range of color finishes.
- D. Samples for Verification: For each type of sign, include the following samples to verify color, pattern and surface texture:
1. Panel Signs: Full-size samples of each type of sign required. Approved sample shall be returned for incorporation into the Work.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Standards: Comply with applicable standards of sign products industry and construction industry for selection of materials, fabrication of components, assembly, and installation/erection of the system, except to the extent more explicit or stringent requirements are indicated.

- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) (UFAS) and with code provisions as adopted by authorities having jurisdiction.
  - 1. If any recent governmental promulgations have altered the use of raised letters and Braille, those new uses should be utilized and indicated in fabricator's shop drawings.

#### 1.4 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABC Architectural Signing System Division of Nelson-Harkins Industries.
  - 2. ABC Stamp.
  - 3. Allenite Signs; Allen Marking Products, Inc.
  - 4. Andco Industries Corp.
  - 5. APCO Graphics, Inc.
  - 6. Architectural Graphics, Inc.
  - 7. ASI Sign Systems, Inc.
  - 8. Best Manufacturing Co.
  - 9. Inland Pacific Signage
  - 10. Modulex
  - 11. Mohawk Sign Systems.
  - 12. New Hermes, Inc.
  - 13. Supersine Company (The).
  - 14. Vomar Products, Inc.



## 2.2 PANEL SIGNS

- A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.
  2. Sign edges shall be straight, smooth and free of cutting marks or other imperfections.
- B. Interior Room Identification Signs: 1/8" thick plastic laminate with 1/32" raised graphic image with a contrasting color background. Sign material laminates shall utilize proper adhesives, be smooth, consistent and free of bubbles, bulging, and foreign matter, and guaranteed not to delaminate nor cause discoloration or deterioration of any materials used in fabrication.
1. All signs shall have grade 2 braille located at the lower, center area of the sign.
  2. Letter Style: "Delta Book", unless indicated otherwise.
  3. Copy in center of sign.
  4. Color: White lettering and pictograms; background as selected.
  5. Finish: Semi-matte, smooth, free of scratches, gouges and other imperfections. Incorporate ultraviolet inhibitor into sign materials to produce maximum color stability.
  6. Corner: Radiused.
- C. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the sign schedule. The copy on detail drawings are generic and intended for layout and spacing only. Actual copy for all signs is listed in the sign schedule. A shop drawing submittal is required for approval of alternate letter size or other layout changes as a result of an exceptionally long message or other special condition.
1. Verify locations of sign installations to ensure that each sign will fit in its designated location. Adjust the number of lines of text if needed and show on shop drawings. Avoid hyphenating a word to continue it on next line of text.
- D. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. The fabricator is responsible for proper use of Grade 2 Braille in terms of size, placement, and spelling, including proper contractions. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Raised-Copy Thickness: Not less than 1/32 inch.

## 2.3 ACCESSORIES

- A. Mounting Methods: Unless otherwise indicated, all interior signs shall be installed with mechanical fasteners in pre-drilled holes and inserts. Fasteners to be stainless steel.
- B. Vinyl Film and Copy: Provide opaque nonreflective vinyl film and graphics, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.
  - 1. Sign Type E: Vinyl cut letters for exterior application on exterior glass surfaces.
    - a. Character Size: 3-inch high.
    - b. Color: White.
    - c. Text Messages: Refer to legend.

## 2.4 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
  - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door, or to the right side of double doors. Where not possible, such as when there is insufficient wall space at single doors or to the right of double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door. Unless otherwise indicated or scheduled, locate signs 60" above finished floor to centerline of sign. When the door swing is on the same side of the wall as the sign, locate the sign 15" away from edge of door in closed position, to centerline of sign.

- B. Wall-Mounted Signs: Attach signs to interior wall surfaces which will be installed with mechanical fasteners in pre-drilled holes with inserts as required.
- C. Make all provisions necessary and take special precautions to prevent damage to the Work. Any items damaged shall be restored to the original condition at no additional cost to the Owner.

### 3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until Substantial Completion.

### 3.3 SIGN SCHEDULE

- A. Sign Type A: (Similar to Mohawk Sign Systems Style M-203)

1. Sign Size: 1-5/8" x 9"
2. Character Size: 5/8" high with 1/4" high Braille.
3. Text/Message: Refer to Legend.

- B. Sign Type B: (Similar to Mohawk Sign Systems Style M-203)

1. Sign Size: 3" x 9"
2. Character Size: 5/8" high with 1/4" high Braille.
3. Text/Message: Refer to Legend.

- C. Sign Type C: (Similar to Mohawk Sign Systems Style M-203-8PMR)

1. Sign Size: 8" x 8"
2. Character Size: 3/4" high with 1/4" high Braille.
3. Text/Message: "Men", "Women", or "Toilet" with ADA and figurine symbols; refer to Legend.

- D. Sign Type D: Vinyl cut letters for exterior application on metal surfaces.

1. Character Size: 1" high
2. Color: Black.
3. Text/Message: Refer to legend
4. Locations: Coordinate with Architect.

- E. Sign Type E: Vinyl cut letters for exterior application on metal surfaces.

1. Character Size: 4" high.
  2. Color: Red.
  3. Text/Messages: Refer to legend.
  4. Locations: Fuel areas.
- F. Sign Type F: Vinyl cut letters for exterior application on metal surfaces.
1. Character Size: 3" high.
  2. Color: Red on white background (4" high background).
  3. Text/Messages: Refer to legend.
  4. Locations: Exterior doors; coordinate with Architect and local Fire Chief.
- G. Sign Type G: Vinyl cut letters for exterior application on exterior glass surfaces.
1. Character Size: 6" high.
  2. Color: White.
  3. Text Messages: Refer to legend.
  4. Locations: Exterior face of entry glazing; coordinate location.

**DOOR SIGN SCHEDULE-LEGEND**

Door No.	Type	Name
<b>HATCHERY BUILDING</b>		
113b	G	0000-0 (Confirm Address)
110A	B	CONFERENCE ROOM
112	A	MANAGER
115	B	VISITOR
114A, B	B	MUD ROOM
122A, B	B	MECHANICAL/ELECTRICAL
116, 119, 120	C	TOILET
124A, B	B	BOOT ROOM
123 A, B	B	LAB
<b>SHOP BUILDING</b>		
303A	B	DRY STORAGE
302A	B	SHOP
301A	B	MAINTENANCE

END OF SECTION 10 14 00

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BPA MRS COHO HATCHERY

SIGNS  
10 14 00 - 6

## SECTION 10 28 00 - TOILET, AND BATH ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Accessories for toilet rooms and showers.
- B. Grab bars.

#### 1.2 REFERENCES

- A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- B. ASTM A 167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999 (Reapproved 2004).
- C. ASTM A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2004.
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2006a.
- E. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.
- F. ASTM B 456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2003.
- G. ASTM C 1036 - Standard Specification for Flat Glass; 2006.
- H. ASTM F 2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004.
- I. GSA CID A-A-3002 - Mirrors, Glass; U.S. General Services Administration; 1996.

#### 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

#### 1.4 SUBMITTALS

- A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Toilet Accessories: Standard used for Design is Bradley, Diplomat Series. Provide accessories by one of the following:
  - 1. American Specialties, Inc.
  - 2. Bradley Corporation
  - 3. Bobrick Washroom Equipment, Inc.
- B. All items of each type to be made by the same manufacturer.

### 2.2 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 3 keys for each accessory; master key all lockable accessories.
- C. Stainless Steel Sheet: ASTM A 666, Type 304.
- D. Stainless Steel Tubing: ASTM A 269, Type 304 or 316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A 653/A 653M, with G60/Z180 coating.
- F. Mirror Glass: Float glass, ASTM C 1036 Type I, Class 1, Quality Q2, with silvering, copper coating, and suitable protective organic coating to copper backing in accordance with GSA CID A-A-3002.
- G. Adhesive: Two component epoxy type, waterproof.
- H. Fasteners, Screws, and Bolts: Hot dip galvanized.
- I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

### 2.3 FINISHES

- A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.
- B. Galvanizing for Items Other than Sheet: Comply with ASTM A 123/A 123M; galvanize ferrous metal and fastening devices.

- C. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.

#### 2.4 TOILET ROOM ACCESSORIES (refer to schedule)

- A. Toilet Paper Dispenser: Double-roll dispenser with controlled delivery and vandal-resistant self-locking mechanisms; surface mounted with concealed anchorage.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
  - 1. Capacity: 400 multifold minimum.
- C. Hand Dryer: Electric ADA compliant hand dryer with cast iron housing, vitreous enamel finish and touch lever control.
- D. Soap Dispenser: Liquid soap dispenser, wall-mounted, with stainless steel cover and vertical stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
  - 1. Minimum Capacity: 40 ounces.
- E. Mirrors: Stainless steel framed, 6 mm thick tempered glass mirror.
  - 1. Size: As indicated on drawings.
  - 2. Frame: 0.05 inch channel shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
  - 3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
- F. Grab Bars: Stainless steel, 1-1/2 inches outside diameter, minimum 0.05 inch wall thickness, nonslip grasping surface finish, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
  - 1. Length and configuration: As indicated on drawings.

### PART 3 - EXECUTION

#### 3.1 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.

### 3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### 3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions.
- 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

### 3.4 SCHEDULE

- A. Toilet Accessories: Products are based on "Bradley Diplomat Series":
  - 1. Towel Dispenser: 2A00.
  - 2. Soap Dispenser Wall: 6A00.
  - 3. Mirrors: 7405 Series, 24" x 36".
  - 4. Toilet Paper Dispenser: 5A00.
  - 5. Grab Bars: #812 36-inch length at rear of toilet and 42-inch length with 18-inch length at side of toilet.
  - 6. Electric Hand Dryer: 2897-28.
  - 7. Seat Cover Dispenser: FA40

END OF SECTION 10 28 00



## SECTION 10 44 00 - FIRE-PROTECTION SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Portable fire extinguishers.
  - 2. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
  - 3. Mounting brackets for fire extinguishers

#### 1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Authority Having Jurisdiction: All items under this Section and their installation, are to be reviewed and approved by the Fire Marshall and any other authority having jurisdiction.

#### 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
  - 1. Sheet: ASTM B 209.
  - 2. Extruded Shapes: ASTM B 221.
- C. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3,6 mm thick.

### 2.3 PORTABLE FIRE EXTINGUISHERS

- A. Available Manufacturers:
  - 1. Amerex Corporation.
  - 2. Ansul Incorporated.
  - 3. Badger Fire Protection.
  - 4. Buckeye Fire Equipment Company.
  - 5. General Fire Extinguisher Corporation.
  - 6. JL Industries, Inc.
  - 7. Kidde Fyrnetics.
  - 8. Larsen's Manufacturing Company.
  - 9. Modern Metal Products; Div. of Technico.
  - 10. Watrous; Div. of American Specialties, Inc.
- B. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet indicated.

1. Handles and Levers: Manufacturer's standard ADA and Federal Handicap Accessible Standards (UFAS).
  2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity; 4-A:80-B:C, 10-lb, nominal capacity and 20-A:120-B:C, 20-lb nominal capacity where indicated on drawings, with mono ammonium phosphate-based dry chemical in enameled-steel container.

## 2.4 FIRE-PROTECTION CABINET

### A. Available Manufacturers:

1. Fire End & Croker Corporation.
2. General Accessory Mfg. Co.
3. JL Industries, Inc.
4. Kidde Fyrnetics.
5. Larsen's Manufacturing Company.
6. Modern Metal Products; Div. of Technico.
7. Moon American.
8. Potter Roemer; Div. of Smith Industries, Inc.
9. Watrous; Div. of American Specialties, Inc.

### B. Cabinet Type: Suitable for 5-lb. and 10 lb. fire extinguishers where indicated.

### C. Cabinet Construction: Provide manufacturer's standard box, with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

### D. Cabinet Material: Baked enamel-steel sheet.

### E. Semirecessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Verify rough opening requirements with available wall depth. Location as indicated on drawings.

1. Rolled-Edge Trim: 3-inch backbend depth.

### F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall; with no trim, where indicated.

- G. Cabinet Trim Material: Baked enamel-steel sheet.
- H. Door Material: Baked enamel-steel sheet.
- I. Door Style: Vertical duo panel with frame.
- J. Door Glazing: Clear float glass.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide recessed door pull and friction latch.
  - 2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- L. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
    - a. Install mounting bracket in cabinets equal to Larsen's No. 883 and mounting bracket No. 817 at wall mounted locations.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door, hinge side.
      - 2) Application Process: Silk-screened.
      - 3) Lettering Color: Black.
      - 4) Orientation: Vertical.

## 2.5 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 1. Weld joints and grind smooth.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.7 STEEL FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair bond using manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed. Coordinate locations with Architect.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
  - 1. Where indicated, provide surface mounted and semi-recessed fire-protection cabinets.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

## SECTION 10 51 26-PLASTIC LOCKERS AND BENCHES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Solid plastic lockers and locker room benches.

#### 1.2 RELATED SECTIONS

- A. Division 06 Section "Rough Carpentry" for locker anchorage.

#### 1.3 REFERENCES

- A. ASTM International (ASTM):

1. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

- B. US Federal Government:

1. U.S. Architectural & Transportation Barriers Compliance Board. Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG).

- A. GREENGUARD Environmental Institute (GREENGUARD):

1. GREENGUARD certified low emitting products.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each type of product indicated include fabrication details, description of materials and finishes.

1. Product Test Reports: When requested by Architect, provide documentation indicating compliance of products with requirements, from a qualified independent testing agency.

- B. Shop Drawings: Include overall locker dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.

- C. Samples for Selection: Furnish samples of manufacturer's full range of colors for initial selection.

- D. Samples for Approval: Furnish a physical sample of the material in the selected color.

1. Size: 6 by 6 inch (102 by 102 mm) in type of finish specified.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Installation instructions.
- B. Warranty: Sample of special warranty.

## 1.6 MAINTENANCE SUBMITTALS

- A. Operation and Maintenance Data.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of plastic lockers. Manufacturers seeking approval must submit the following in accordance with Instructions to Bidders and Division 01 requirements:
  - 1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
  - 2. Samples of each component of product specified.
  - 3. List of successful installations of similar products available for evaluation by Architect.
  - 4. Submit substitution request not less than 15 days prior to bid date.
- B. Installers Qualifications: An experienced Installer regularly engaged in the installation of lockers for a minimum of 3 years.
- C. Source Limitations: Obtain plastic lockers and trim accessories from single manufacturer.
- D. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 100 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. Indoor Environmental Quality Certification: Provide certificate indicated that products have been certified under the following programs, or a comparable certification acceptable to Owner:
  - 1. GREENGUARD Indoor Air Quality Certified.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver plastic lockers to the site until the building is enclosed and HVAC systems are in operation. Deliver plastic lockers in manufacturer's original packaging. Store in an upright condition. Protect plastic lockers from exposure to direct sunlight.



- B. Ship plastic lockers fully assembled.
- C. Lift and handle plastic lockers from the base not the sides.

#### 1.9 WARRANTY

- A. Special Manufacturer's Warranty: 20 year against rust, delamination or breakage of plastic parts under normal use.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of Bradley Corporation, Menomonee Falls, WI 53051, (800)272-3539, fax (262)251-5817; Email [info@BradleyCorp.com](mailto:info@BradleyCorp.com); Website [www.bradleycorp.com](http://www.bradleycorp.com).
  - 1. Provide basis of design products or comparable products from a pre-approved manufacturer:
    - a. Submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

#### B. MATERIALS

- 1. High Density Polyethylene (HDPE): 30 percent pre-consumer recycled content polyethylene thermoplastic formed under high pressure into solid plastic components.
- 2. Stainless-Steel Sheet: ASTM A 666, Type 304.
- 3. Fasteners: Tamper-Resistant Fasteners: Stainless steel torx-head screws.
  - a. Locker Connectors: No. 10-24 sex bolts.
  - b. Anchors: Type and size required for secure anchorage.
  - c. Drilled-in-place Masonry Anchors: Minimum 1/4 by 1-3/4 inch (6 by 44 mm) screws.

#### 2.2 STANDARD PLASTIC LOCKERS

- A. Basis-of-Design Product: Bradley LENOXLOCKERS.
- B. Locker Configuration: Double tier.
- C. Locker Dimensions
  - 1. Height, Nominal: 36 inch (914 mm).
  - 2. Width: 15 inch (381 mm).

3. Depth: 15 inch (381 mm).
- D. Material: HDPE plastic, 30 percent recycled material.
- E. Sides, Tops, Bottoms, Dividers, and Shelves: 3/8 inch (10 mm) thick HDPE plastic with smooth finish.
- F. Locker Tops: Flat top.
- G. Doors: Fabricate from a single piece 1/2 inch (13 mm) HDPE plastic.
1. Doors and Frame: 1/2 inch (13 mm) thick HDPE plastic with matte texture finish with ventilation slots.
  2. Logo on Door: Match Owner's artwork.
  3. Handle: ADA/ABA Compliant handle fabricated from injection molded plastic.
  4. Locks: Standard hasp.
    - a. Padlock: Lock by Owner.
  5. Hinges: Continuous piano hinges, .05 inch (1.3 mm) thick type 304 stainless steel fabricated to wrap around edges of door and frame and attached with stainless steel tamper-resistant screws.
    - a. Finish: Powder coated to match color of locker.
  6. Latching Bar: Full-height latch bar constructed of 1/2 inch (13 mm) HDPE plastic secured to locker with stainless steel tamper-resistant screws.
- H. Color: As selected by Architect from manufacturer's full range.
- I. Accessories:
1. Coat Hooks: Black polycarbonate double hook.
  2. End Panels: 3/8 inch (10 mm) thick, with color and finish matching locker body.
  3. Filler Panels: 1/2 inch (13 mm) HDPE filler panel, with color and finish matching locker body, attached with 3/8 inch (10 mm) thick HDPE solid plastic angle bracket.
  4. Wall Hooks: Black powder coated, cast zinc hook two per locker.
  5. Number Plate: Black painted aluminum with silver numbers. Provide one per locker.
  6. Locker Base: 1 inch (26 mm) solid HDPE plastic, with black or finish matching locker body, 4 inch (101 mm) high.

7. Coat Rod: Schedule 40 PVC with plastic pole sockets and stainless steel tamper-resistant screws.

## 2.3 PEDESTAL BENCH

- A. Basis-of-Design Product: **Bradley LENOX PEDESTAL Bench.**
- B. Pedestal Bench Materials:
  1. Bench Top: 1-1/2 inch (39 mm) thick HDPE plastic, 30 percent recycled material, with matte texture finish.
  2. Pedestal: Black anodized aluminum with welded aluminum flanges top and bottom.
- C. Provide 1 benches total; one in vestibule / mud room.
- D. Dimensions
  1. Length: 72 inch (1828 mm).
  2. Width: 9.5 inch (241 mm).
  3. Height: 18-1/2 inch (470 mm).
- E. Color: As selected by Architect from manufacturer's full range.

## 2.4 LOCKER FABRICATION

- A. Fabricate locker box from a single sheet of HDPE solid plastic with corners fused together. Weld frames and shelves to box assembly. Provide all welded construction of locker parts without dovetail slots or metal fasteners. Add welded gussets in single tier full height lockers.
- B. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.
- C. Hardware Attachment: All hinges, handles, hasps, hooks, latch bars, and locks attached with tamper-resistant screws.
- D. Provide ventilated panels where indicated.
- E. Continuous Base: Set toe clearance 3 inch (76 mm) from locker front. Notch end caps for ease of installation.
- F. Filler Panels: Fabricated in unequal leg angle shape; finished to match lockers.
- G. Finished End Panels: Fabricated with 3/8-inch (9.5-mm) wide edge dimension, configured to conceal fasteners and holes at exposed ends of plastic lockers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install lockers in climate controlled environment, shielded from direct sunlight.
- B. General: Install on floor or other firm support. Install level, plumb, and true.
  - 1. Position locker base per approved shop drawing. Using fasteners provided by manufacturer, anchor base sections to the floor.
  - 2. Attach filler pieces to lockers with male-female sex bolts.
  - 3. Position first locker according to submittal layout. Square and plumb the locker using concealed shims. Secure the locker to the wall at the top and bottom of the locker. Position second locker next to first, square and plumb to align the tops and bottoms; and temporarily clamp lockers together. Drill four holes through the sides of the lockers and connect lockers using sex bolts provided by manufacturer.
- C. Accessories: Fit exposed connections of trim, fillers, and closures together to form tight, hairline joints, with concealed fasteners and splice plates furnished by locker manufacturer. Install as indicated on approved shop drawings.
  - 1. Coat Hooks: Attach with at least two fasteners.
  - 2. Clothes Rods: Attach at height indicated.
  - 3. Filler Panels: Attach with concealed fasteners.
  - 4. Finished End Panels: Attach at ends indicated.
- D. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, spaced as indicated. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

### 3.2 FINAL CLEANING

- A. Clean locker interior and exterior surfaces.
- B. Remove packaging and construction debris and legally dispose of off-site.

END OF SECTION 10 51 26

## SECTION 11 41 26 – WALK-IN FREEZER

### PART 1 -- GENERAL

#### 1.1 SUMMARY

This section includes the requirements for the walk-in freezer.

#### 1.2 QUALITY ASSURANCE

- A. Freezer manufacturer shall have a minimum of ten (10) years experience constructing similar equipment.
- B. Fabricator/installer shall have a minimum of ten (10) years freezer installation for similar projects.

#### 1.3 SUBMITTALS

- A. Submittals shall be in conformance with Section 01 33 00 - Submittals and Shop Drawings.
- B. Shop drawings shall indicate geometry and materials to be used.
- C. Submit two (2) copies of manufacturer's literature for panel material.
- D. Submit engineering properties of composite materials.
- E. Submit all product data for cooling system, condenser, and all components of the system.
- F. Five (5) year warranty for completed freezer including the manufacturer's system components against failure of any kind.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect finish (with plastic coating) and edges in accordance with panel manufacturer's recommendations.
- B. Store material in accordance with panel manufacturer's recommendations.

### PART 2 -- PRODUCTS

#### 2.1 FREEZER

##### A. SIZE

- 1. Freezer size shall be 16' x 10' x 8' high rectangular indoor freezer with floor.
- 2. The Freezer shall have (1) one door for entry in the freezer from the feed prep area.
- 2. Pre-Approved Vendor: Chinook Refrigeration, Inc or Equal.

##### B. PANELS

- 1. Wall panels shall be 4-inch minimum high density urethane NSF (foam gasketed).
  - a. Exterior finish: 26 GA. Minimum, White.
  - b. Interior finish: Stainless Steel 304 #4. Connection to ceiling and floor shall be Cam-Lock.
- 2. Ceilings shall be 4-inch minimum high density urethane NSF panels, designed for 10 lbs/sq. ft. live load.
  - a. Exterior finish shall be metal, interior finish shall be Stainless Steel 304 #4

3. The freezer shall be supplied with one overlapping style freezer doors, 4' x 7'.
  - a. Door shall be 4-inch minimum high density urethane with 26GA minimum sheeting.
  - b. Door shall be supplied with four (4) sided heat cable, thermosteel backing, and magnetic gasket.
  - c. Doors shall be non-wood constructed.
4. Freezer shall include a vapor proof light, toggle switch with pilot light, analog 2-inch minimum flush mounted dial thermometer, and a standard 115V heated air vent.
5. Freezer shall also be equipped with 4-inch minimum high density urethane floor panels, and low temperature Flex Barrier strip curtain for a 4' x 7' net opening.

C. COOLING SYSTEM

1. The freezer shall be cooled with a Heatcraft pre-assembled remote split system with a 0°F holding temperature or equal.
  - a. Use Imperial P/N MOH025L62CFT condenser unit with P/N LSF120BMC6K evaporator.
2. Motor: 480 / 3-60 HZ.
3. Refrigerant: R404a

D. CONDENSER

1. Hermetic outdoor condenser unit with defrost timer, thermostat & liquid line solenoid,

**PART 3 -- EXECUTION**

- A. Installation shall be located as shown on the drawings.
- B. Installation shall be as indicated by the manufacturer and as approved by the engineer.
- C. Condenser shall be mounted to the exterior of the building. Supporting shelf, brackets and mounting hardware to mount the condenser to the exterior wall shall be designed and provided by the freezer manufacturer.

- END OF SECTION -

## SECTION 11 53 16 - INCUBATORS

### PART 1 -- GENERAL

#### 1.1 DESCRIPTION OF WORK

The work includes furnishing all labor, materials and equipment for the installation of vertical flow incubation cabinets as shown on the Drawings and as specified herein.

#### 1.2 GENERAL REQUIREMENTS

- A. Manufacturer's Qualifications. Only manufacturers with 3 years of proven experience and satisfactory performance in the manufacture of specified or comparable items will be acceptable for the items for this project. All equipment shall fully meet the intent of the specification. Design Builder shall review for acceptance any equipment not listed to determine whether it will fulfill the intent of the contract documents. Design Builder reserves the right to reject any equipment which, in the Engineer's opinion, does not fulfill the intent of the contract documents.

#### 1.3 SUBMITTALS

- A. Submit the following in accordance with SECTION 01 33 00 – Contractor Submittals:

Submit complete manufacturer's background data with shop drawing data including performance records and manufacturing history as required in 1.2.A above.

Submit detailed shop drawings with full layout dimension data.

Submit complete descriptive data.

### PART 2 -- PRODUCTS

#### 2.1 VERTICAL FLOW INCUBATION CABINETS

- A. General. The basic unit shall consist of an aluminum tray stand complete with double stacks of eight (8) fiberglass trays.
- B. Tray Stand. Incubation cabinet stand structural components shall be 6061 T-6 aluminum supports with tray slides of polyester resin reinforced with glass roving. Stands shall be provided with floor mounting clips. Tray stand shall be approximately 23-1/2 inches wide by 25 inches deep by 32-1/2 inches high per eight trays.
- C. Incubation Trays. Shall consist of 4 components; a water distribution ring, egg and fry compartment, a cover screen, and tray media.
1. Water distribution ring shall be constructed of polyester resin reinforced with glass roving, size 21-1/4 inch by 24-3/4 inch by 3-3/8 inch. Water outflow openings shall be designed to eliminate dribble, backflow and dripping into tray below. Inflow water receiving compartment shall be designed to minimize possible overflow and splashing from trays above. Water flow capacity shall be 4 to 6 gpm. A 1-inch diameter clean-out hole shall be located on the front of the tray and shall be equipped with a

- stainless steel activator rod and rubber stopper. Molded surface shall be smooth, without cracks or crevices, to permit rapid, easy cleaning.
2. Egg and fry compartment and cover screen shall be polyester resin reinforced with glass roving. Metal parts shall be stainless steel. Net size of egg compartment shall be 16-inch by 13-3/4 inch by 2-inch. The fiberglass screens are to be provided by the manufacturer for each tray. The screen material shall consist of a 12 x 12 per square inch (standard salmon) PVC-coated mesh mounted by the incubator manufacturer in the top and bottom of each egg tray compartment. The egg container tray and cover when removed from the rack shall float when placed in water. Hold down clamps shall permit easy removal of the cover separately or egg container cover and tray as a unit.
  3. Tray media shall consist of a rigid PVC net pipe material, 30 mm in diameter. A sufficient number of pipes shall be placed in each tray to loosely fill the tray (gaps between pipes no greater than 1/8 inch). Tray media shall be as manufactured by Daishin Kogyo or approved equal.
- D. Manufacturers. FAL/Heath Tray by Marisource, Fife WA. The named incubator unit is the only known item which functions satisfactorily. Other manufacturers of a fish incubator unit must submit complete design and layout and proof of production capability of such design before a consideration of acceptance will be given.
- E. Accessories
1. General: Provide the complete array of piping, valves and incidentals as required to equip the incubation cabinets as shown on the Drawings. There shall not be any brass, bronze or zinc parts or coatings in the incubation system, use aluminum, stainless steel or plastic piping system as shown.
- F. Incubator Schedule:

Location	No. of Incubators	
	Single Stack	Double Stack
Incubation Room	-	18

### PART 3 -- EXECUTION

#### 3.1 INSTALLATION

- A. Install all vertical flow incubation cabinets detailed in this specification at the locations shown on the Drawings. Coordination of work with other trades is required for proper installation.
- B. Do not install vertical flow incubation cabinets until all ceiling, wall and floor construction is completed, unless special permission to address extenuating circumstances is obtained from the Design Builder.

-- END OF SECTION --



## SECTION 11 94 01 - FIBERGLASS TANKS

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The work includes furnishing all labor, materials and equipment for the installation of fiberglass fish rearing tanks as shown on the drawings and as specified herein.
- B. Provide the following:
  - 1. Ten (10) 26.25-foot diameter by 6.67-foot deep dual drain fiberglass fish rearing tanks, including inlet supply diffusers, side box drains, bottom drain stand pipes, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 2. Eighteen (18) 10-foot diameter by 4-foot deep fiberglass fish rearing tanks, including inlet spraybars, center drains, external drain stand pipes, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 3. Four (4) 10-foot diameter by 8-foot deep pump sumps, including side box drains, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 4. Two (2) 12-foot long by 1.5-foot wide and deep egg troughs, including tank stand and drain fittings as shown on the Drawings and specified herein.

#### 1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

##### A. Codes

NFPA 70                                      National Electric Code

##### B. Commercial Standards

ASTM C 581                                      Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service

ASTM D 638                                      Test Method for Tensile Properties of Plastics

ASTM D 695                                      Test Method for Compressive Properties of Rigid Plastics

ASTM D 790                                      Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D 883                                      Definitions of Terms Relating to Plastics

ASTM D 2563	Recommended Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts
ASTM D 2583	Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D 3299	Filament-Wound Glass Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
ASTM D 4097	Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks

C. When 2 or more of the above regulations are applicable, the more stringent requirement shall be met.

### 1.3 SUBMITTALS

A. Provide the following submittals in accordance with Section 01 33 00 – Contractor Submittals.

1. Shop Drawings. Shop drawings and design calculations shall be submitted showing details of construction and layouts for review and acceptance before materials are fabricated.
2. Product Data. Submit manufacturer's printed literature for care and maintenance for review and acceptance, including certification the manufacturer has at least five years of experience in the fabrication and supply of circular dual drain aquaculture tanks of the size specified.
3. CONTRACTOR shall provide color samples of a standard color palette for OWNER selection and approval.

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Tanks and accessories shall be delivered and placed without damage.

### 1.5 WARRANTY

A. **All Components:** The Manufacturer shall furnish to the CONTRACTOR the Manufacturer standard 1-year workmanship warranty, commencing on the date of installation and acceptance at the Project by the OWNER, through the CONTRACTOR.

## PART 2 -- PRODUCTS

### 2.1 REQUIREMENTS

A. Manufacturers' Qualifications

1. Only manufacturers with 5 years or more of proven experience and satisfactory performance in the manufacture of fiberglass reinforced plastic fish rearing tanks.
2. All manufacturers shall be required to submit a complete set of design calculations, material specifications and shop drawings.

B. Description of Fiberglass Fish Rearing Tank

1. Provide fiber-reinforced plastic tanks complete and ready for piping hookup and installation in the two sizes indicated in Section 1.1.B.1 and Section 1.1.B.2. The tanks are to be used for the production of fish in water temperatures ranging from 0 to 20 degrees Celsius. The tanks are to be used for an interior, covered application as shown on the drawings and but may be subjected to the maximum ambient temperature range and fluctuations for the geographical location in the event of a facility shut-down.
2. Tanks shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing changes required prior to installation. Units to be provided with reinforcement sufficient to maintain less than 1/2" total deflection at midpoint when filled with water.
3. Tank standpipe openings and screen slots shall be fabricated for use as shown on the project plans.
4. Tanks shall include viewing windows of approximately 1.5ft square located with the top of the window 1-ft below the top of the tank. Window shall be located to face the central drive aisle in the hatchery building as shown on the Drawings.
5. All tank side box drain standpipes shall be provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.
6. Each tank shall be provided with slotted screens to prevent fish from entering the sidebox area and bottom drain sumps.
  - a. Screens shall be marine grade aluminum 1/8-inch maximum opening size. Slotted perforations shall be oriented horizontally.
  - b. Screens for multiple tanks of a given size shall be interchangeable between tanks.
  - c. Screens shall be smooth on both faces without any sharp edges.

B. Description of Fiberglass Drain Sump

1. Provide fiber-reinforced plastic drain sumps complete and ready for piping hookup and installation as indicated in Section 1.1.B.3.
2. Tanks shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing

changes required prior to installation. Units to be provided with reinforcement sufficient to maintain less than 1/2" total deflection at midpoint when filled with water.

3. All tanks shall be fitted with a bottom drain assembly that is factory installed, and is adequately protected from damage during normal shipping and handling.
4. All tanks shall be fitted with a side box provided by the tank manufacturer. Side boxes that combine side drain and bottom drain flow as indicated on the drawings.
5. All tank side box drain standpipes shall be provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.

B. Description of Fiberglass Riser Standpipe

1. Provide fiber-reinforced plastic Riser Standpipes complete and ready for piping hookup and installation as indicated in Section 1.1.B.4.
2. Riser standpipes shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing changes required prior to installation. Units to be provided with reinforcement sufficient to withstand forces consistent with proper operation of standpipe and appurtenances under normal flow conditions.
3. All riser standpipes shall be fitted with a removable inner standpipe provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.

2.2 WORKMANSHIP

- B. **Visual Defects:** ASTM D2563 shall be used for quality control of both filament-wound and hand lay-up construction. Acceptance levels shall be as follows:

<u>Process Surface:</u>	<u>Defects:</u>
Blisters	None
Burned Areas	None
Chips	None
Cracks	None
Crazing	None
Dry Spots	None
Entrapped Air	None at surface. If in laminate 1/16-in dia max and 5/sq in max.
Exposed Glass	None
Exposed Cut Edges	None
Foreign Matter	None
Pits	Max 1/8-in dia X 1/32-in deep, max 10/sq ft.
Scratches	None (coated)
Surface Porosity	None

Wrinkles	Max deviation 10 percent of wall thickness.
Sharp Discontinuity	None

Non-Process Surface: Defects:

Blisters	Max 1/4-in X dia 1/16-in high.
Burned Areas	None
Chips	Max 1/4-in with max thickness of 20 percent of wall.
Cracks	None
Crazing	Slight
Dry Spots	Max 2 sq in/sq ft
Entrapped Air	1/8-in dia max; no more than 3 percent of area.
Exposed Glass	None
Exposed Cut Edges	None
Foreign Matter	None if it affects the properties of laminate.
Pits	Max 1/8-in dia X 1/16-in deep.
Scratches	None (coated)
Surface Porosity	None
Wrinkles	Max deviation 20 percent of wall thickness, but not exceed 1/8-in.
Sharp Discontinuity	None

- C. If the area fails to meet the requirements of entrapped air or voids in less than 40 percent of the total surface, those areas shall be repaired and reinspected. If the defective areas exceed 40 percent of the total surface, the entire vessel shall be rejected.
- D. **Shop Inspection:** The OWNER or OWNER Representative shall be permitted access to the manufacturing area during fabrication and shall be notified one week prior to the estimated date of tests and/or inspections. Final inspection and approval shall be obtained prior to shipment unless written waiver is obtained. The shop inspection of the equipment shall include the following:
1. Check for compliance with drawing dimensions and adherence to construction standards.
  2. An acetone wipe test to check surface cure. No surface tackiness is permitted.
  3. A Barcol hardness test; at least 90 percent of manufacturer's specified hardness must be attained.
  4. Examination of laminated (nozzle) cutouts.
  5. A hydrotest of at least 24 hours duration to check for leaks.

2.3 BOLTS, ANCHOR BOLTS, WASHERS, SUPPORTS, AND HOLD DOWN LUGS

- E. The CONTRACTOR shall provide bolts, anchor bolts, nuts, washers, and supports as required for the plastic and fiber glass items in this Section and in accordance with the requirements of the manufacturers of the plastic and fiber glass items. Bolts, anchor bolts, washers, hold down lugs, and supports required in connection with the plastic or fiber glass items shall be of Type 316 stainless steel.

## **PART 3 -- EXECUTION**

### **3.1 TANK INSTALLATION AND DELIVERY**

- A. The fiberglass tank manufacturer shall review and certify in writing that all installation requirements as shown on the plans are in accordance with design character and limitations of the unit.
- B. The tanks shall be covered and protected to prevent damage in shipment and handling. All finished surfaces are to be protected. Tanks shall not be stored in the open at manufacturer's site or at job site. Any damage to the units incurred in transit and unloading shall be the responsibility of the manufacturer. Permits, import requirements, and precautionary measures required for highway transport are the entire responsibility of the manufacturer.
- C. The manufacturer shall be responsible for delivering and supervising the unloading of the units at the hatchery. Visually imperfect units shall be rejected. The manufacturer and CONTRACTOR shall fully cooperate in the unloading and installation of the units at the hatchery.
- D. The manufacturer shall fully cooperate and shall assist the CONTRACTOR with respect to the tank shipping and loading/unloading schedule. The shipping schedule shall conform to the project completion schedule.
- E. The manufacturer shall provide a qualified site representative with the first shipment of units to the project site to insure proper unloading, handling and final installation. The CONTRACTOR shall provide equipment to handle and install the tanks in strict accordance with the manufacturer's instructions.
- F. The manufacturer shall provide a qualified site representative during installation of the units to verify proper installation and grading of the tank bedding material, verify proper tank installation, and connections to the process piping.
- G. The manufacturer shall provide a qualified site representative during start up and commissioning to provide guidance to the CONTRACTOR and to provide training to Hatchery personnel on the correct operation of the tanks including start up procedures, operational procedures, and end of season draining procedures.
- H. All minor defects shall be refinished by the manufacturer prior to completion of the Project and acceptance by the OWNER. The refinished surface shall show no discernible variations in appearance from the surrounding areas.
- I. Prior to shipment, the tanks shall be cleaned to remove any residual parting agent, film or other deleterious material. The units shall be carefully cleaned (per the manufacturer's instructions) prior to completion of the project.
- J. The first tank manufactured shall be inspected by the OWNER and the CONTRACTOR for conformance to drawings and specifications prior to manufacturing remaining order. All subsequent tanks shall be inspected by the CONTRACTOR prior to shipment to the site.

- END OF SECTION -

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## SECTION 11 94 01 - FIBERGLASS TANKS

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The work includes furnishing all labor, materials and equipment for the installation of fiberglass fish rearing tanks as shown on the drawings and as specified herein.
- B. Provide the following:
  - 1. Ten (10) 26.25-foot diameter by 6.67-foot deep dual drain fiberglass fish rearing tanks, including inlet supply diffusers, side box drains, bottom drain stand pipes, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 2. Eighteen (18) 10-foot diameter by 4-foot deep fiberglass fish rearing tanks, including inlet spraybars, center drains, external drain stand pipes, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 3. Four (4) 10-foot diameter by 8-foot deep pump sumps, including side box drains, screens, and bottom drain assemblies as shown on the Drawings and specified herein.
  - 4. Two (2) 12-foot long by 1.5-foot wide and deep egg troughs, including tank stand and drain fittings as shown on the Drawings and specified herein.

#### 1.2 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

##### A. Codes

NFPA 70                      National Electric Code

##### B. Commercial Standards

ASTM C 581                      Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass Fiber Reinforced Structures, Intended for Liquid Service

ASTM D 638                      Test Method for Tensile Properties of Plastics

ASTM D 695                      Test Method for Compressive Properties of Rigid Plastics

ASTM D 790                      Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

ASTM D 883                      Definitions of Terms Relating to Plastics

ASTM D 2563	Recommended Practice for Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts
ASTM D 2583	Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 2584	Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D 3299	Filament-Wound Glass Fiber Reinforced Thermoset Resin Chemical-Resistant Tanks
ASTM D 4097	Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks

C. When 2 or more of the above regulations are applicable, the more stringent requirement shall be met.

### 1.3 SUBMITTALS

A. Provide the following submittals in accordance with Section 01 33 00 – Contractor Submittals.

1. Shop Drawings. Shop drawings and design calculations shall be submitted showing details of construction and layouts for review and acceptance before materials are fabricated.
2. Product Data. Submit manufacturer's printed literature for care and maintenance for review and acceptance, including certification the manufacturer has at least five years of experience in the fabrication and supply of circular dual drain aquaculture tanks of the size specified.
3. CONTRACTOR shall provide color samples of a standard color palette for OWNER selection and approval.

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery of Materials:** Tanks and accessories shall be delivered and placed without damage.

### 1.5 WARRANTY

A. **All Components:** The Manufacturer shall furnish to the CONTRACTOR the Manufacturer standard 1-year workmanship warranty, commencing on the date of installation and acceptance at the Project by the OWNER, through the CONTRACTOR.

## PART 2 -- PRODUCTS

### 2.1 REQUIREMENTS

A. Manufacturers' Qualifications

1. Only manufacturers with 5 years or more of proven experience and satisfactory performance in the manufacture of fiberglass reinforced plastic fish rearing tanks.
2. All manufacturers shall be required to submit a complete set of design calculations, material specifications and shop drawings.

#### B. Description of Fiberglass Fish Rearing Tank

1. Provide fiber-reinforced plastic tanks complete and ready for piping hookup and installation in the two sizes indicated in Section 1.1.B.1 and Section 1.1.B.2. The tanks are to be used for the production of fish in water temperatures ranging from 0 to 20 degrees Celsius. The tanks are to be used for an interior, covered application as shown on the drawings and but may be subjected to the maximum ambient temperature range and fluctuations for the geographical location in the event of a facility shut-down.
2. Tanks shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing changes required prior to installation. Units to be provided with reinforcement sufficient to maintain less than 1/2" total deflection at midpoint when filled with water.
3. Tank standpipe openings and screen slots shall be fabricated for use as shown on the project plans.
4. Tanks shall include viewing windows of approximately 1.5ft square located with the top of the window 1-ft below the top of the tank. Window shall be located to face the central drive aisle in the hatchery building as shown on the Drawings.
5. All tank side box drain standpipes shall be provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.
6. Each tank shall be provided with slotted screens to prevent fish from entering the sidebox area and bottom drain sumps.
  - a. Screens shall be marine grade aluminum 1/8-inch maximum opening size. Slotted perforations shall be oriented horizontally.
  - b. Screens for multiple tanks of a given size shall be interchangeable between tanks.
  - c. Screens shall be smooth on both faces without any sharp edges.

#### C. Description of Fiberglass Drain Sump

1. Provide fiber-reinforced plastic drain sumps complete and ready for piping hookup and installation as indicated in Section 1.1.B.3.
2. Tanks shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing

changes required prior to installation. Units to be provided with reinforcement sufficient to maintain less than 1/2" total deflection at midpoint when filled with water.

3. All tanks shall be fitted with a bottom drain assembly that is factory installed, and is adequately protected from damage during normal shipping and handling.
4. All tanks shall be fitted with a side box provided by the tank manufacturer. Side boxes that combine side drain and bottom drain flow as indicated on the drawings.
5. All tank side box drain standpipes shall be provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.

D. Description of Fiberglass Riser Standpipe

1. Provide fiber-reinforced plastic Riser Standpipes complete and ready for piping hookup and installation as indicated in Section 1.1.B.4.
2. Riser standpipes shall conform to all dimensions and have the features indicated on the Drawings. CONTRACTOR shall verify tank dimensions and resolve any spacing changes required prior to installation. Units to be provided with reinforcement sufficient to withstand forces consistent with proper operation of standpipe and appurtenances under normal flow conditions.
3. All riser standpipes shall be fitted with a removable inner standpipe provided by the tank manufacturer. Standpipes shall seat in a molded PVC pipe coupling where shown in the Drawings to provide watertight seal at base.

2.2 WORKMANSHIP

- B. **Visual Defects:** ASTM D2563 shall be used for quality control of both filament-wound and hand lay-up construction. Acceptance levels shall be as follows:

<u>Process Surface:</u>	<u>Defects:</u>
Blisters	None
Burned Areas	None
Chips	None
Cracks	None
Crazing	None
Dry Spots	None
Entrapped Air	None at surface. If in laminate 1/16-in dia max and 5/sq in max.
Exposed Glass	None
Exposed Cut Edges	None
Foreign Matter	None
Pits	Max 1/8-in dia X 1/32-in deep, max 10/sq ft.
Scratches	None (coated)
Surface Porosity	None

Wrinkles	Max deviation 10 percent of wall thickness.
Sharp Discontinuity	None

Non-Process Surface: Defects:

Blisters	Max 1/4-in X dia 1/16-in high.
Burned Areas	None
Chips	Max 1/4-in with max thickness of 20 percent of wall.
Cracks	None
Crazing	Slight
Dry Spots	Max 2 sq in/sq ft
Entrapped Air	1/8-in dia max; no more than 3 percent of area.
Exposed Glass	None
Exposed Cut Edges	None
Foreign Matter	None if it affects the properties of laminate.
Pits	Max 1/8-in dia X 1/16-in deep.
Scratches	None (coated)
Surface Porosity	None
Wrinkles	Max deviation 20 percent of wall thickness, but not exceed 1/8-in.
Sharp Discontinuity	None

- C. If the area fails to meet the requirements of entrapped air or voids in less than 40 percent of the total surface, those areas shall be repaired and reinspected. If the defective areas exceed 40 percent of the total surface, the entire vessel shall be rejected.
- D. **Shop Inspection:** The OWNER or OWNER Representative shall be permitted access to the manufacturing area during fabrication and shall be notified one week prior to the estimated date of tests and/or inspections. Final inspection and approval shall be obtained prior to shipment unless written waiver is obtained. The shop inspection of the equipment shall include the following:
1. Check for compliance with drawing dimensions and adherence to construction standards.
  2. An acetone wipe test to check surface cure. No surface tackiness is permitted.
  3. A Barcol hardness test; at least 90 percent of manufacturer's specified hardness must be attained.
  4. Examination of laminated (nozzle) cutouts.
  5. A hydrotest of at least 24 hours duration to check for leaks.

2.3 BOLTS, ANCHOR BOLTS, WASHERS, SUPPORTS, AND HOLD DOWN LUGS

- E. The CONTRACTOR shall provide bolts, anchor bolts, nuts, washers, and supports as required for the plastic and fiber glass items in this Section and in accordance with the requirements of the manufacturers of the plastic and fiber glass items. Bolts, anchor bolts, washers, hold down lugs, and supports required in connection with the plastic or fiber glass items shall be of Type 316 stainless steel.

## **PART 3 -- EXECUTION**

### **3.1 TANK INSTALLATION AND DELIVERY**

- A. The fiberglass tank manufacturer shall review and certify in writing that all installation requirements as shown on the plans are in accordance with design character and limitations of the unit.
- B. The tanks shall be covered and protected to prevent damage in shipment and handling. All finished surfaces are to be protected. Tanks shall not be stored in the open at manufacturer's site or at job site. Any damage to the units incurred in transit and unloading shall be the responsibility of the manufacturer. Permits, import requirements, and precautionary measures required for highway transport are the entire responsibility of the manufacturer.
- C. The manufacturer shall be responsible for delivering and supervising the unloading of the units at the hatchery. Visually imperfect units shall be rejected. The manufacturer and CONTRACTOR shall fully cooperate in the unloading and installation of the units at the hatchery.
- D. The manufacturer shall fully cooperate and shall assist the CONTRACTOR with respect to the tank shipping and loading/unloading schedule. The shipping schedule shall conform to the project completion schedule.
- E. The manufacturer shall provide a qualified site representative with the first shipment of units to the project site to insure proper unloading, handling and final installation. The CONTRACTOR shall provide equipment to handle and install the tanks in strict accordance with the manufacturer's instructions.
- F. The manufacturer shall provide a qualified site representative during installation of the units to verify proper installation and grading of the tank bedding material, verify proper tank installation, and connections to the process piping.
- G. The manufacturer shall provide a qualified site representative during start up and commissioning to provide guidance to the CONTRACTOR and to provide training to Hatchery personnel on the correct operation of the tanks including start up procedures, operational procedures, and end of season draining procedures.
- H. All minor defects shall be refinished by the manufacturer prior to completion of the Project and acceptance by the OWNER. The refinished surface shall show no discernible variations in appearance from the surrounding areas.
- I. Prior to shipment, the tanks shall be cleaned to remove any residual parting agent, film or other deleterious material. The units shall be carefully cleaned (per the manufacturer's instructions) prior to completion of the project.
- J. The first tank manufactured shall be inspected by the OWNER and the CONTRACTOR for conformance to drawings and specifications prior to manufacturing remaining order. All subsequent tanks shall be inspected by the CONTRACTOR prior to shipment to the site.

- END OF SECTION -

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## **SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS**

### **PART 1 - GENERAL**

#### 1.1 SECTION INCLUDES

- A. Horizontal slat louver blinds.
- B. Operating hardware.

#### 1.2 SUBMITTALS

- A. Product Data: Provide data indicating physical and dimensional characteristics.
- B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

#### 1.4 PROJECT CONDITIONS

- A. Coordinate the work with window installation and placement of concealed blocking to support blinds.
- B. Take field measurements to determine sizes required.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- A. Horizontal Louver Blinds:
  - 1. Levolor Contract; Product Mark I Dustguard, 1" blind: [www.levolorcontract.com](http://www.levolorcontract.com).

#### 2.2 BLINDS AND BLIND COMPONENTS

- A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand.
- B. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
  - 1. Width: 1 inch.
  - 2. Thickness: 0.008 inch.
  - 3. Color: As selected from manufacturer's full range.

- C. Slat Support: Woven polypropylene cord, ladder configuration.
- D. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats
  - 1. Color: Same as slats.
- E. Bottom Rail: Pre-finished, formed steel with top side shaped to match slat curvature; with end caps. Color: Same as headrail.
- F. Lift Cord: Braided nylon; continuous loop.
  - 1. Free end weighted.
  - 2. Color: As selected.
- G. Control Wand: Extruded hollow plastic; hexagonal shape.
  - 1. Removable type.
  - 2. Length of window opening height less 3 inches.
  - 3. Color: As selected.
- H. Headrail Attachment: Wall brackets.
- I. Accessory Hardware: Type recommended by blind manufacturer.

## 2.3 FABRICATION

- A. Fabricate blinds to fit within openings with uniform edge clearance of 1 inch.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verify that openings are ready to receive the work.
- B. Ensure structural blocking and supports are correctly placed.

### 3.2 INSTALLATION

- A. Install blinds in accordance with manufacturer's instructions.
- B. Secure in place with flush countersunk fasteners.

### 3.3 INSTALLATION TOLERANCES

- A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.
- B. Maximum Offset From Level: 1/8 inch.

3.4 ADJUSTING

- A. Adjust blinds for smooth operation.

3.5 CLEANING

- A. Clean blind surfaces just prior to occupancy.

3.6 SCHEDULE

- A. Provide at all exterior windows in Rooms 110, 111, and 112.

- END OF SECTION -

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## SECTION 13 34 15 - RESIDENTIAL HOMES

### Part 1 -- GENERAL

#### 1.1 SUMMARY

- A. This specification defines the minimum standards for stick-framed home construction and outfitting to meet the Contract Requirements for the Melvin R. Sampson Coho Hatchery Residences. The standards identify minimum square footage of living space, floor plan configuration, and finishes.
- B. In general, this Project encompasses the new construction of three (3), each approximately 2,000-square foot homes.
- C. The unit shall be constructed to Wind Zone 1 requirements and Roof Load to South Zone.

#### 1.2 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 - Contractor Submittals

### Part 2 -- PRODUCTS

#### 2.1 SITE WORK

- A. Refer to Division 02 for further specifications related to Site Work.
- B. Excavation and backfill of footings, foundations, walls, etc.
- C. Installation and connection of all utilities including water, sewer, and electric.
- D. A landscaping allowance of \$7,000 each has been included.
  - 1. The landscaping budget includes a fully automatic water irrigation system.

#### 2.2 CONCRETE

- A. Refer to Division 03 for further specifications related to Concrete.
- B. All footings, foundations, stem walls, retaining walls, and slab on grade concrete is included.
- C. All exposed exterior concrete slab shall have a broom finish.
- D. All Exposed exterior concrete walls shall be hand sacked and patched however not completely free from concrete form lines or markings
- E. All exposed interior concrete (i.e. garage slab on grade) shall have smooth finish.

#### 2.3 WOOD AND PLASTICS

- A. Refer to Division 06 for further specifications related to Wood and Plastics.
- B. Casework
  - 1. New shaker style cabinets are included in the Kitchen and Bathrooms.
  - 2. An allowance of \$15.00/SF for laminate countertops is included.
- C. Trim/Millwork

1. MDF base and door/window casing is included.
- D. Framing
1. All framing shall be installed according to standard trade practices and per local and State code requirements.

## 2.4 THERMAL AND MOISTURE PROTECTION

- A. Refer to Division 07 for further specifications related to Thermal and Moisture Protection.
- B. Insulation shall be installed to meet building code requirements.
- C. Exterior siding shall consist of:
  1. Hardie lap siding
  2. Hardie board and batten siding
- D. All joints, trim, coping, parapets, etc. shall be flashed as required.
- E. Metal roofing is included.
- F. Gutters and downspouts are included.
- G. All exterior joints shall be caulked and properly sealed

## 2.5 DOORS AND WINDOWS

- A. Refer to Division 08 for further specifications related to Doors and Windows.
- B. Doors and Hardware
  1. Exterior doors shall be insulated hollow metal doors.
  2. Exterior sliding glass doors shall be vinyl.
  3. All interior doors shall be paint grade hollow core or Masonite.
  4. Standard brushed nickel hardware at all doors is included.
- C. Windows
  1. All windows shall be vinyl.

## 2.6 FINISHES

- A. Refer to Division 09 for further specifications related to Finishes.
- B. Carpet
  1. The following areas shall receive carpet:
    - i. All Bedrooms, Office/Guest Rooms and associated closets.
    - ii. Basement
  2. An allowance of \$4.50/SF has been included.
- C. Ceramic Tile
  1. All bathroom floors shall receive vinyl flooring.
    - iii. A material only allowance of \$2.50/SF has been included.
  2. A tile surround at the fireplace is included.
    - iv. A material only allowance of \$8.00/SF has been included for this tile.
  3. A tile backsplash from countertop to bottom of upper cabinets is included in the Kitchen.
    - v. A material only allowance of \$15.00/SF has been included for the Kitchen backsplash.
- D. Paint

1. Paints and stains shall be applied according to standard trade practices.
  2. Interior:
    - vi. One wall color and one ceiling color is included throughout.
  3. Exterior:
    - vii. One main body color and one trim color is included.
- E. Drywall
1. Drywall shall be installed according to standard trade practices.
  2. Drywall shall be taped, sanded, and textured with a “knock down” texture.
- F. Hardwood Flooring
1. No hardwood flooring has been figured

## 2.7 SPECIALTIES

- A. Brushed Nickel Toilet and Bath Accessories are included.
- B. Each residence shall have a Type 13D sprinkler installed and tied into the potable water system. The sprinkler layout shall be designed by an experienced installer and approved by the Contractor. Installation shall be completed by an experienced installer.

## 2.8 EQUIPMENT

- A. An allowance of \$5,000.00 has been included for the following stainless steel appliances :
  1. Refrigerator
  2. Microwave
  3. Electric Range
  4. Dishwasher
  5. Washer and Dryer

## 2.9 FURNISHINGS

- A. Furnishings are not included.
- B. Window coverings are not included.

## 2.10 HVAC

- A. Applicable trade permits for this scope of work.
- B. A fully functional HVAC system will be installed per standard trade practices to meet State and local codes and mandates.
- C. Includes one zone with wall mounted thermostat.

## 2.11 PLUMBING

- A. Applicable trade permits for this scope of work.
- B. A fully functional plumbing system will be installed per standard trade practices to meet State and local codes and mandates.
- C. Includes a radon removal system in the crawlspace.

- D. All fixtures to be brushed nickel.
- E. Bathrooms to receive shower/tub combo inserts.
- F. 50 gallon electric water heater.
- G. Connect potable water to fire sprinkler system described under Article 2.7.B above.

## 2.12 ELECTRICAL

- A. Applicable trade permits for this scope of work.
- B. A fully functional electrical system will be installed per standard trade practices to meet State and local codes and mandates.
- C. The majority of lighting throughout the interior shall be achieved via recessed can lighting.
- D. Exterior lighting will include lights at all exterior doors.

## Part 3 -- EXECUTION

### 3.1 COORDINATION WITH CONTRACTOR

- A. Home supplier shall coordinate with contractor for foundation requirements.
- B. Supplier shall provide contractor with scaled drawings.

### 3.2 DELIVERY

- A. Manufacturer shall provide delivery to the site for each of the new residences. Delivery shall be coordinated with the contractor.

### 3.3 INSTALLATION

- A. Home supplier shall install the home on the foundation. Installation shall include all materials and equipment required for placing the home on the Contractor-supplied foundation.

- END OF SECTION -



## SECTION 13 34 19 - METAL BUILDING SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Structural-steel framing.
  - 2. Metal roof panels.
  - 3. Metal wall panels.
  - 4. Foam-insulation-core metal wall panels.
  - 5. Metal soffit panels.
  - 6. Thermal insulation.
  - 7. Doors and frames.
  - 8. Windows.
  - 9. Accessories.
- B. Related Sections:
  - 1. Section 083613 "Sectional Doors."

#### 1.3 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
  - 1. Structural-steel-framing system.
  - 2. Metal roof panels.
  - 3. Metal wall panels.
  - 4. Insulation and vapor retarder facings.
  - 5. Flashing and trim.
  - 6. Doors.

7. Windows.
  8. Accessories.
- B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.
1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
  2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
    - a. Show provisions for attaching.
  3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
    - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
    - b. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
  4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
    - a. Flashing and trim.
    - b. Gutters.
    - c. Downspouts.
    - d. Roof ventilators.
    - e. Louvers.
    - f. Service walkways.
- C. Samples for Initial Selection: For units with factory-applied color finish.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:
1. Metal Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
  2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
  3. Vapor-Retarder Facings: Nominal 6-inch- square Samples.
  4. Windows: Full-size, nominal 12-inch- long frame Samples showing typical profile.
  5. Accessories: Nominal 12-inch- long Samples for each type of accessory.

- E. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
  - 1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.
  - 2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- F. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified erector and manufacturer.
- B. Manufacturer Accreditation: Statement that metal building system and components were designed and produced by a manufacturer accredited according to the International Accreditation Service's AC472.
- C. Welding certificates.
- D. Metal Building System Certificates: For each type of metal building system, from manufacturer.
  - 1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
    - a. Name and location of Project.
    - b. Order number.
    - c. Name of manufacturer.
    - d. Name of Contractor.
    - e. Building dimensions including width, length, height, and roof slope.
    - f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
    - g. Governing building code and year of edition.
    - h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
    - i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
    - j. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- E. Erector Certificates: For each product, from manufacturer.
- F. Manufacturer Certificates: For each product, from manufacturer.

- G. Material Test Reports: For each of the following products:
  - 1. Structural steel including chemical and physical properties.
  - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 4. Shop primers.
  - 5. Nonshrink grout.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- I. Source quality-control reports.
- J. Field quality-control reports.
- K. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- L. Warranties: Sample of special warranties.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.
  - 1. Accreditation: According to the International Accreditation Service's AC472.
  - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.
- C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- E. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."

- G. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- H. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- I. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
  - 2. Combustion Characteristics: ASTM E 136.
- J. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Protect foam-plastic insulation as follows:
  - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
  - 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

## 1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements:
  - 1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
  - 2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

## 1.9 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.10 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace

standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements,

1. Provide Kingspan 200 Inverted Rib at walls
2. Provide Kingspan Kingzip at roof
3. Or comparable product by one of the following:
  - a. Behlen Mfg. Co.
  - b. Butler Manufacturing Company; a BlueScope Steel company.
  - c. Garco Building Systems; Division of NCI Building Systems, L.P.
  - d. VP Buildings; a United Dominion company.

### 2.2 METAL BUILDING SYSTEMS

- A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

- B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
2. Rigid Modular: Solid-member, structural-framing system with interior columns.
3. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.
4. Truss-Frame Modular: Truss-member, structural-framing system with interior columns.
5. Lean to: Solid- or truss-member, structural-framing system without interior columns, designed to be partially supported by another structure.

- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of load-bearing end-wall and corner columns and rafters.

- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and **exterior-framed (bypass)** girts.

- E. Roof System: Manufacturer's standard foam-insulation-core metal wall panels.
- F. Exterior Wall System: Manufacturer's standard foam-insulation-core metal wall panels.

## 2.3 METAL BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
  - 1. Design Loads: As indicated on Drawings.
  - 2. Design Loads: As required by the latest edition of ASCE/SEI 7.
  - 3. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:
    - a. Rafters: Vertical deflection of **1/240** of the span.
    - b. Purlins and Girts: Deflection of **1/180** of the span.
    - c. Metal Roof Panels: Vertical deflection of **1/180** of the span.
    - d. Metal Wall Panels: Horizontal deflection of **1/180** of the span.
    - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
  - 4. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
    - a. Lateral Drift: Maximum of **1/120** of the building height.
  - 5. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): **120 deg F, ambient; 180 deg F**, material surfaces.
- E. Air Infiltration for Metal Roof and Wall Panels: Air leakage through assembly of not more than **0.06 cfm/sq. ft.** of roof area when tested according to ASTM E 1680 at negative test-pressure difference of **1.57 lbf/sq. ft.**



- F. Water Penetration for Metal Roof and Wall Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of **2.86 lbf/sq. ft.**.
- G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for **Class 90**.
- H. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C 1363 or ASTM C 518:
  - 1. Metal Roof Panel Assemblies:
    - a. As indicated on drawings
  - 2. Metal Wall Panel Assemblies:
    - a. As indicated on drawings

## 2.4 STRUCTURAL-STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
  - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
    - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
  - 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
  - 3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
  - 4. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
  - 5. Truss-Frame Modular Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
  - 6. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
  - 7. Exterior Column Type: **Tapered**.
  - 8. Rafter Type: Tapered.

- B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
  2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.
    - a. Depth: [As indicated] [As needed to comply with system performance requirements] <Insert dimension>.
  2. Purlins: Steel joists of depths indicated.
  3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.
    - a. Depth: 8 inch.
  4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
  5. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
  6. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
  7. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
  8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
  9. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from **zinc-coated (galvanized) steel sheet**.
  10. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
  11. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- D. Canopy Framing: Manufacturer's standard structural-framing system, designed to withstand required loads; fabricated from shop-welded, built-up steel plates or

structural-steel shapes. Provide frames with attachment plates and splice members, factory drilled for field-bolted assembly.

1. Type: As indicated.

E. Bracing: Provide adjustable wind bracing as follows:

1. Rods: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50; or ASTM A 529/A 529M, Grade 50; minimum 1/2-inch- diameter steel; threaded full length or threaded a minimum of 6 inches at each end.
2. Cable: ASTM A 475, 1/4-inch- diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
7. Bracing: Provide wind bracing using any method specified above, at manufacturer's option.

F. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide **hot-dip galvanized** bolts for structural-framing components that are galvanized.

G. Materials:

1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.

8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grades 33 through 80 or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
  - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.
9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for primary framing.
10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for secondary framing.
11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A, carbon-steel, hex-head bolts; ASTM A 563 carbon-steel hex nuts; and ASTM F 844 plain (flat) steel washers.
  - a. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
12. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
  - a. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
13. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts[ **or tension-control, bolt-nut-washer assemblies with spline ends**]; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.
14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex-head steel structural bolts with spline ends.
  - a. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50.
15. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM A 572/A 572M, Grade **50** or ASTM A 36/A 36M or **ASTM A 307, Grade A**. The grade shall match the material type stated in the shop drawings provided by the designer of the PEMB. If the material type is not identified the Contractor shall contact the engineer and receive the grade required in written communication.
  - a. Configuration: Straight.
  - b. Nuts: ASTM A 563.

- c. Plate Washers: ASTM A 36/A 36M carbon steel.
  - d. Washers: ASTM F 436 hardened carbon steel.
  - e. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
16. Headed Anchor Rods: ASTM F 1554, Grade 36.
- a. Configuration: Straight.
  - b. Nuts: ASTM A 563.
  - c. Plate Washers: ASTM A 36/A 36M carbon steel.
  - d. Washers: ASTM F 436 hardened carbon steel.
  - e. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
17. Threaded Rods: ASTM A 36/A 36M.
- a. Nuts: ASTM A 563.
  - b. Washers: **ASTM F 436** hardened.
  - c. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- H. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.
    - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
  2. Prime galvanized members with specified primer after phosphoric acid pretreatment.
  3. Primer: SSPC-Paint 15, Type I, red oxide.

## 2.5 METAL ROOF PANELS

- A. Vertical-Rib, Standing-Seam Metal Roof Panels Formed with vertical ribs at panel edges and **intermediate stiffening ribs symmetrically spaced** between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) steel sheet, **0.028-inch** nominal thickness.
    - a. Exterior Finish: Fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's full range.
  2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel sheet.
  3. Joint Type: Panels snapped together.
  4. Joint Type: Mechanically seamed, folded according to manufacturer's standard.

5. Panel Coverage: **16 inches**.
6. Panel Height: **2 inches**.
7. Uplift Rating: **UL 90**.

B. Materials:

1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
  - c. Surface: **Embossed** finish.

C. Finishes:

1. Exposed Coil-Coated Finish:
  - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## 2.6 METAL WALL PANELS

A. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and **intermediate stiffening ribs symmetrically spaced** between major ribs; designed to be installed by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.

1. Material: Zinc-coated (galvanized) steel sheet, **0.028-inch** nominal thickness.
  - a. Exterior Finish: Fluoropolymer.
  - b. Color: As selected by Architect from manufacturer's full range.
2. Major-Rib Spacing: **12 inches** o.c.

3. Panel Coverage: **36 inches**.
4. Panel Height: **1.188 inches**.

B. Materials:

1. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
  - c. Surface: **Embossed** finish.

C. Finishes:

1. Exposed Coil-Coated Finish:
  - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## 2.7 FOAM-INSULATION-CORE METAL WALL PANELS

A. Description: Provide factory-formed and -assembled, metal wall panels fabricated from two metal facing sheets and an insulation core foamed in place during fabrication, with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Concealed-Fastener, Foam-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
  - a. Facings: Fabricate panel with exterior and interior facings of same material and thickness.

- b. Exterior Surface: Smooth, flat.
- c. Panel Coverage: **36 inches** nominal.
- d. Panel Thickness: **2 inches**.
- e. Thermal-Resistance Value (R-Value): R-19.

B. Panel Performance:

- 1. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297/C 297M.
- 2. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
- 3. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F according to ASTM D 2126.
- 4. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F according to ASTM D 2126.
- 5. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for two million cycles.
- 6. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
- 7. Fire-Test-Response Characteristics: Class A according to ASTM E 108.

C. Polyisocyanurate Insulation-Core Performance:

- 1. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
- 2. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
- 3. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.

D. Materials:

- 1. Polyisocyanurate Insulation: Modified polyisocyanurate foam using a non-CFC blowing agent, foamed-in-place or board type as indicated, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
  - a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
- 2. Metallic-Coated Steel Sheet: Restricted-flatness steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40; structural quality.
  - c. Surface: [**Smooth, flat**] [**Embossed**] finish.

E. Finishes:

- 1. Exposed Coil-Coated Finish:



- a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

## 2.8 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Concealed-Fastener Metal Soffit Panels: Formed with vertical panel edges and a **single wide recess, centered between panel edges**; with flush joint between panels; with 1-inch- wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps.
  1. Material: Zinc-coated (galvanized) steel sheet, **0.028-inch** nominal thickness.
    - a. Exterior Finish: Fluoropolymer.
    - b. Color: As selected by Architect from manufacturer's full range.
  2. Panel Coverage: **16 inches**.
  3. Panel Height: **1 inch**.

## 2.9 THERMAL INSULATION

- A. Faced Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.
- B. Unfaced Metal Building Insulation: ASTM C 991, Type I, or NAIMA 202, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; 2-inch- wide, continuous, vapor-tight edge tabs; with a flame-spread index of 25 or less.

1. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96/E 96M, Desiccant Method.
  - a. Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
  - b. Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
  - c. Composition: White **vinyl** film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
  - d. Composition: White polypropylene film facing and fiberglass-polyester-blend fabric backing.
  
- C. Mineral-Fiber-Blanket Insulation: ASTM C 665, type indicated below; consisting of fibers manufactured from glass, slag wool, or rock wool.
  1. Nonreflective Faced: Type II (blankets with nonreflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
  2. Reflective Faced: Type III (blankets with reflective membrane covering), Category 1 (membrane is a vapor retarder), Class A (membrane-faced surface with a flame-spread index of 25 or less).
  3. Unfaced: Type I (blankets without membrane covering), passing ASTM E 136 for combustion characteristics.
    - a. Vapor-Retarder Facing: ASTM C 1136, with permeance not greater than 0.02 perm when tested according to ASTM E 96/E 96M, Desiccant Method.
      - 1) Composition: White metallized-polypropylene film facing, fiberglass scrim reinforcement, and kraft-paper backing.
      - 2) Composition: Aluminum foil facing, elastomeric barrier coating, fiberglass scrim reinforcement, and kraft-paper backing.
      - 3) Composition: White [**polypropylene**] [**vinyl**] film facing, fiberglass scrim reinforcement, and metallized-polyester film backing.
      - 4) Composition: White polypropylene film facing and fiberglass-polyester blend fabric backing.
  
- D. Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I (foil facing), Class 2, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, based on tests performed on unfaced core. Provide units tested for interior exposure without an approved thermal barrier.
  
- E. Retainer Strips: 0.025-inch nominal-thickness, formed, metallic-coated steel or PVC retainer clips colored to match insulation facing.
  
- F. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## 2.10 DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames: As specified in Section 081113 "Hollow Metal Doors and Frames."
- B. Swinging Personnel Doors and Frames: Metal building system manufacturer's standard doors and frames; prepared and reinforced at strike and at hinges to receive factory- and field-applied hardware according to BHMA A156 Series.
  - 1. Steel Doors: 1-3/4 inches thick; fabricated from 0.040-inch nominal-thickness, metallic-coated steel face sheets; of **[seamed]** **[seamless]**, hollow-metal construction; with 0.064-inch nominal-thickness, inverted metallic-coated steel channels welded to face sheets at top and bottom of door.
    - a. Design: [Flush panel] [As indicated] <Insert design>.
    - b. Core: Kraft honeycomb with U-factor rating of at least 0.47 Btu/sq. ft. x h x deg F.
    - c. Core: Polystyrene foam with U-factor rating of at least 0.16 Btu/sq. ft. x h x deg F.
    - d. Core: Polyurethane foam with U-factor rating of at least 0.07 Btu/sq. ft. x h x deg F.
    - e. Glazing Frames: Steel frames to receive field-installed glass.
    - f. Glazing: As specified in Section 088000 "Glazing."
  - 2. Steel Frames: Fabricate 2-inch- wide face frames from 0.064-inch nominal-thickness, metallic-coated steel sheet.
    - a. Type: [Knocked down for field assembly] [Factory welded].
  - 3. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold- or hot-rolled steel sheet.
  - 4. Hardware:
    - a. Provide hardware for each door leaf, as follows:
      - 1) Hinges: BHMA A156.1. Three **[plain]** **[antifriction]**-bearing, standard-weight, full-mortise, stainless-steel or bronze, template-type hinges; 4-1/2 by 4-1/2 inches, with nonremovable pin.
      - 2) Lockset: BHMA A156.2. [Key-in-lever cylindrical] [Mortise, with lever handle] type.
      - 3) Exit Device: BHMA A156.3. Touch- or push-bar type.
      - 4) Threshold: BHMA A156.21. Extruded aluminum.
      - 5) Silencers: Pneumatic rubber; three silencers on strike jambs of single door frames and two silencers on heads of double door frames.
      - 6) Closer: BHMA A156.4. Surface-applied, standard-duty hydraulic type.



- a. Color and Gloss: [As indicated by manufacturer's designations] [Match Architect's sample] [As selected by Architect from manufacturer's full range] <Insert color and gloss>.

## 2.11 WINDOWS

- A. Aluminum Windows: As specified in Section 085113 "Aluminum Windows."
- B. Aluminum Windows: Metal building system manufacturer's standard, with self-flashing mounting fins, and as follows:
  1. Type, Performance Class, and Performance Grade: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 and as follows:
    - a. Horizontal-Sliding Units: **[HS-LC25] [HS-C30]** <Insert designation>.
    - b. Single-Hung Units: [H-LC25] [H-C30] <Insert designation>.
    - c. Fixed Units: [F-LC25] [F-C30] <Insert designation>.
  2. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 0.064-inch thickness at any location for main frame and sash members.
    - a. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
  3. Mullions: Between adjacent windows, fabricated of extruded aluminum matching finish of window units.
  4. Fasteners, Anchors, and Clips: Nonmagnetic stainless steel, aluminum, or other noncorrosive material, compatible with aluminum window members, trim, hardware, anchors, and other components of window units. Fasteners shall not be exposed, except for attaching hardware.
    - a. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.128 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, spline grommet nuts.
  5. Hardware: Manufacturer's standard; of aluminum, stainless steel, die-cast steel, malleable iron, or bronze; including the following:
    - a. Cam-action sweep sash lock and keeper at meeting rails.
    - b. Spring-loaded, snap-type lock at jambs.
    - c. Pole-operated, cam-action locking device on meeting rail where rail is more than 72 inches above floor.
    - d. Lift handles for single-hung units.
    - e. Nylon sash rollers for horizontal-sliding units.
    - f. Steel or bronze operating arms.

6. Sliding-Type Weather Stripping: Woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric; complying with AAMA 702/112.
  7. Insect Screens: Provide removable insect screen on each operable exterior sash, with screen frame finished to match window unit, and as follows:
    - a. Aluminum Wire Fabric: 18-by-18, 18-by-16, or 18-by-14 mesh of 0.013-inch- diameter, coated aluminum wire; complying with FS RR-W-365, Type VII.
    - b. Glass-Fiber Mesh Fabric: 18-by-16 or 18-by-14 mesh of PVC-coated, glass-fiber threads, woven and fused to form a fabric mesh; complying with ASTM D 3656.
    - c. Fabric: Manufacturer's standard aluminum wire fabric or glass-fiber mesh fabric.
- C. Glazing: Comply with requirements specified in Section 088000 "Glazing."
- D. Glazing:
1. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear), 3 mm thick.
  2. Heat-Treated Float Glass: ASTM C 1048, Type I, Quality-Q3, Class I (clear), Condition A, 3 mm thick.
  3. Tinted Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 2, 3 mm thick.
    - a. Tint Color: [Blue] [Blue-green] [Bronze] [Green] [Gray] [Manufacturer's standard color] <Insert color>.
  4. Patterned Glass: ASTM C 1036, Type II, Quality-Q6, Class 1 (clear), Form 3, Pattern P3 (random), 3 mm thick.
  5. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of 2.5-mm-thick clear float glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  6. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
    - a. Provide safety glazing labeling.
  7. Glazing Stops: Screw-applied or snap-on glazing stops coordinated with Section 088000 "Glazing" and with glazing system indicated. Match material and finish of window frames.
  8. Factory-Glazed Fabrication: Glaze window units in the factory to greatest extent possible and practical for applications indicated. Comply with requirements in Section 088000 "Glazing."
- E. Finish:
1. Mill finish.
  2. Baked-Enamel Finish: Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 0.7 mil, medium gloss.

- a. Color: [As indicated by manufacturer's designations] [As selected by Architect from manufacturer's full range] <Insert color>.

## 2.12 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
  1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
  2. Clips: Manufacturer's standard, formed from [**steel**] [**stainless-steel**] sheet, designed to withstand negative-load requirements.
  3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from [**steel**] [**stainless-steel sheet or nylon-coated aluminum**] sheet.
  4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
  6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
  3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible

closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- D. Flashing and Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
  2. Opening Trim: Formed from **[0.022-inch]** **[0.034-inch]** nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- long sections, sized according to SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
  2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Formed from 0.022-inch nominal-thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
1. Circular-Revolving Type: Minimum **[20-inch-]** **<Insert dimension>** diameter throat opening; fabricated from 0.028-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with matching base and rain cap.
    - a. Type: **[Directional]** **[Stationary]** revolving.
    - b. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; or aluminum, 1/2-inch- square mesh, 0.063-inch wire.
    - c. Dampers: Spring-loaded, butterfly type; pull-chain operation; with pull chain of length required to reach within 36 inches of floor.
    - d. Reinforce and brace units, with joints properly formed and edges beaded to be watertight under normal positive-pressure conditions.
    - e. Mount ventilators on square-to-round bases for ridge or on-slope mounting, designed to match roof pitch and roll formed to match metal roof panel profile.



2. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; fabricated from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
  - a. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; or aluminum, 1/2-inch- square mesh, 0.063-inch wire.
  - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches of floor.
  - c. Throat Size: **[9 inches] [12 inches] [9 or 12 inches]**, as standard with manufacturer, and as required to comply with ventilation requirements].
  
- H. Louvers: Size and design indicated; self-framing and self-flashing. Fabricate welded frames from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet; finished to match metal wall panels. Form blades from 0.040-inch nominal-thickness, metallic-coated steel sheet; folded or beaded at edges, set at an angle that excludes driving rains, and secured to frames by riveting or welding. Fabricate louvers with equal blade spacing to produce uniform appearance.
  1. Blades: Fixed.
  2. Blades: Adjustable type, with weather-stripped edges, and manually operated by hand crank or pull chain.
  3. Free Area: Not less than **[7.0 sq. ft.] <Insert dimension>** for 48-inch- wide by 48-inch- high louver.
  4. Bird Screening: Galvanized steel, 1/2-inch- square mesh, 0.041-inch wire; with rewirable frames, removable and secured with clips; fabricated of same kind and form of metal and with same finish as louvers.
    - a. Mounting: **[Interior] [Exterior]** face of louvers.
  5. Vertical Mullions: Provide mullions at spacings recommended by manufacturer, or 72 inches o.c., whichever is less.
  
- I. Roof Curbs: Fabricated from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.
  1. Curb Subframing: Fabricated from 0.064-inch nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
  2. Insulation: 1-inch- thick, rigid type.
  
- J. Service Walkways: Fabricated from 0.052-inch nominal-thickness, metallic-coated steel plank grating; with slip-resistant pattern; **[18-inch] [24-inch] [36-inch]** overall width. Support walkways on framing system anchored to metal roof panels without penetrating panels; with predrilled holes and clamps or hooks for anchoring.

- K. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
- L. Materials:
1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
    - a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
    - b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
    - c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws[, **with EPDM sealing washers bearing on weather side of metal panels**].
    - d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head[, **with EPDM sealing washers bearing on weather side of metal panels**].
    - e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
    - f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
  2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
  3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
  4. Metal Panel Sealants:
    - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
    - b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

## 2.13 SOURCE QUALITY CONTROL

- A. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to evaluate product.
- B. Special Inspector: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
  - 1. Special inspections will not be required if fabrication is performed by manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
    - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.
- C. Testing: Test and inspect shop connections for metal buildings according to the following:
  - 1. Bolted Connections: Shop-bolted connections shall be **[tested and]** inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - 2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

## 2.14 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
  - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
  - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
  - 1. Make shop connections by welding or by using high-strength bolts.
  - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
  - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
  - 4. Weld clips to frames for attaching secondary framing.
  - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
  - 1. Make shop connections by welding or by using non-high-strength bolts.
  - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
  - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. **Base[ and Bearing] Plates:** Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
    - a. Joint Type: Snug tightened or pretensioned.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
  2. Locate and space wall girts to suit openings such as doors and windows.
  3. Locate canopy framing as indicated.
  4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists[ **and Joist Girders**]: Install joists[, **girders**,] and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
  2. Space, adjust, and align joists accurately in location before permanently fastening.
  3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
  4. Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
  5. Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for high-strength structural bolt installation and tightening requirements.
  6. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
1. Tighten rod and cable bracing to avoid sag.
  2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

### 3.4 METAL PANEL INSTALLATION, GENERAL

- A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
  - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
    - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
  - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
  - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
  - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
  - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of

gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

### 3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge[ **and hip**] caps as metal roof panel work proceeds.
  2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
  2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
  3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
  4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
  5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.
  6. Provide metal closures at [**peaks**] [**rake edges**] [**rake walls**] [**and**] each side of ridge[ **and hip**] caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
  2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
  3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
  4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.



- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
  - 2. Shim or otherwise plumb substrates receiving metal wall panels.
  - 3. When two rows of metal panels are required, lap panels 4 inches minimum.
  - 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
  - 5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
  - 6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
  - 7. Install screw fasteners in predrilled holes.
  - 8. Install flashing and trim as metal wall panel work proceeds.
  - 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
  - 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
  - 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
- C. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches o.c., spaced not more than manufacturer's recommendation. Fully engage tongue and groove of adjacent insulated metal wall panels.
  - 1. Install clips to supports with self-tapping fasteners.
  - 2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- D. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as

indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.7 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

### 3.8 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
  - 1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
  - 2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
  - 3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
  - 4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.
- B. Blanket Roof Insulation: Comply with the following installation method:
  - 1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof panels fastened to secondary framing.
  - 2. Between-Purlin Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Hold in place with bands and crossbands below insulation.
  - 3. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
    - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

4. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder between purlins. Carry vapor-retarder-facing tabs up and over purlin, overlapping adjoining facing of next insulation course and maintaining continuity of retarder. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.
    - a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
  5. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
  2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
- D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
  2. At fire-rated openings, install frames according to, and doors with clearances specified in, NFPA 80.
- E. Sliding Service Doors: Bolt support angles to opening head members through factory-punched holes. Bolt door tracks to support angles at maximum 24 inches o.c. Set doors and operating equipment with necessary hardware, jamb and head mold stops, continuous hood flashing, anchors, inserts, hangers, and equipment supports.
- F. Field Glazing: Comply with installation requirements in Section 088000 "Glazing."

### 3.9 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
  3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
  2. Tie downspouts to underground drainage system indicated.
- E. Circular Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Mount ventilators on flat level base. Install preformed filler strips at base to seal ventilator to metal roof panels.
- F. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.
- G. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.

1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
  2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
  3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
  4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
- H. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- I. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

### 3.10 FIELD QUALITY CONTROL

- A. Special Inspections: **[Owner will engage]** **[Engage]** a qualified special inspector to perform the following special inspections:
1. Inspection of fabricators.
  2. Steel construction.
  3. <Insert special inspections>.
- B. Testing Agency: **[Owner will engage]** **[Engage]** a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be **tested and** inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.11 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Adjustable Louvers: After completing installation, including work by other trades, lubricate, test, and adjust units to operate easily and be free of warp, twist, or distortion as needed to provide fully functioning units.
  - 1. Adjust louver blades to be weathertight when in closed position.

### 3.12 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
  - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
  - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
  - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
  - 1. Immediately before final inspection, remove protective wrappings from doors and frames.
- G. Windows: Clean metal surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances. Clean factory-glazed glass immediately after installing windows.

- H. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
  - 1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
    - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

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## SECTION 13 45 00 – INTAKE SCREEN

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The Intake Screen Supplier shall furnish all components, materials, sub-assemblies, and all appurtenant work for the intake screen, complete as defined in this specification, and in accordance with the requirements of the Contract Documents.
- B. Contractor shall perform all work required to install manufacturer-supplied Intake Screen including, but not limited to, excavation, concrete placement, hardware, and miscellaneous required components for a fully functional Intake Screen.

#### 1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

##### A. Commercial Standards

ASTM A 36	Standard Specification for Carbon Structural Steel
ASTM A 276	Specifications for Stainless Steel Bars and Shapes
ASTM A 193	Stainless steel bolts
AWS D1.1	Structural Welding Code – Steel
AWS D1.6	Structural Welding Code – Stainless Steel
Agency Fish Screening Criteria (WDFW, NMFS, as applicable)	

#### 1.3 WORK INCLUDED

- A. Contractor shall supply, install, and test Intake Screen as per the manufacturer directions.

#### 1.4 DESCRIPTIONS

- A. This section covers the contract item Intake Screen, which includes the following:
  - 1. Furnishing, installing, and testing cone screen and drive assembly at the location shown.
  - 2. The intake screen shall include the following:
    - a. Cone shaped fish screen over the surface water supply pipeline entrance.
    - b. Lifting eyes to allow the screen to be lifted in and out of the water by owner-supplied lifting device.
    - c. A steel cover plate to fit over the pipe intake entrance, should the screen be removed from the intake.

- d. A self-cleaning system consisting of three (3) brush-cleaning arms that rotate around the screen and wipe the screen surface clean.
  - e. Hydraulic motor unit drive mechanism integrated into the interior of the screen assembly to power the cleaning system and rotate brush assemble in both directions.
  - f. Remote control panel for cleaning system.
  - g. Testing.
  - h. Spare parts.
- B. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating conditions in conformity with approved detail drawings, specifications, engineering data, and recommendations of the equipment manufacturer.

#### 1.5 SUPPLIER

- A. The Intake Screen and associated cleaning mechanism shall be designed and furnished by a single supplier with demonstrated experience with similar intake screening systems.

#### 1.6 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.
- B. Product data, make, and model of manufactured components, including cone screen, physical dimensions and weights of components, propeller, gear reducer, coatings, and anchoring system.
- C. Shop drawings shall illustrate the general arrangement of the Intake Screen unit and system components including the propeller drive unit, as well as dimensions, materials, connections and anchoring requirements.
- D. Construction materials used in the project, including product data sheets, MSDS sheets on the hydraulic oil, material certifications for stainless steel.
- E. List of spare parts to be furnished.
- F. Three (3) sets of technical manuals detailing operation and maintenance information. The manuals shall include basic installation, removal, inspection, operating, and maintenance procedures.
- G. Welder certifications for stainless steel and carbon steel as appropriate.
- H. **Certificates:**
  - 1. Intake screen manufacturer's certification shall be submitted, attesting that the Intake Screen meets all applicable agency fish screening criteria.

## 1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Delivery of Materials:** Intake Screen shall be delivered and placed without damage.

## 1.8 WARRANTY

- A. **All Components:** The Manufacturer shall furnish to the CONTRACTOR the Manufacturer standard 1-year workmanship warranty, commencing on the date of installation and acceptance at the Project by the OWNER, through the CONTRACTOR.

## PART 2 -- PRODUCTS

### 2.1 GENERAL

- A. The cone screen unit shall be designed to cover the intake opening and prevent the entrainment and impingement of juvenile fish while allowing water to pass freely into the intake of the water supply pipeline. When the screen is installed it shall seal over the intake base.
- B. An internal flow cone baffle shall be incorporated to evenly distribute the intake flow over the screen area.
- C. The screen system shall use a hydraulic motor driven brush cleaning system. The exterior of the screen shall be cleaned when the brush arms rotate about the top center of the screen unit and the brushes wipe the screen surface.
- D. The screen cleaning system shall be powered by a hydraulic power unit drive that is connected to the brush assembly. Details of the drive unit to be determined by the manufacturer.

### 2.2 INTAKE SCREEN

- A. Provide Intake Screens, Inc. propeller driven intake screen model ISI C66-18, or approved equal.
- B. The screen shall be fabricated from wedgewire screen that has a maximum slot size of 1.75 mm.
- C. The screen shall have a support system welded to the back of the screen surface and designed for the site and intake conditions.
- D. The pipe entrance under the screen shall be fitted with a cover plate. The cover plate shall be placed over the entrance should the fish screen be removed from service.
- E. The screen shall seal against the level and smooth concrete base with a maximum gap of 1.75 mm.
- F. The minimum screen percent open area shall be 50 percent.
- G. The screen shall be capable of being removed by owner supplied equipment using manufacturer supplied lifting lugs.

## 2.3 SCREEN CLEANING DRIVE UNIT

- A. Hydraulic motor unit drive mechanism, 480v 3 phase power supply, integrated into the interior of the screen assembly to power the cleaning system and rotate brush assemble in both directions.
- B. Remote control panel with NEMA 3R rated enclosure, adjustable timer for cleaning frequency.
- C. Hydraulic hose – 3/8-inch inside diameter, fiber reinforced polyester, rated for 3000 psi working pressure, protected inside polyethylene sleeve from control panel to screen cleaner drive motor.
- D. The hydraulic oil used in the gear box shall be non-toxic to aquatic organisms, meet EPA L-50 requirements, and be inherently biodegradable as approved by NMFS. Chevron Clarity, or equal.

## 2.4 CLEANING BRUSHES

- A. Brush material shall be 612 nylon.
- B. Brush arms shall be stainless steel and have stainless steel clips for supporting the brush.

## 2.5 PERFORMANCE STANDARDS

- A. The Intake Screen shall be sized so that the maximum approach velocity of the water at the screen to no more than 0.4 feet per second during a peak diversion at the lowest river elevation expected.

## 2.6 MATERIALS

- A. Materials shall conform to the following:
  - 1. Fish screen unit construction, except for the motors and drive plates, shall be fabricated from ASTM A 276, Type 304 Stainless Steel.
  - 2. All non-stainless steel shall conform to ASTM A 36 and epoxy coated after fabrication. Dissimilar metal connections shall be insulated with gaskets as recommended by the screen manufacturer.
  - 3. Stainless steel bolting materials shall conform to ASTM A 193.

## 2.7 SPARE PARTS

- A. Spare parts shall be interchangeable with, and shall be made of the same material as, the corresponding part to be replaced. Provide the following spare parts:
  - 1. One (1) complete set of replacement brushes.

## 2.8 PRECAST CONCRETE BASE

- A. The precast concrete base shall meet the requirements of Section 03 45 33.

## 2.9 MANUFACTURERS

- A. **Intake Screens, Inc.**
- B. **Or approved equal**

## **PART 3 -- EXECUTION**

### 3.1 FABRICATION AND WORKMANSHIP

- A. Metalwork shall be free from wrap, twists, dents, buckle and other defects. Installation shall be neat, plumb, square, straight and in alignment. Provisions shall be made for expansion throughout to avoid damage. Surfaces shall be cleaned and left free from stains, marks, burrs, or other defects.
- B. Welding on the fish screen unit shall be in accordance with AWS D1.6 for stainless steel. Field welding and cutting operations shall be performed with tarps or shields to prevent slag or other debris from falling in the water.

### 3.2 QUALITY ASSURANCE

- A. Welding and welding operators shall be qualified in accordance with AWS D1.6 and D1.1 as appropriate. Procedure qualification tests shall be performed on samples of steel that matches the steel to be used in this section.

### 3.3 FIELD TESTING AND OPERATIONS AND MAINTENANCE MANUAL TESTING

- A. The screen manufacturer shall perform field testing and a demonstration of the cleaning system in the presence of the Engineer and Owner or Owner's Representative.

- END OF SECTION -

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## SECTION 22 05 00 – PLUMBING, GENERAL

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide plumbing piping and specialties, complete and operable, as indicated in accordance with the Contract Documents.

#### 1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.
- B. Shop Drawings
  - 1. General arrangement drawings of system components
  - 2. Catalog cuts and other manufacturer information for products
- C. Samples: electrically-fused test joint for drainage and vent piping

#### 1.3 WORKMANSHIP AND MATERIALS

- A. WORK shall in strict accordance with the International Building Code and codes of the State of Washington, Kittitas County, and any other authorities having jurisdiction.
- B. The CONTRACTOR shall have required certifications and shall be thoroughly familiar with the local codes.
- C. The CONTRACTOR shall obtain and pay for necessary permits.
- D. Protection
  - 1. Care shall be taken at all times to protect floors, stairways, and walls during the make-up and installation of piping and equipment.
  - 2. The CONTRACTOR shall remove stains and repair damage before final acceptance of the WORK.
- E. Identifying Marks
  - 1. If the ENGINEER finds materials that have identifying marks removed or lack such marks completely, such items will be rejected until the CONTRACTOR has furnished proof that said items conform to the Specifications.
  - 2. Adequacy and extent of such proof will be determined by the ENGINEER.

## PART 2 -- PRODUCTS

### 2.1 GENERAL

- A. Plumbing piping, fixtures, specialties, and equipment shall be as recommended by the manufacturer for the intended usage.
- B. Floor drains or floor sinks shall be provided for equipment drains.
- C. No equipment drains shall discharge to floor slabs.

### 2.2 PIPING AND FITTINGS

- A. Cast iron sanitary, storm, vent pipe, and fittings shall be manufactured in accordance with and shall meet the requirements of ASTM A74 – Cast Iron Soil Pipe and Fittings.
- B. Dimensions of cast iron soil pipe and fittings shall be as given in Table 2 of ASTM A74.
- C. Hub-less cast iron soil pipe and fittings with **Clamp-All** type pipe couplings, or equal, shall be used for above ground sanitary, storm, and vent piping where approved for use by local authorities.
- D. Hub-less cast iron soil pipe and fittings shall meet CISPI Standard 301.
- E. Pipe couplings shall have high-torque capacity and shall meet FM standard 1680.
- F. Copper tubing and fittings for potable and service water 3-inch and smaller shall be Type K copper tube with soldered fittings.
- G. Flashing
  - 1. Vent piping passing through the roof shall be flashed.
  - 2. Flashing shall extend a minimum 12 inches from the outer surface of the pipe in each direction.
  - 3. Flashing shall be fabricated from one piece of spun, heavy, 0.064 prime aluminum or 4-pound lead sheet.
- H. Laboratory Drains
  - 1. Drainage and vent piping from equipment in the laboratories shall be constructed from acid-resistant polypropylene.
  - 2. P-trap joints shall be screwed with a polypropylene compression ring wedge to form an acid-tight connection in accordance with the manufacturer's recommendations.
  - 3. Plain-end joints shall be electrically-fused slip-on fittings.
  - 4. Fusion Welding



- a. The fusion welding procedure shall be in accordance with the manufacturer's recommendations.
  - b. A test joint shall be prepared to demonstrate the fusion quality.
  - c. Submit the test joint prior to final installation of the piping system.
5. Where acid drains are located above an office space, provide a Type 316 stainless steel drip pan with a drain routed to a safe location designated by the ENGINEER.
  6. Drainage piping from sinks and equipment shall extend through deep-seal polypropylene traps and terminate at the main sanitary sewer.
  7. The piping shall follow local code requirements for combination waste and vent systems and for floor drains and sinks.
  8. The piping shall be constructed from flame-retardant polypropylene with mechanical joints, as manufactured by **Lab-Line/Enfield**, or equal.

## 2.3 INSULATION

- A. Hot and cold water piping, valves, fittings, and exposed horizontal sanitary, storm, and vent piping shall be provided with one-inch-thick insulation in accordance with the requirements of Section 22 07 00 – Plumbing Insulation.
- B. Coverings
  1. Cover valves, flanges, fittings, and ends-of-insulation with a pre-molded high- and low-temperature PVC fitting cover, end cap, or similar pre-formed unit.
  2. The pre-formed covers shall be sized to receive the same thickness of insulation as used in the adjacent piping and shall be in accordance with Section 22 07 00 – Plumbing Insulation.
- C. Exposed Piping
  1. Exposed supply and drain piping for lavatories shall be insulated under the wash basins in order to prevent burns and abrasions to handicapped persons.
  2. Removable insulated covers shall be **Plumberex Specialty Products Handy-Shield type**, or equal.

## 2.4 HANGERS, SUPPORTS, AND MISCELLANEOUS METAL WORK

- A. General
  1. For utility piping, such as cold water, hot water, compressed and vacuum air, and sanitary drain pipes located inside the building, the CONTRACTOR shall provide hangers and supports for vertical, axial, and seismic loads in accordance with the Code.
  2. No perforated strap hangers nor wire supports will be permitted.

3. Pipe supports shall be as indicated in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
- B. Hangers supporting insulated piping shall be sized to fit the pipe plus the insulation.
  - C. Insulation at support points shall be provided with metal shields in order to prevent damage to the insulation.
  - D. Spacing
    1. Pipe support spacing for steel and cast iron pipe shall be as indicated in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
    2. Copper tube support spacing shall be not more than 6 feet between supports.
  - E. Rod sizes for pipe hangers shall be as recommended by the hanger manufacturer.
  - F. Pipe hangers used to support uninsulated copper tube shall be constructed of copper or copper-plated.
  - G. Vertical piping shall be supported at the base with fittings made for this purpose or shall be supported from the nearest horizontal member or floor with a riser extension pipe clamp.
  - H. Inserts
    1. Anchors that are installed into existing concrete shall be **Grinnel Figure 117, Modern Figure 740**, or equal, expansion case inserts.
    2. Drill clean holes for the insertion of case and patch concrete around the hole, as required.
    3. Continuous-slotted concrete inserts, if used, shall be **Crawford Figure 148, Fee & Mason Figure 9000**, or equal.
    4. The CONTRACTOR shall provide secondary angle supports between main inserts in order to handle the loads which can be properly supported by such arrangement.
    5. Concrete inserts shall be as indicated in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
    6. Inserts shall be galvanized.

## 2.5 PIPE SLEEVES

- A. Sleeves shall be constructed from Schedule 40 galvanized steel pipe, one size larger than the pipe passing through, or where pipe is insulated, one size larger than the pipe plus insulation.
- B. At exposed wall or ceiling surfaces, install a suitable chromium plated brass wall plate approved by the ENGINEER.

## 2.6 VALVES

- A. Water shutoff valves shall be the gate type, except on fixture supply piping where globe valves shall be used.
- B. Hose Valves
  - 1. Interior hose valves shall be provided as indicated.
  - 2. The hose nipple shall be a female iron pipe thread inlet with hose thread outlet.
  - 3. Hose bibbs shall be 3/4-inch size.
- C. Gate, globe, check, plug, and angle valves shall be in accordance with the requirements of the following Sections:
  - 1. Section 43 25 00 – Valves, General
  - 2. Section 43 25 42 – Misc Valves
  - 3. Section 43 25 04 – Ball Valves
  - 4. Section 43 25 07 – Plug Valves
- D. Shut-Off Valves
  - 1. Provide shut-off valves on cold water piping at entrances to pipe chases and other inaccessible areas and wherever indicated or required to obtain the maximum efficiency for shut-off control on the water system.
  - 2. Shut-off valves shall be placed on hot and cold water connections to equipment and fixtures.
  - 3. Lavatory and sink stops with wheel handle shall be fabricated of brass with chrome plating.
  - 4. Extra long barrel stops shall be used where supply piping is concealed behind partitions.
  - 5. Show the locations of shut-off valves on the Shop Drawings.
- E. Valves shall open by turning counterclockwise, and shall be provided with suitable handwheels or nuts as required.
- F. Relief Valves
  - 1. Provide a temperature and pressure relief valve of bronze for each water heater.
  - 2. Provide pressure relief valves at other locations where indicated.
  - 3. Relief valves shall be equipped with manual test levers.

4. Provide piping to convey the relief valve discharge to the nearest floor drain, the building exterior, or elsewhere if approved by the ENGINEER.

## 2.7 ACCESS DOORS AND COVERS

- A. Access doors, where required in ceilings for access to valves, controls, and other equipment, shall be **Karp Associates, Style DSC-210, Inryco-Milcor, Style AT**, or equal.
- B. The doors shall be of sufficient size to allow access but shall be not less than 12-inch by 12-inch.
- C. Ceilings with lay-in acoustical tile do not require access panels.
- D. Valves and equipment located above ceiling tile shall have a 3/4-inch-diameter blue plastic button with a letter "V" set in the tile.
- E. Floor Covers
  1. Floor access covers in unfinished concrete floors not exposed to chemicals shall be constructed of galvanized cast iron with a clear opening of not less than 8-inch by 8-inch, and shall be **Alhambra Foundry Company, Model A-2015, Neenah Foundry Co., No. R-6687**, or equal.
  2. In traffic or chemical areas, access covers shall be **Alhambra Foundry Company, Model A-1240, Neenah Foundry Co., Model R-1977**, or equal, with a clear opening of not less than 10 inches in diameter.

## 2.8 ROOF DRAINS

- A. Roof drains shall be provided with galvanized cast iron drain bodies, a threaded outlet, removable locking mushroom aluminum or brass stone strainers, clamping collars with integral gravel guards, a receiver, a deck clamp, and extension sleeves where required.
- B. Manufacturers, or Equal
  1. **Josam Mfg. Co., Series 21500**
  2. **Jay R. Smith Mfg. Co., Fig. 1010**
  3. **Zurn Industries, Inc., Series Z-100**

## 2.9 FLOOR DRAINS IN TILED FLOORS

- A. Floor drains in shower rooms and other finished or tiled floors shall be provided with a 5-inch nickel-bronze strainer and cast iron body in the sizes indicated, and where located on upper floors provided with a clamping collar with 4-lb sheet lead flashing 12 inches minimum all around.
- B. Manufacturers, or Equal
  1. **Josam Mfg. Co.,**

2. **Jay R. Smith Mfg. Co.,**

3. **Zurn Industries, Inc.,**

#### 2.10 FLOOR DRAINS IN CONCRETE FLOORS

- A. Floor drains in concrete floors shall be constructed of cast iron, in the sizes indicated, and provided with sediment buckets.
- B. Each floor drain located on an upper floor shall have a clamping collar, with 4-lb sheet lead flashing 12 inches minimum all around.
- C. Where lead flashing does not comply with the Code, use epoxy waterproofing material and submit a Shop Drawing for review.
- D. Manufacturers, or Equal

1. **Josam Mfg. Co.,**

2. **Jay R. Smith Mfg. Co.,**

3. **Zurn Industries, Inc.,**

#### 2.11 FLOOR DRAINS IN CHEMICAL AREAS

- A. Floor drains in chemical handling areas subject to corrosive liquids shall be made of high-silicon-content corrosion-resistant cast iron with NO-HUB mechanical joints, in the sizes indicated.
- B. Thermoplastic floor drains are not acceptable.
- C. Manufacturer, or Equal

1. **Flowserve Corp., Model 5502-CB,** for slab-on-grade drains

2. **Flowserve Corp., Model 5501-CBF,** for drains on upper floors

#### 2.12 FLOOR SINKS

- A. Floor sinks shall be 12-inch by 12-inch by 8-inch, constructed of acid-resistant white enameled cast iron, with epoxy-coated interior aluminum dome strainer, nickel-bronze or acid-resistant full-size, half, or quarter grating as required by the number of indirect wastes, and shall be provided with a flashing clamp for upper floor locations only.
- B. Thermoplastic floor sinks are not acceptable.
- C. Manufacturers, or Equal

1. **Josam Mfg. Co., Series 49040**

2. **Jay R. Smith Mfg. Co., 3150 Series**

2.13 TRAP SEALS AND PRIMERS

- A. Where required by the Code, floor drains and floor sinks connected to the sanitary sewer shall be protected by trap primers connected to the water supply at the nearest plumbing fixture.
- B. Run 1/2-inch copper tubes from the primers to the traps.
- C. Trap primers shall be mounted in accessible locations.
- D. Manufacturers, or Equal
  - 1. **Josam Mfg. Co., Model 88250**
  - 2. **Jay R. Smith Mfg. Co., Model 2699**
  - 3. **Zurn Industries, Inc., Model Z-1022**

2.14 CLEANOUTS

- A. Cleanouts shall be heavy plugs with tapered shoulders against caulked lead or heavy brass plugs.
- B. Where underground or concealed, cleanouts shall be brought to floor level and to accessible locations with access covers and frames.
- C. Manufacturers, or Equal

Service	Josam Series	J.R. Smith No.	Zurn No.
Exposed Locations	<b>58500-20</b>	<b>4405</b>	<b>Z-1440-A</b>
Underground (finished floors)	<b>56010/30</b>	<b>4143</b>	<b>ZN-1400-2</b>
Walls, Concealed	<b>58790-20</b>	<b>4535</b>	<b>ZN-1445-1-A</b>
Traffic Areas	<b>56070</b>	<b>4240</b>	<b>Z-1420-27</b>

- D. Cleanouts shall have a minimum diameter of 3 inches.
- E. Stack cleanouts shall be installed at the base of each stack.
- F. Cleanouts shall be fabricated from galvanized cast iron with ABS plastic cleanout plugs.

2.15 HOSE BIBBS AND HYDRANTS

- A. Hose bibbs and hydrants in exposed locations subject to freezing shall be the non-freeze type.

- B. Hose bibbs connected to a non-potable water supply shall be provided with plastic or stainless steel warning signs reading "DO NOT DRINK" in clearly legible letters, permanently attached at the hose bibb.
- C. Hose bibbs shall be provided with vacuum breakers as furnished by **Crane Co., American Standard**, or equal.
- D. Manufacturers, or Equal

Drawing Callout	Fixture Type	Description
HB-1	Indoor Hose Bibb	
HB-2	Non-Freeze Hydrant, Wall-Type	Heavy duty bronze hydrant with nickel-bronze face, hinged cover, recessed box, and key. Length to suit wall. 1. <b>Jay R. Smith Mfg. Co., Fig. 5509</b> 2. <b>Josam Mfg. Co.,</b> 3. <b>Zurn Industries, Inc.,</b>
HB-3	Hose Hydrants	Heavy duty bronze hydrant, with composition disc, handwheel, cap and chain. Sizes 1-1/2 inch and 2-1/2 inch: 1. <b>Fire-End and Croker Corp, Model 180</b> 1. <b>Apollo (Conbraco Industries, Inc.) Model 70-805</b> 2. <b>Fire-End and Croker Corp, Model 180</b>
HB-3	Non-Freeze Hydrant, Post-Type	Exposed bronze hydrant, post-type, depth of bury to suit local conditions; minimum 4-feet. <b>Woodford Manufacturing Co., Model Iowa Y1</b>
HB-4	Wall Hydrant, Box-Type	Recessed, with nickel-bronze box, hinged cover, and key. 1. <b>Jay R. Smith Mfg. Co., Series 5709</b> 2. <b>Josam Mfg. Co.,</b> 3. <b>Zurn Industries,</b>

## 2.16 SHOCK ABSORBERS

- A. Building cold and hot water piping that is connecting self-closing faucets, quick-action valves, water closets, emergency showers, washers, and dishwashers, shall be protected by shock absorbers located at each fixture or battery of fixtures.
- B. Shock absorbers shall be corrosion-resistant, permanently sealed, and shall be sized and installed to the manufacturer's printed recommendations.
- C. Manufacturers, or Equal
  - 1. **Josam "SHOKTROLS"**
  - 2. **Jay R. Smith "HYDROTROL"**
  - 3. **Zurn, Model Z-1022**

## 2.17 WALL-MOUNTED HOSE RACKS

- A. The CONTRACTOR shall provide wall-mounted hose racks at the indicated locations.
- B. Racks shall be of welded steel construction, minimum 8-gauge sheet steel, hot-dip galvanized after fabrication, and shall have a capacity to hold 100 feet of the indicated hose.
- C. Racks located in the open shall be supported from two 2-by-2-by-1/4-inch galvanized steel angle posts set in a concrete base or as indicated.

## 2.18 HOSES AND NOZZLES

- A. The CONTRACTOR shall furnish the following lengths of hose:
  - 1. Provide 5 each 75-ft lengths of 3/4-inch hose.
- B. Each length of hose shall be provided with male and female connectors and a nozzle.
- C. Hoses shall be fabricated from seamless extruded rubber with a dacron cotton exterior designed for a working pressure of at least 200 psig.
- D. Nozzles
  - 1. Nozzles shall be capable of complete shut-off and shall produce a solid straight stream and up to a 90-degree conical fog.
  - 2. Nozzle material shall be polished brass.
  - 3. Nozzles shall be provided with rubber bumpers.
- E. Nozzle Manufacturers, or Equal
  - 1. **W.D. Allen Mfg. Co.**



2. **Fire-End and Croker Corp.**
3. **Halprin Supply Co.**
4. **Western Fire Equipment Co.**

#### 2.19 HIGH IMPACT SPRAY NOZZLES

- A. Provide 3/4-inch high-impact jet spray nozzles, with a flat 65-degree spray angle and male thread connections.
- B. The capacity of the nozzle shall be 20 gpm at 40 psi head, and its material shall be Type 316 stainless steel.
- C. The nozzles shall be **Veejet-Spray Nozzles, Model HU-3/4-316SS-8040**, or equal.

#### 2.20 BACKFLOW PREVENTER

1. Provide reduced pressure backflow prevention units where indicated.
2. The units shall be of bronze body construction, with celcon check seats and stainless steel relief valve seats, shafts, and bolts.
3. The units shall be provided with tight-seating check valve and relief assemblies, and bronze bodies with non-rising stem ball valve test cocks.
4. The units shall be **Watts Regulator Co., No. 909 Series**, or equal.
5. Installation shall meet local code requirements.
6. Backflow preventers for automatic sprinkler systems shall be in accordance with the requirements of Section 43 25 42 – Miscellaneous Valves.

#### 2.21 PAINTING

- A. Ferrous metal, except finished, galvanized, and machined surfaces, shall have surfaces prepared and primed in the shop in accordance with the requirements of Section 09 96 00 – Protective Coating.
- B. Prime colors shall be compatible with finish coats that are applied in the field.
- C. Self-contained units such as wall-mounted hose racks shall be supplied with factory-applied finish coats of baked enamel.
- D. Field painting shall comply with the requirements of Section 09 96 00 – Protective Coating.

## **PART 3 -- EXECUTION**

### **3.1 PREPARATION**

- A. The CONTRACTOR shall coordinate the roughing-in process with provisions for wall and floor sleeves, pipe inserts, and cutting of roof and floor penetrations, such that drain lines will have the required invert elevations and slopes.

### **3.2 OPENINGS**

#### **A. New Construction**

- 1. The CONTRACTOR shall provide necessary openings in walls, floors, and roofs for the passage of piping and plumbing equipment within and into the building.
- 2. Openings shall be as indicated or as required to provide passage for the plumbing WORK.

#### **B. Existing Construction**

- 1. The CONTRACTOR shall provide openings required in existing walls, floors, and roofs for the passage of piping and plumbing equipment.
- 2. Openings shall be as indicated or required for passage.
- 3. Openings shall be cut in a neat and orderly manner, minimizing damage to existing structures.
- 4. Patching of openings shall match existing construction.
- 5. The CONTRACTOR shall be responsible for hangers and supporting members installed in existing masonry or structural steel as required for the proper completion of the WORK.

### **3.3 INSTALLATION AND APPLICATION**

- A. The CONTRACTOR shall provide plumbing specialties in accordance with manufacturer's printed instructions.
- B. Pipe shall be arranged in a neat and orderly manner to occupy the minimum amount of space and so that the pipe will not obstruct passageways and movement of building occupants or interfere with normal operation and maintenance of any equipment.
- C. Pipe shall be carefully placed and properly sloped and shall be neatly and firmly supported by hangers or supports.
- D. Piping in buildings shall be as close to the ceilings or walls as possible unless indicated otherwise.
- E. Joints
  - 1. Screwed joints shall be made with joint compound and be tight and leakproof.

2. A sufficient number of brass-to-ferrous metal seat unions shall be placed in lines such that any pipe, valve, or piece of equipment may be easily disconnected.

F. Drainage and Sanitary Lines

1. Drainage and sanitary lines shall be properly run, trapped, and vented in order to conform to Code requirements.
2. Changes in direction shall be made with "Y" branch fittings and shall be of the same size as the pipe.
3. Changes in pipe size shall be made with reducing fittings.
4. The minimum depth of cover shall be 3 feet.

G. Horizontal soil, drain, and waste pipes shall be provided with a slope of at least 1/4 inch per foot, unless indicated otherwise.

H. Floor drains and cleanouts shall be installed such that the tops of the drains are flush with the finished floor.

I. Plug each natural gas outlet, including valves, with a threaded plug or cap immediately after installation, and retain the plugs until continuing piping or equipment connections are completed.

J. Joints in PE pipe shall be installed such that the longitudinal pull out resistance of each joint is at least equal to the tensile strength of the pipe

3.4 EQUIPMENT DAMAGE AND REMOVAL

A. The CONTRACTOR's operations shall be carried out in such a manner as to guard against damage to those portions of the structure and equipment that are to remain in the finished WORK.

B. Any damage caused by the CONTRACTOR or Subcontractor through their operations shall be repaired to the satisfaction of the ENGINEER.

3.5 TESTING

A. The CONTRACTOR shall perform such tests as are required by local ordinances and Codes in the presence of a local governing authority inspector to show that piping is tight, leak-free, and otherwise satisfactory, and shall also perform such tests as the ENGINEER may direct to insure that fixtures and equipment operate properly.

B. The CONTRACTOR shall pay the costs to perform such tests and the costs of making changes or repairs until the WORK is acceptable to the governing authorities.

3.6 DISINFECTION

A. After potable water supply lines are successfully tested, they shall be disinfected by introducing an HTH solution, liquid chlorine, or chlorine solution of sufficient strength.

- B. The line shall then be filled with water and maintained under not less than 10 psig pressure, for not less than 48 hours, during which period each valve on the line shall be opened and closed several times, after which it shall be flushed clean and then tested by the OWNER.
- C. This procedure shall be repeated as often as necessary until the line is pronounced safe for use by the OWNER.
- D. No cross-connection between the water main and any pipe not yet disinfected will be permitted.

- END OF SECTION -

## SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING AND PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

**A. This Section includes the following:**

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Equipment supports.

- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

#### 1.2 DEFINITIONS

- A. **Terminology:** As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

#### 1.4 SUBMITTALS

**A. Product Data for the following:**

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.

2. Metal framing systems. Include Product Data for components.
  3. Equipment supports.
- C. Welding certificates.
- 1.5 QUALITY ASSURANCE
- A. **Welding:** Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. **Description:** MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

**B. Manufacturers:**

1. Bergen-Power Pipe Supports.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. Carpenter & Paterson, Inc.
4. Empire Industries, Inc.
5. ERICO/Michigan Hanger Co.
6. Globe Pipe Hanger Products, Inc.
7. Grinnell Corp.
8. GS Metals Corp.
9. National Pipe Hanger Corporation.
10. Tolco Inc.

- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. **Description:** MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. **Description:** MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

#### **B. Manufacturers:**

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

- C. **Coatings:** Manufacturer's standard finish, unless bare metal surfaces are indicated.

- D. **Nonmetallic Coatings:** Plastic coating, jacket, or liner.

### 2.5 THERMAL-HANGER SHIELD INSERTS

- A. **Description:** 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

#### **B. Manufacturers:**

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. Pipe Shields, Inc.
4. Rilco Manufacturing Company, Inc.

- C. **Insulation-Insert Material for Cold Piping:** Water-repellent treated, ASTM C533, Type I calcium silicate with vapor barrier.
- D. **Insulation-Insert Material for Hot Piping:** Water-repellent treated, ASTM C533, Type I calcium silicate.
- E. **For Trapeze or Clamped Systems:** Insert and shield shall cover entire circumference of pipe.
- F. **For Clevis or Band Hangers:** Insert and shield shall cover lower 180 degrees of pipe.
- G. **Insert Length:** Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 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.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Masterset Fastening Systems, Inc.
    - d. MKT Fastening, LLC.
    - e. Powers Fasteners.
- B. **Mechanical-Expansion Anchors:** Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.



## 2.7 EQUIPMENT SUPPORTS

- A. **Description:** Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. **Structural Steel:** ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
- B. **Grout:** ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- G. **Vertical-Piping Clamps:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. **Hanger-Rod Attachments:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. **Building Attachments:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.
    - b. Medium (MSS Type 32): 1500 lb.

- c. Heavy (MSS Type 33): 3000 lb.
- 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.
- J. **Saddles and Shields:** Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. **Steel Pipe Hanger Installation:** Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. **Trapeze Pipe Hanger Installation:** Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A36/A36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. **Metal Framing System Installation:** Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. **Thermal-Hanger Shield Installation:** Install in pipe hanger or shield for insulated piping.
- E. **Fastener System Installation:**

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. **Equipment Support Installation:** Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. **Load Distribution:** Install hangers and supports so 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 so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. **Insulated Piping:** Comply with the following:
1. Attach clamps and spacers to piping.
    - a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - b. NPS 4: 12 inches long and 0.06 inch thick.
  - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Insert Material: Length at least as long as protective shield.
  6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. **Grouting:** Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. **Field Welding:** Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. **Hanger Adjustments:** Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.6 PAINTING

- A. **Touch Up:** Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. **Galvanized Surfaces:** Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

- END OF SECTION -

## SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. **This Section includes the following:**

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.

B. Mechanical systems shall include the following items to the extent required on plans or in other sections of these specifications.

1. All piping systems inside the building.
2. All piping systems exterior to the building.
3. All equipment associated with the above systems.

#### 1.2 PERFORMANCE REQUIREMENTS

A. **Seismic-Restraint Loading:**

1. Site Class as Defined in the IBC: D.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: II.
  - a. Component Importance Factor: **1.0**.
  - b. Component Response Modification Factor: **2.5**.
  - c. Component Amplification Factor: **See ASCE 7-05 for applicable system requirements.**

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): **See ASCE 7-05 for applicable system requirements.**
4. Design Spectral Response Acceleration at 1-Second Period: **See ASCE 7-05 for applicable system requirements.**

### 1.3 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. The isolator manufacturer shall furnish submittals indicating capacities and sizes of isolators and bases for isolated equipment. Data shall include outside diameter and heights (free, operating, solid) of springs; free and operating heights of neoprene and fiberglass isolators; and loads on each isolator. Calculations and selection data shall include structural consideration, such as floor span, slab on grade, etc.
- D. All calculations and selection shall be based on the actual equipment to be installed whether the equipment is as specified or is a substitute item.
- E. Provide a schedule of equipment being supported listing the specific isolation device proposed for approval. Include the approved schedule with the Operation and Maintenance Manual.
- F. Welding certificates.
- G. **Qualification Data:** For professional engineer.
- H. Field quality-control test reports.

### 1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC and ASCE 7-05 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, preapproved by ICC-ES, or preapproved 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.



- D. The Contractor shall coordinate with the supplier of vibration isolation equipment to ensure isolators are sized for the actual equipment supplied.
- E. The supplier of equipment specified in this Section shall coordinate with all trades to identify the locations of all required isolation devices.

## **PART 2 - PRODUCTS**

### **2.1 VIBRATION ISOLATION PRODUCTS**

- 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. Kindorf.
- 2. Grinnell.
- 3. Elcen.
- 4. Unistrut.
- 5. Kinetics Noise Control.
- 6. Mason Industries.
- 7. Vibration Eliminator Co., Inc.
- 8. Amber Booth

- B. **SUPPORTS**

- 1. Equipment isolator pads shall be Mason type W neoprene waffle pad. Provide an appropriate durometer or equal (hardness) for a recommended loading of 40 to 60 psi. Provide pad with steel backing plate or other options as required for the application.
- 2. Neoprene isolators shall be Mason model ND or equal and shall incorporate completely enclosed metal inserts to permit bolting to the supported unit.
- 3. Spring isolators shall be Mason model SLF or equal. Units to be freestanding, unhoused, laterally stable spring mounts, incorporating leveling bolts and 1/4" thick noise isolation pads. The outside spring diameter shall be equal to or greater than 80% of the designed spring operating height, and the horizontal stiffness shall be at least 80% of the vertical stiffness. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

- C. **HANGERS**

- 1. Equipment hanger isolators shall be combination series elastomer spring type, Mason Industries model 30N or equal. Elastomer element shall provide an isolation bushing for the hanger rod. Units shall have stamped or welded housings with a

lower hole large enough to allow 30° movement of the lower rod before contacting the housing. Springs shall be laterally stable and shall have a minimum additional travel to solid equal to 50% of the rated deflection. Elastomer element shall be rated for a minimum of .25" deflection.

2. Hanger isolators for equipment under 75 lbs. shall be Mason Model HD or equal.
3. Isolated ceiling hangers shall include welded steel assemblies designed to be incorporated into the isolated ceiling suspension system specified for this project. Hanger assembly brackets shall be designed to allow a 15 degrees off vertical alignment of ht suspension member without making metal-to-metal contact between suspension and hanger assembly members. Isolation hanger load capacities shall be selected by the manufacturer to provide a minimum vertical static deflection of the steel spring element of 1.0 inch and maintain an additional deflection to solid of 0.5 inch. Hanger assemblies shall include a method by which the installing contractor can preload the steel spring element to restrict additional vertical deflection of the steel spring to 1/4" on installation of finish ceiling materials.

## 2.2 SEISMIC PRODUCTS

### A. CABLE SUPPORT ASSEMBLIES

1. Cables and Cable End Connections:
  - a. Manufacturers
    - 1) Kindorf.
    - 2) Grinnell.
    - 3) Elcen.
    - 4) Unistrut.
    - 5) Kinetics Noise Control.
    - 6) Mason Industries.
    - 7) Vibration Eliminator Co., Inc.
    - 8) Amber Booth
  - b. Steel cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide an all directional restraint.
  - c. Cable end connections shall be steel assemblies that swivel to final installation angle. Cable end connections shall utilize two clamping bolts to provide proper angle engagements.
2. Rod Clamps:
  - a. Manufacturers

- 1) Kindorf.
- 2) Grinnell.
- 3) Elcen.
- 4) Unistrut.
- 5) Kinetics Noise Control.
- 6) Mason Industries.
- 7) Vibration Eliminator Co., Inc.
- 8) Amber Booth

b. Clamps designed to secure steel angles to rods.

#### B. PIPE SUPPORT ASSEMBLIES

1. Manufacturer:
  - a. B-Line
2. Pre-engineering piping seismic restraint system designed to resist seismic loading in any direction.
3. Certified and signed by registered professional structural engineer that details are in accordance with the requirements of the International Building Code for the listed seismic criteria.
4. System shall be a complete seismic system and shall include:
  - a. Installation details and devices for vertical, transverse and longitudinal bracing.
  - b. Attachment details to structure complete with bolt types and sizes.

#### C. WATER HEATER RESTRAINTS

1. Manufacturers:
  - a. Holdrite BS Series
  - b. Amber Booth
  - c. Engineer approved equal
2. Heavy gauge steel bands for support of water heater to resist horizontal displacement due to earthquake motion in listed seismic zone in accordance with International Building Code.
3. Designed for 50, 75 or 120 gallon water heater.

4. California State Architect Approved.

## **PART 3 - EXECUTION**

### 3.1 APPLICATIONS

- A. **Multiple Pipe Supports:** Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

### 3.2 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.

### 3.3 SEISMIC PROVISION SPECIFIC

#### 1. General:

- a. All in-line equipment shall be braced independently of pipe or ducts.
- b. Welding shall conform to AWS D1.1 and shall use either shielded or submerged arc methods.
- c. When conduit is to be installed, it shall be braced the same as the equivalent weight pipe.
- d. Use either cable or solid bracing for all situations. Do not mix bracing types in the same direction.
- e. Bolt holes shall be 1/8 inch larger than the bolt diameter unless otherwise noted.

#### 2. Piping System

- a. Support and brace piping as specified herein.
- 1) At the Contractor's option, a pre-engineered support system specified in this section may be utilized. Support and brace piping system in complete accordance with the manufacturer's recommendations.
- b. Brace all pipes 2-1/2 inch and larger.
- 1) Exceptions:
- a) Brace all fuel oil, gas piping (including fuel gases, medical gases and compressed air) 1 inch ID and larger.

- b) Brace all piping in boiler and mechanical equipment rooms 1-1/4" ID and larger.
- c) Bracing is not required for piping suspended from individual hangers 12 inches or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached and where the hanger provides a non-moment generating (swivel) connection to the structure.
- c. Details indicated provide lateral bracing system. A typical vertical support system must also be used. However, where brace occurs, the vertical angle shown may replace a typical vertical support.
- d. Transverse bracings at 40 feet on center maximum.
  - 1) Except gas piping shall be at 20 feet.
  - 2) Except where lesser spacing is indicated in the tables.
- e. Longitudinal bracings at 80 feet on center maximum.
  - 1) Except gas piping shall be at forty feet.
  - 2) Except where lesser spacing is indicated in the tables.
- f. Transverse bracing from one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24 inches (610 mm) of the elbow or tee and similar size.
- g. Do not use branch lines to brace main lines.
- h. Provide oversized pipe sleeves through walls or floors to allow for anticipated differential movements.
- i. Provide flexibility in joints where pipes pass through building seismic or expansion joints, or where rigidly supported pipes connect to equipment with vibration isolators.
  - 1) For threaded piping, the flexibility may be provided by the installation of swing joints.
  - 2) For piping with manufactured ball joints, select the length of piping offset using Seismic Drift in place of the expansion given in the joint manufacturer's selection table. Seismic Drift = 0.015 feet per foot of height above the base where seismic separation occurs.
- j. At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 30 feet (9.1 m) on center.

- k. Do not fasten one rigid piping system to two dissimilar parts of a building that may respond in a different mode during an earthquake; for example, a wall and a roof.
- l. Piping grouped for support on trapeze-type hangers shall be brazed at the same intervals as determined by the smallest diameter pipe of the group. Hanger rods shall be increased in cross-sectional area proportionate to the increased weight per linear foot of pipe and contents supported at each trapeze hanger. No trapeze-type hanger shall be secured with less than two ½ inch (12.7 mm) bolts.
- m. Bracing rigidly attached to pipe flanges, or similar, shall not be used where it would interfere with thermal expansion of piping.
- n. Spreaders shall be provided between racked or adjacent piping runs to prevent contact during seismic activity whenever pipe or insulated pipe surfaces are less than 4 inches (102 mm) or four times the maximum displacement due to seismic force. Spreaders to be applied at same interval as sway braces. Spreaders shall be applied to surface of bare or insulated hot pipe and over insulation utilizing high-density inserts and pipe protection shields where vapor-barrier-type insulation is employed.
- o. Flexible Couplings or Joints:
  - 1) Flexible couplings or joints in building piping shall be provided at bottom of all pipe risers 3-1/2 inches size and larger. Cast-iron waste and vent piping need only comply with these provisions when caulked joints are used. Flexible bell and spigot pipe joints using rubber gaskets or no-hub fittings may be used at each branch adjacent to tees and elbows for underground waste piping inside of building to comply with these requirements.
  - 2) All underground piping except heat distribution system, shall have flexible couplings installed adjacent to building as shown. Additional flexible couplings shall be provided as follows:
    - a) On each side of the joints of demarcation between soils having widely differing degrees of consolidation.
    - b) At all points that can be considered to act as anchors.
    - c) On every branch of a tee and each side of an elbow.

- END OF SECTION -

## SECTION 22 07 00 - PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Insulation Materials:
  - a. Cellular glass
  - b. Flexible elastomeric.
  - c. Mineral fiber.
  - d. Polyolefin.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Field-applied fabric-reinforcing mesh.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

#### 1.2 SUBMITTALS

A. **Product Data:** For each type of product indicated.

##### B. Shop Drawings:

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, flanges, valves, and specialties for each type of insulation.
3. Detail removable insulation at piping specialties, equipment connections, and access panels.

- C. Field quality-control reports.

### 1.3 QUALITY ASSURANCE

- A. **Fire-Test-Response Characteristics:** Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E84, 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 and inspecting 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.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. **Cellular Glass:** Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cell-U-Foam Corporation; Ultra-CUF
    - b. Pittsburgh Corning Corporation; FOAMGLAS Super K
    - c. Owens-Corning
    - d. Armstrong
    - e. Johns-Manville
    - f. Knauf



- g. CertainTeed
  - 2. Block Insulation: ASTM C552, Type I.
  - 3. Special-Shaped Insulation: ASTM C552, Type III.
  - 4. Board Insulation: ASTM C552, Type IV.
  - 5. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
  - 6. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C552, Type II, Class 2.
  - 7. Factory fabricate shapes according to ASTM C450 and ASTM C585.
- G. **Flexible Elastomeric:** Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials and Type II for sheet materials.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- H. **Mineral-Fiber, Preformed Pipe Insulation:**
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- I. **Mineral-Fiber, Pipe and Tank Insulation:** Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100

deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. CertainTeed Corp.; CrimpWrap.
  - b. Johns Manville; Micro-Flex.
  - c. Knauf Insulation; Pipe and Tank Insulation.
  - d. Manson Insulation Inc.; AK Flex.
  - e. Owens Corning; Fiberglas Pipe and Tank Insulation.
- J. **Polyolefin:** Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534 or ASTM C1427, Type I, Grade 1 for tubular materials and Type II, Grade 1 for sheet materials.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armacell LLC; Tubolit.
    - b. Nomaco Inc.; IMCOLOCK, IMCOSHEET, NOMALOCK, and NOMAPLY.
    - c. RBX Corporation; Therma-cell.

## 2.2 INSULATING CEMENTS

- A. **Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement:** Comply with ASTM C449/C449M.
  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. Insulco, Division of MFS, Inc.; Smooth Kote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. **Cellular-Glass Polystyrene Adhesive:** Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  1. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Products, Division of ITW; CP-96 CHIL-RENE.
  - b. Foster Products Corporation, H.B. Fuller Company; 81-33.
- C. **Flexible Elastomeric and Polyolefin Adhesive:** Comply with MIL-A-24179A, Type II, Class I.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Aeroflex USA Inc.; Aero seal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H.B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
- D. **Mineral-Fiber Adhesive:** Comply with MIL-A-3316C, Class 2, Grade A.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H.B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- E. **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 one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H.B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- F. **PVC Jacket Adhesive:** Compatible with PVC jacket.
- 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Chemical Company (The); 739, Dow Silicone.
- b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
- c. P.I.C. Plastics, Inc.; Welding Adhesive.
- d. Red Devil, Inc.; Celulon Ultra Clear.
- e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. **Vapor-Barrier Mastic:** Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H.B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D1644, 59 percent by volume and 71 percent by weight.
  - 5. Color: White.
- C. **Breather Mastic:** Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Products, Division of ITW; CP-10.
    - b. Foster Products Corporation, H.B. Fuller Company; 35-00.

- c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
  - d. Marathon Industries, Inc.; 550.
  - e. Mon-Eco Industries, Inc.; 55-50.
  - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F1249, 3 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.5 SEALANTS

### A. **Joint Sealants:**

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Products, Division of ITW; CP-76.
  - b. Foster Products Corporation, H.B. Fuller Company; 30-45.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
  - f. Vimasco Corporation; 750.
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.

### B. **Color:** White. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H.B. Fuller Company; 95-44.

- c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: Aluminum.

**C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:**

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

**2.6 FACTORY-APPLIED JACKETS**

**A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:**

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E84.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E84.
  - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
6. 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, available products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

## 2.7 TAPES

- A. **ASJ Tape:** White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0838.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. **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. Compac Corp.; 130.
  - b. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
  - 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. **PVDC Tape:** White vapor-retarder PVDC tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
2. Width: 3 inches.
3. Film Thickness: 4 mils.
4. Adhesive Thickness: 1.5 mils.
5. Elongation at Break: 145 percent.
6. Tensile Strength: 55 lbf/inch in width.

## 2.8 CORNER ANGLES

- A. **PVC Corner Angles:** 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. **Aluminum Corner Angles:** 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.



## **PART 3 - EXECUTION**

### **3.1 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.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. **Install insulation with factory-applied jackets as follows:**
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap.
  4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. **For above ambient services, do not install insulation to the following:**
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.3 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- C. **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."

### 3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. **Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:**
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a

removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. **Install removable insulation covers at locations indicated. Installation shall conform to the following:**
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.5 CELLULAR-GLASS INSULATION INSTALLATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

### 3.6 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**B. Insulation Installation on Pipe Flanges:**

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 MINERAL-FIBER INSULATION INSTALLATION

**A. Insulation Installation on Straight Pipes and Tubes:**

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

**B. Insulation Installation on Pipe Flanges:**

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

**C. Insulation Installation on Pipe Fittings and Elbows:**

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

**D. Insulation Installation on Valves and Pipe Specialties:**

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

**3.8 POLYOLEFIN INSULATION INSTALLATION**

**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.

**3.9 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 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.



### 3.10 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.

### 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. **Domestic Hot and Recirculated Hot Water: Insulation shall be a minimum thickness of one of the following:**
  - 1. Owens-Corning Fiberglass 25 ASJ/SSL
    - a. ½" thick for pipe size 1-1/4" and under and 1" thick for 1-1/2" pipe size and above.
  - 2. Flexible Elastomeric
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 3. Mineral-Fiber, Preformed Pipe Insulation, Type I
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 4. Polyolefin
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
- B. **Domestic Chilled Water (Potable):** Insulation shall be one of the following:
  - 1. Owens-Corning Fiberglass 25 ASJ/SSL ½" thick for pipe sizes 2" and under and 1" thick for pipe sizes 2-1/2" to 4".
  - 2. Flexible Elastomeric
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 3. Mineral-Fiber, Preformed Pipe Insulation, Type I

- a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 4. Polyolefin
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
- C. **Roof Drain and Overflow Drain Bodies:** Insulation shall be one of the following:
- 1. Owens-Corning Fiberglass 25 ASJ/SSL 1" thick for pipe sizes 2" to 4".
  - 2. Flexible Elastomeric
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 3. Mineral-Fiber, Preformed Pipe Insulation, Type I
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
  - 4. Polyolefin
    - a. Thickness as required to meet or exceed thermal and mechanical protection as listed above.
- D. **Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:** Insulation shall be:
- 1. Similar and equal to HandiLav-guard insulation kits as manufactured by Truebro, Inc. Color shall be white.

- END OF SECTION -

## SECTION 22 10 00 - PLUMBING EQUIPMENT

### PART 1 -- GENERAL

#### 1.1 SUMMARY

- A. The CONTRACTOR shall provide electric water heaters, circulating pumps tempering tank, emergency showers and other plumbing equipment as indicated, complete with water and electric connections and hook-ups, for a complete and operable installation as indicated in accordance with the requirements of the Contract Documents.

#### 1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 00 – Contractor Submittals.
- B. O&M Data
  - 1. Submittals shall include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

### PART 2 -- PRODUCTS

#### 2.1 GENERAL

- A. Plumbing piping, fixtures, specialties, equipment, and appurtenances shall be new, first-quality products manufactured for the intended usage.
- B. Materials, capacities, features, finishes, and manufacturers shall be as indicated and shall be compatible with elements of the WORK to which they relate or connect.

#### 2.2 INSTANTANEOUS ELECTRIC WATER HEATER

- A. Provide an electric instantaneous water heater of the size and capacity as indicated.
- B. Control
  - 1. The unit shall be microprocessor controlled.
  - 2. When a hot water tap is opened, the cold water entering the heater shall pass over a thermostat, turning on an electrical heat coil that shall heat the water up to 125 degrees F.
  - 3. As the mixture of hot and cold water is adjusted, other converting thermostats shall recalculate the flow of energy sequentially adding or subtracting energy to maintain a constant temperature.
  - 4. When the hot water is turned off, the flow of energy shall turn off as well.
- C. The heater shall be UL-listed, and shall be guaranteed for life against leakage and rupture.

## 2.3 INSTANTANEOUS ELECTRIC WATER HEATER FOR EMERGENCY SHOWERS AND EYE WASH

- A. Provide an electric instantaneous water heater of the size and capacity as indicated.
- B. The heater shall minimize temperature fluctuation from normal flows as high as 20 GPM with instantaneous drops to as low as 2.5 GPM with minimal overshoot to aid in the transition between emergency shower use to the use of an eyewash station.
- C. The hot water shall ensure temperatures never exceed “tepid” ANSI standards, and shall operate without the necessity of tempering valves and scald guards.
- D. Control
  - 1. The unit shall be microprocessor controlled.
  - 2. When an emergency shower or eye wash is activated, the cold water entering the heater shall pass over a thermostat, turning on an electrical heat coil that shall heat the water up to 125 degrees F.
  - 3. As the mixture of hot and cold water is adjusted, other converting thermostats shall recalculate the flow of energy sequentially adding or subtracting energy to maintain a constant temperature.
  - 4. When the hot water is turned off, the flow of energy shall turn off as well.
- E. The heater shall be UL-listed, and shall be guaranteed for life against leakage and rupture.
- F. Instantaneous electric waters shall be provided with the following features:
  - 1. precise digital temperature control to ensure safe operation within the ANSI standards
  - 2. internal safety features
  - 3. anti-scald protection
  - 4. thermal overheat protection
  - 5. flow activation
  - 6. internal fusing
  - 7. Incoloy heating elements
  - 8. bimetal overheat protection
  - 9. NEMA-4 enclosure
  - 10. external emergency stop button

11. solid-state relays
12. internal finger-safe fusing
13. dual PID control with digital display of set-point and actual temperature
14. copper/brass construction for increased heat exchanger life

G. Manufacturers, or Equal

1. Option 1: Safety Shower and Eyewash: **KELTECH INCORPORATED, Model SN 36KW.**
2. Option 2: Eyewash only: **KELTECH INCORPORATED, Model CLE 18KW.**

2.4 EMERGENCY SHOWER WATER TEMPERING TANK

- A. The tempering tanks for the emergency shower and eyewash shall be provided complete with:
1. minimum 2-inch inlet and outlet connections;
  2. minimum one-inch relief valve opening with relief valve;
  3. minimum 3/4-inch drain opening with valve;
  4. minimum one inch of insulation; and
  5. galvanized jacket finished in acrylic enamel.
- B. Tank interior shall be glass lined, with an alkaline borosilicate composition which has been fused to the steel base by firing at a temperature of 1600 degrees F.
- C. Glass coating shall be continuous over the entire inner surface of the tank.
- D. Cathodic protection shall be provided.
- E. Tank
1. The tank shall have a working pressure of 150 psig.
  2. Furnish a 5-year limited warranty, Manufacturers, or Equal
  3. **Lochinvar, Model No. LTVS5G0080-RJ;**
  4. **A.O. Smith;**
  5. **State Industries, Inc.;** or,
  6. Equal

## 2.5 EMERGENCY SHOWER THERMOSTATIC MIXING VALVE

### A. General

1. Provide a thermostatic mixing valve to mix hot and cold water to supply tempered water.
2. Mixing valve shall supply tempered water to one or more emergency drench showers and eyewash fixtures, and shall be capable of supplying a flow rate up to 40 GPM.

### B. The thermostatic mixing valve shall meet the following requirements:

1. Provide 2 separate thermostatic mixing elements and 3 outlet temperature gauges.
2. The mixing valve shall be constructed of bronze, brass, copper and stainless steel.
3. Tempered Water
  - a. Twin thermostatic mixing elements shall respond independently to changes in incoming hot and cold water temperatures in order to maintain outlet temperatures to within plus or minus 5 degrees F.
  - b. Varying conditions can cause a maximum change in hot water or cold water temperatures of 30 degrees F, and a 50 percent drop in inlet supply pressure.
  - c. Hot and cold inlet pressures shall be equal.
  - d. The outlet temperature factory setting shall be 80 degrees F.
4. Fail-Safe Backup
  - a. Provide liquid thermal thermostats with tamper-resistant control adjustment.
  - b. The system shall shut off incoming hot water if the cold water supply fails.
  - c. Provide redundant thermostatic elements in order to provide tempering even if one element were to fail.
  - d. If the hot water supply is interrupted or the thermostatic elements fail, the valve shall provide cold water flow via a bypass loop.
5. Inlet Pressure and Temperature

Maximum inlet pressure, psig	125
Maximum inlet temperature, degrees F	180
Minimum inlet temperature, degrees F	120

Recommended inlet temperature, degrees F	140
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C. Manufacturers, or Equal

1. **Haws Model No. 9202**; or,

2.6 EXPANSION/COMPRESSION TANKS AND ACCESSORIES

A. General

1. Provide expansion/compression tanks and accessories as indicated.
2. The tanks shall be hydrostatically tested for a working pressure of 125 psig and shall be ASME rated.
3. The tanks shall be provided with a 1/2-inch water gauge glass, a 1/2-inch tank drain, and a 3/4-inch tank fitting.
4. The tanks shall be provided with hangers and supports.
5. The tanks shall be completely insulated as recommended by the tank manufacturer.
6. The sizes and capacities of the tanks shall be as indicated.

B. Manufacturers, or Equal

1. Expansion/Compression Tanks

a. **Wellmate**

b. **Bell and Gossett;**

c. **Taco;**

d. **Thrush**

2. Tank Fitting

a. **Wellmate**

b. **Bell and Gossett HFT Series;**

c. **Taco;**

d. **Thrush;**

e. Tank fitting shall be sized to fit the tank and by the same manufacturer of the tank.

## 2.7 PRESSURE GAUGES

### A. **Pressure gauges shall consist of:**

1. minimum 4-1/2-inch diameter dial;
2. cast aluminum case;
3. zero adjustment;
4. phosphor bronze or stainless bourdon tube and socket;
5. stainless steel movement;
6. double strength glass window; and
7. white face with black embossed figures and graduations.

B. Pressure gauges shall have a guaranteed accuracy of 1/2 to one percent of the scale range.

C. The pressure range shall be 0-80 psig.

D. Provide each pressure gauge with a pigtail siphon and a 3-way cock.

E. Pressure gauges shall be arranged such that they may be read from the operating floor.

F. Manufacturers, or Equal

1. **Ashcroft Maxisafe Durogauge;**
2. **Wexsler;**

## 2.8 THERMOMETERS

A. Thermometers shall have a temperature range of 50-250 degrees F.

B. Thermometers shall be of an "every angle" design, and shall include a 9-inch aluminum case and a chrome plated brass joint with a locking device.

C. The bulb material shall be copper plated steel.

D. Thermometers shall have a "red reading" mercury tubing protected by a dust-tight cover glass.

E. Stem

1. The stem shall be located in an elbow or tee.
2. The stem length shall be not less than 9 inches, and shall extend into the piping being served not less than 3/4 of the diameter of the pipe.



F. Thermometers shall be arranged such that they may be read from the operating floor.

G. Manufacturers, or Equal

1. **Ashcroft, Industrial Glass Type;**

2. **Wexsler;**

3. or Equal

## 2.9 PRESSURE RELIEF VALVE

A. Pressure relief valves shall have a relieving capacity and pressure as required to permit a rise in pressure within the vessel or piping not more than 25 percent above the working pressure when the valve is relieving.

B. The valve shall consist of a semi-steel body with stainless steel trim suitable for tight shutoff.

C. The valve shall be equipped with a manual lift lever for testing, and shall be field adjustable to a minimum of plus or minus 10 percent of the normal setting.

D. The valve shall be constructed to the requirements of ASME Code for Unfired Vessels and stamped accordingly.

E. Manufacturers, or Equal

1. **Lunkenheimer Figure 629;**

2. **Consolidated Type 1851;**

3. or Equal

## PART 3 -- EXECUTION

### 3.1 WATER HEATER INSTALLATION

A. The CONTRACTOR shall install the water heaters in accordance with the manufacturer's printed instructions.

B. The WORK shall be coordinated with plumbing piping and related electrical WORK.

C. The CONTRACTOR shall provide steel pipe supports for tanks, independent of building structural framing members.

D. Tanks shall be cleaned and flushed after installation but prior to Startup.

E. Equipment openings shall be sealed until piping connections are made.

- END OF SECTION -

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## SECTION 22 11 16 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Escutcheons.
6. Sleeves and sleeve seals.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. **Seismic Performance:** Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to SEI/ASCE 7.

#### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61 for potable domestic water piping and components.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. The piping material requires specified in this section shall only be applicable to Domestic Water Piping.

## 2.2 COPPER TUBE AND FITTINGS

- A. **Hard Copper Tube:** ASTM B88, Type K water tube, drawn temper.
  - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. **Soft Copper Tube:** ASTM B88, Type K and ASTM B88, Type K water tube, annealed temper.
  - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

## 2.3 PEX TUBE AND FITTINGS

- A. **PEX Distribution System:**
  - 1. Fittings for PEX Tube: ASTM F1807, 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.
  - 3. Tubing: ASTM F877, SDR 9 tubing.
- B. **Manufacturers:**
  - 1. **Uponor**
  - 2. **Watts Radiant**
  - 3. **Zurn**

## 2.4 PVC PIPE AND FITTINGS

- A. **PVC Pipe:** ASTM D1785, Schedule 80.
  - 1. PVC Welded Socket Fittings: ASTM D2467 for Schedule 80.
  - 2. All PVC piping shall be per the individual pipe material specification.

## 2.5 PIPING JOINING MATERIALS

- A. **Pipe-Flange Gasket Materials:** AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

- B. **Metal, Pipe-Flange Bolts and Nuts:** ASME B18.2.1, carbon steel unless otherwise indicated.
- C. **Solder Filler Metals:** ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.
- D. **Brazing Filler Metals:** AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- E. **Solvent Cements for Joining CPVC Piping and Tubing:** ASTM F493.
- F. **Plastic, Pipe-Flange Gaskets, Bolts, and Nuts:** Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.6 SPECIALTY VALVES

- A. All valves shall comply with the respective valve Section and specification Section 43 25 00 – Valves, General.

### B. **CPVC Union Ball Valves:**

#### 1. Description:

- a. Standard: MSS SP-122.
- b. Pressure Rating: 125 psig at 73 deg F.
- c. Body Material: CPVC.
- d. Body Design: Union type.
- e. End Connections for Valves NPS 2 and Smaller: Detachable, socket.
- f. End Connections for Valves NPS 2-1/2 to NPS 4: Flanged.
- g. Ball: CPVC; full port.
- h. Seals: PTFE or EPDM-rubber O-rings.
- i. Handle: Tee shaped.

### C. **CPVC Ball Check Valves:**

#### 1. Description:

- a. Pressure Rating: 125 psig at 73 deg F.
- b. Body Material: CPVC.
- c. Body Design: Union-type ball check.
- d. End Connections for Valves NPS 2 and Smaller: Detachable, socket.

- e. End Connections for Valves NPS 2-1/2 to NPS 4: Flanged.
- f. Ball: CPVC.
- g. Seals: EPDM- or FKM-rubber O-rings.

## 2.7 TRANSITION FITTINGS

- A. **Fitting-Type Transition Couplings:** Manufactured piping coupling or specified piping system fitting.
- B. **Sleeve-Type Transition Coupling:** AWWA C219.
- C. **Plastic-to-Metal Transition Fittings:**
  - 1. Description: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.
- D. **Plastic-to-Metal Transition Unions:**
  - 1. Description: CPVC four-part union. Include brass threaded end, solvent-cement-joint plastic end, rubber O-ring, and union nut.

## 2.8 DIELECTRIC FITTINGS

- A. **Description:** Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. **Insulating Material:** Suitable for system fluid, pressure, and temperature.
- C. **Dielectric Unions:** Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F
- D. **Dielectric Flanges:** Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035) minimum working pressure as required to suit system pressures.
- E. **Dielectric Couplings:** Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F (107 deg C).
- F. **Dielectric Nipples:** Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F.

## 2.9 FLEXIBLE CONNECTORS

- A. **Bronze-Hose Flexible Connectors:** Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

B. **Stainless-Steel-Hose Flexible Connectors:** Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

## 2.10 SLEEVES

A. **Cast-Iron Wall Pipes:** Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. **Galvanized-Steel-Sheet Sleeves:** 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. **Galvanized-Steel-Pipe Sleeves:** ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

D. **Stack Sleeve Fittings:** Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

## 2.11 SLEEVE SEALS

A. **Description:** Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Carbon steel.

3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

## 2.12 GROUT

A. **Standard:** ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. **Characteristics:** Nonshrink; recommended for interior and exterior applications.

C. **Design Mix:** 5000-psi, 28-day compressive strength.

- D. **Packaging:** Premixed and factory packaged.

### **PART 3 - EXECUTION**

#### **3.1 EARTHWORK**

- A. Comply with requirements in specification Section 31 30 00 – Earthwork for excavating, trenching, and backfilling.

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install 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, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and 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 "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level without pitch and plumb.
- H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- I. Install seismic restraints on piping. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- 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 PEX piping with loop at each change of direction of more than 90 degrees.
- S. PEX piping from manifold to stop valves to be of continuous lengths.
- T. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- U. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- V. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- W. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. **Threaded Joints:** Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  1. Apply appropriate tape or thread compound to external pipe threads.
  2. **Damaged Threads:** Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. **Brazed Joints:** Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- E. **Soldered Joints:** Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

- F. **Pressure-Sealed Joints:** Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- 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.
- I. **Plastic Piping Solvent-Cement Joints:** Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
  - 2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
  - 3. PVC Piping: Join according to ASTM D2855.
- J. **PEX Piping Joints:** Not allowed.
- K. **Dissimilar-Material Piping Joints:** Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE INSTALLATION

- A. **General-Duty Valves:** Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

### 3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. **Dielectric Fittings for NPS 2 and Smaller:** Use dielectric couplings, couplings or nipples, or nipples unions.
- C. **Dielectric Fittings for NPS 2-1/2 to NPS 4:** Use dielectric flanges.
- D. **Dielectric Fittings for NPS 5 to NPS 6:** Use dielectric flange kits.

### 3.7 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation, and install water meters according to utility company's requirements.
- B. Water meters will be furnished by utility company.
- C. Install water meters according to AWWA M6, utility company's requirements, and the following:
- D. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.

- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. **Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:**
1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  6. NPS 6: 10 feet with 5/8-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. **Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:**
1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
  6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  7. NPS 6: 12 feet with 3/4-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. **Install vinyl-coated hangers for CPVC piping with the following maximum horizontal spacing and minimum rod diameters:**
1. NPS 1 and Smaller: 36 inches with 3/8-inch rod.
  2. NPS 1-1/4 to NPS 2: 48 inches with 3/8-inch rod.
- J. Install supports for vertical CPVC piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.
- K. **Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:**

1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.
- L. Install hangers for vertical PEX piping every 48 inches.
- M. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. **Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:**
  1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
  3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. **Escutcheons for New Piping:**
  1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
  5. Bare Piping in Equipment Rooms: One piece, cast brass.
  6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.
- C. **Escutcheons for Existing Piping:**

1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: Split casting, cast brass with chrome-plated finish.
5. Bare Piping in Unfinished Service Spaces: Split casting, cast brass with polished chrome-plated finish.
6. Bare Piping in Equipment Rooms: Split casting, cast brass.
7. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting floor plate.

### 3.11 SLEEVE INSTALLATION

- A. **General Requirements:** Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Permanent sleeves are not required for holes formed by removable PE sleeves.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in new partitions, slabs, and walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- H. Seal space outside of sleeves in concrete slabs and walls with grout.
- I. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- J. **Install sleeve materials according to the following applications:**
  1. Sleeves for Piping Passing Through Concrete Floor Slabs: Steel pipe.
  2. Sleeves for Piping Passing Through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
    - a. Extend sleeves 2 inches above finished floor level.

- b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
- 3. **Sleeves for Piping Passing through Gypsum-Board Partitions:**
  - a. PVC pipe or Steel pipe sleeves for pipes smaller than NPS 6.
  - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.
  - c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
- 4. **Sleeves for Piping Passing Through Concrete Roof Slabs:** Steel pipe.
- 5. **Sleeves for Piping Passing Through Exterior Concrete Walls:**
  - a. Steel pipe sleeves for pipes smaller than NPS 6.
  - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
  - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- K. **Fire-Barrier Penetrations:** Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

### 3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.13 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.

### 3.14 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.



### 3.15 CLEANING

#### A. **Clean and disinfect potable domestic water piping as follows:**

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
  - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
  - b. Fill and isolate system according to either of the following:
    - 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.

### 3.16 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, building service piping, NPS 3 and smaller, shall be one of the following:**

1. Soft copper tube, ASTM B88, Type K; wrought-copper solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

D. **Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:**

1. Hard copper tube, ASTM B88, Type L; wrought-copper solder-joint fittings; and brazed joints.
2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

**E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:**

1. Hard copper tube, ASTM B88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.
4. PEX Tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints. PEX tube may only be used for fixture runouts.
5. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

**F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:**

1. Hard copper tube, ASTM B88, Type L; cast- or wrought- copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

### 3.17 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 valves for piping NPS 2 and smaller. Use butterfly, ball, valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball 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.**

**C. Iron grooved-end valves may be used with grooved-end piping.**

D. CPVC valves matching piping materials may be used.

- END OF SECTION -

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## SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-feet head of water.

#### 1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

#### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A74, Service class.
  - 1. Gaskets: ASTM C564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A888 or CISPI 301.
  - 1. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
  - 2. Shielded Couplings: ASTM C1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
    - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve.

- b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C564, rubber sleeve.
- C. Copper DWV Tube: ASTM B306, drainage tube, drawn temper.
  - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- D. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40, solid wall.
  - 1. ABS Socket Fittings: ASTM D2661, made to ASTM D3311, drain, waste, and vent patterns.
- E. Solid-Wall PVC Pipe: ASTM D3034, solid-wall drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D3034, socket type, made to ASTM D3034, drain, waste, and vent patterns.
- F. Trap Primer Water Supply Piping
  - 1. *All lines identified as trap primer piping* on plans, or required by the schedule, shall be ½" PEX tubing meeting ASTM F876 and F877. PEX tubing shall be rated for continuous operation at 100 psi and 180°F and shall be dimensionally consistent with SDR-9 piping.
  - 2. Trap primer piping shall be continuous without splices and shall be sloped continuously towards the waste fitting connection. Provide support as required to prevent sagging and displacement during concrete operations.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
  - 2. Hubless cast-iron soil pipe and fittings and solvent stack fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
  - 4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.

5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
  2. Hubless cast-iron soil pipe and fittings and solvent stack fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  3. Steel pipe, drainage fittings, and threaded joints.
  4. Copper DWV tube, copper drainage fittings, and soldered joints.
  5. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  6. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
  2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  3. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- F. Underground, soil and waste Piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
  2. Hubless cast-iron soil pipe and fittings; standard, heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
  3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
  4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

### 3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Section 22 05 00 – Plumbing, General.
- B. Install cleanouts at grade at building exit and extend to where building sanitary drains connect to building sanitary sewers. Coordinate with site contractor.

- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. 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."
- E. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- F. 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.
- G. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- I. Install ABS soil and waste drainage and vent piping according to ASTM D2661.
- J. Install PVC soil and waste drainage and vent piping according to ASTM D2665.
- K. Install underground ABS and PVC soil and waste drainage piping according to ASTM D2321.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."



- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
  - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B813, water-flushable, lead-free flux; ASTM B32, lead-free-alloy solder; and ASTM B828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D2665.

### 3.4 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
  - 1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
  - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
  - 3. Install backwater valves in accessible locations.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Section 22 05 48 – Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Pipe hangers and supports are specified in Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment.
- D. Support vertical piping and tubing at base and at each floor.

- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.
  - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
  - 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.

- L. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
- M. Install supports for vertical ABS and PVC piping every 48 inches.
- N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
  - 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. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. **Reinspection:** If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

- C. **Reports:** Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
  - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 2. Prepare reports for tests and required corrective action.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.9 PROTECTION

- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

- END OF SECTION -

## SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Light-commercial electric water heaters.
  - 2. Commercial, storage electric water heaters.
  - 3. Water heater accessories.

#### 1.2 SUBMITTALS

- A. Submittals shall be in accordance with specification Section 01 33 00 – Contractor Submittals.
- B. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- C. Shop Drawings: Diagram power, signal, and control wiring.
- D. Contractor shall submit operation and maintenance data.

#### 1.3 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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

#### 1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fails in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period(s): From date of Substantial Completion:
  - a. Household Electric Water Heaters: Five years.
  - b. Commercial Electric Water Heaters: Five years.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS**

- A. **Description:** Comply with UL 174 for household, storage electric water heaters.
  1. Manufacturers:
    - a. American Water Heater Company.
    - b. Bradford White Corporation.
    - c. Electric Heater Company (The); Hubbell Heaters Division.
    - d. GSW Water Heating Company.
    - e. Heat Transfer Products, Inc.
    - f. Lochinvar Corporation.
    - g. Rheem Water Heater Div.; Rheem Manufacturing Company.
    - h. Ruud Water Heater Div.; Rheem Manufacturing Company.
    - i. Smith, A.O. Water Products Company.
    - j. State Industries, Inc.
  2. Storage-Tank Construction: Steel, vertical arrangement.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig (1035 kPa).

- c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
3. Factory-Installed Storage-Tank Appurtenances:
- a. Anode Rod: Replaceable magnesium.
  - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
  - c. Drain Valve: ASSE 1005.
  - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
  - e. Jacket: Steel with enameled finish.
  - f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
  - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
  - h. Temperature Control: Adjustable thermostat for each element.
  - i. Safety Control: High-temperature-limit cutoff device or system.
  - j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
4. Special Requirements: NSF 5 construction with legs for off-floor installation.

## 2.3 WATER HEATER ACCESSORIES

- A. **Water Heater Stands:** Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches (457 mm) above the floor.
- B. **Water Heater Mounting Brackets:** Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- C. **Drain Pans:** Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4 (DN 20).
- D. **Piping-Type Heat Traps:** Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- E. **Water Regulators:** ASSE 1003, water-pressure reducing valve. Set at 25-psig (172.5-kPa) maximum outlet pressure, unless otherwise indicated.

- F. **Shock Absorbers:** ASSE 1010 or PDI WH 201, Size A water hammer arrester.

## **PART 3 - EXECUTION**

### **3.1 WATER HEATER INSTALLATION**

- A. Install commercial water heaters on concrete bases.
  - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
- B. Install 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.
- C. 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.
- D. 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 water heaters that do not have tank drains. Refer to specification Section 22 11 16 – Domestic Water Piping for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters.
- F. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

### **3.2 CONNECTIONS**

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 26 05 26 – Grounding
- C. Connect wiring according to Division 26 05 19 – Insulated Wire and Cable

### **3.3 FIELD QUALITY CONTROL**

- A. Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.
- B. Perform the following field tests and inspections:



1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
  3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.
- 3.4 DEMONSTRATION
- A. Engage a factory-authorized service representative to train OWNER'S maintenance personnel to adjust, operate, and maintain commercial electric water heaters.

- END OF SECTION -

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## SECTION 22 40 00 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. **This Section includes the following:**

1. Faucets for lavatories and showers.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
6. Water closets.
7. Urinals.
8. Lavatories.
9. Individual showers.
10. Service sinks.

#### 1.2 DEFINITIONS

- A. **ABS:** Acrylonitrile-butadiene-styrene plastic.
- B. **Accessible Fixture:** Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. **FRP:** Fiberglass-reinforced plastic.
- D. **PMMA:** Polymethyl methacrylate (acrylic) plastic.
- E. **PVC:** Polyvinyl chloride plastic.
- F. **Solid Surface:** Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### 1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Shop Drawings:** Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

- D. Submit complete manufacturer's literature for all fixtures, trim, stops, carriers and other accessories.

#### 1.4 COORDINATION

- A. Cooperate in the installation of all fixtures with the General Contractor so that provisions can be made for required plumbing chase clearances, solid backing for mounting fixtures, chair carriers, shower units, drains, etc., and proper elevation for setting roof and floor drains.
- B. Provide the necessary drawings, dimensions and instructions for proper installation of all fixtures and trim.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. **NSF Standard:** Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Fixtures and their installation shall comply with applicable plumbing codes, ANSI standards and ADA requirements.
- G. Note special mounting heights which may be listed on architectural plans and elevations. Install fixture trip (flush) levers on accessible side of all water closets and urinals.

### PART 2 - PRODUCTS

#### 2.1 LAVATORY FAUCETS

- A. Lavatory Faucets
  - 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. American Standard Companies, Inc.
    - b. Bradley Corporation

- c. Chicago Faucets
- d. Delta Faucet Company
- e. Fisher Manufacturing Co.
- f. Kohler Co.
- g. Moen, Inc.
- h. Royal Brass Mfg. Co.
- i. Elkay
- j. Just
- k. Zurn

## 2.2 SHOWER FAUCETS

### A. Shower Faucets:

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. American Standard Companies, Inc.
  - b. Chicago Faucets
  - c. Delta Faucet Company
  - d. Gerber Plumbing Fixtures LLC
  - e. Hansgrohe Inc.
  - f. Kohler Co.
  - g. Leonard Valve Company
  - h. Moen, Inc.
  - i. Royal Brass Mfg. Co.
  - j. Symmons Industries, Inc.
  - k. T & S Brass and Bronze Works, Inc.
  - l. Zurn Plumbing Products Group; AquaSpec Commercial Faucet Operation

## 2.3 FLUSHOMETERS

### A. Flushometers:

1. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Delta Faucet Company
  - b. Sloan Valve Company
  - c. Zurn Plumbing Products Group; Commercial Brass Operation

## 2.4 TOILET SEATS

### A. Toilet Seats:

1. Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Bemis Manufacturing Company
  - c. Church Seats
  - d. Eljer
  - e. Kohler Co.
  - f. Olsonite Corp.
  - g. Sanderson Plumbing Products, Inc.; Beneke Div.

## 2.5 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 Co.
  - b. McGuire Manufacturing Co., Inc.
  - c. Plumberex Specialty Products Inc.
  - d. TCI Products
  - e. TRUEBRO, Inc.
  - f. Zurn Plumbing Products Group; 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.

## 2.6 FIXTURE SUPPORTS

### A. **Subject to compliance with requirements, provide products by one of the following:**

1. Josam Company
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation

### B. **Water-Closet Supports:**

1. Description: Combination carrier designed for accessible mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

### C. **Lavatory Supports:**

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture.
2. Accessible-Fixture Support:

## 2.7 WATER CLOSETS

### A. **Water Closets:**

1. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products.
  - c. Eljer.
  - d. Kohler Co.
  - e. Sloan

## 2.8 LAVATORIES

### A. Lavatories

1. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products
  - c. Eljer
  - d. Kohler Co.

## 2.9 INDIVIDUAL SHOWERS

### A. Individual Showers

1. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Aqua Bath Company, Inc.
  - b. Aqua Glass Corporation
  - c. Aquatic Industries, Inc.
  - d. Clarion Bathware
  - e. Crane Plumbing, L.L.C./Fiat Products
  - f. Jacuzzi, Inc.
  - g. Kohler Co.
  - h. LASCO Bathware
  - i. Praxis Industries, Inc.; Aquarius Products

## 2.10 SERVICE SINKS

### A. Service Sinks

1. Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. American Standard Companies, Inc.
  - b. Commercial Enameling Company
  - c. Eljer



- d. Kohler Co.
- e. Crane Plumbing, L.L.C./Fiat Products
- f. Moen

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.
- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install toilet seats on water closets.
- L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

- N. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- O. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- P. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- R. Set showers in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Wires and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

### 3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by OWNER.

- END OF SECTION -

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