

*SPECIFICATIONS FOR*

**TORRANCE TRANSIT FACILITY  
1<sup>st</sup> & 2<sup>nd</sup> FLOOR RENOVATION PROJECT**

**TORRANCE, CALIFORNIA**

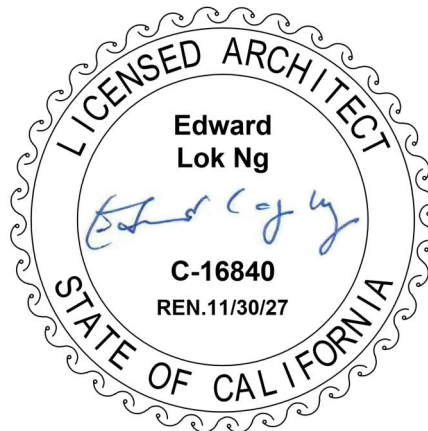
PREPARED FOR:

THE CITY OF TORRANCE, CALIFORNIA

April 2026

PREPARED BY:

**BOA Architecture**  
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(562) 912-7900



**DOCUMENT 00 0101**  
**PROJECT DIRECTORY**

Title : **TORRANCE TRANSIT FACILITY**  
**1<sup>ST</sup> & 2<sup>ND</sup> FLOOR RENOVATION PROJECT**

Client Agency : CITY OF TORRANCE  
TORRANCE TRANSIT SYSTEMS  
20500 MADRONA AVE,  
TORRANCE, CA 90503  
CONTACT:  
Tel:  
Email:

Project Location : Torrance Transit Facility  
20500 Madrona Ave,  
Torrance, CA 90503

Architect : Edward Lok Ng, Architect  
BOA Architecture  
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*Issued separately by the City*

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**SECTION 01 3543**  
**ENVIRONMENTAL PROCEDURES**

**PART 1 - GENERAL**

**1.1 Scope**

- A. The work covered by this section consists of furnishing all labor, material, and equipment and performing all work required for compliance with environmental regulations and preventing pollution during, and as a result of, construction operations under this contract, in addition to those measures set forth in other technical provisions of these specifications.
- B. The Contractor and subcontractors must comply with all applicable environmental federal, state, local environmental, health and safety laws and regulations.

**1.2 Notification**

- A. The Contractor must, after receiving a notice of noncompliance with the foregoing provisions, immediately take corrective action. The notice, when delivered to its Contractor or its authorized representative at the site of the work, is deemed enough for this purpose. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost because of any such stop orders may be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is subsequently determined that the Contractor was in compliance.

**1.3 Environmental Regulatory Compliance**

- A. Within 30 days after receiving the notice to proceed or not less than 15 days prior to commencing on-site work, the Contractor must submit any environmental documents that are required by federal, state, or local environmental regulations. Plans must be approved by the Engineer prior to commencing on-site work and must describe and include, but is not limited to, the following
  - 1. Waste Minimization and Management Plan must describe how natural resources potentially impacted by construction will be protected or managed; construction wastes will be stored and disposed of or recycled; and pollutants associated with building materials will be controlled. The waste minimization and management section of the plan must also list materials and construction debris to be recycled and address the disposal of solid and hazardous wastes and materials, including asbestos and lead-based paint. It must also include tables applicable to the reclamation of chlorofluorocarbons (CFCs) and [hydrochlorofluorocarbons](#) (HCFCs) in accordance with the City recycling code and 1.4 (B) below.

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**ENVIRONMENTAL PROCEDURES**

2. Environmental Compliance Plan must document NEPA compliance by describing mitigation measures to address environmental concerns/sensitive receptors identified in the National Environmental Policy Act (NEPA) document(s) in Section B. 1500, Attachments, and as set out in the mitigation measures in the General Requirements.

**1.4 Environmental Site Controls**

- A. **Location of Hazardous Materials:** The location of the Contractor's temporary storage of any hazardous materials and/or wastes must be appropriately marked and included in the health and Safety Plan (see Section 1.5 below).
- B. **Post Construction Cleanup or Obliteration:** The Contractor must remove and properly dispose of all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, excess or waste materials, or any other vestiges of construction as directed by the Engineer. No separate or direct payment may be made for post construction cleanup, and all associated costs must be considered included in the contract price.
- C. **Dust Control:** The Contractor must keep the site free from dust in accordance with applicable regulations.
- D. **Noise Minimization:** The Contractor must perform demolition and construction operations to minimize noise including conducting work during less sensitive hours of the day in accordance with the City's Noise Ordinance.

**1.5 Health and Safety**

- A. Prior to commencing on-site work, the Contractor must submit an Occupational Safety and Health Administration (OSHA) Emergency Action Plan (EAP) to the Engineer to demonstrate compliance by the Contractor and subcontractors with applicable OSHA regulations. If the Contractor is not required by OSHA to develop a written EAP, i.e., if 10 or fewer are employed for the construction project or any other specific regulations identified by OSHA, then the Contractor shall submit to the Engineer a signed letter stating the Contractor shall meet OSHA's EAP requirements in verbal communication to all employees.
- B. Copies of Material Safety Data Sheets (MSDSs) for any hazardous material(s), as defined by OSHA's Hazard Communications Standard, must be included whenever such materials arrive on-site. MSDSs must be kept together and maintained centrally on-site through to project completion. Provide a copy of each MSDS in the Operating and Maintenance Manual. The use of asbestos containing materials, in excess of one percent as defined by US Environmental Protection Agency regulations, is prohibited in the construction of this project. Provide an executed copy of the "Certificate of

**SECTION 01 3543**  
**ENVIRONMENTAL PROCEDURES**

Asbestos and Lead-Based Paint (New Work)" in the Operating and Maintenance Manual.

- C. The use of lead-based paint is prohibited in the construction of this project.
- D. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.
- E. The Contractor must sign and submit to the Engineer a "Certification of Asbestos and Lead-Based Paint" for this project.
- F. See following exhibits for additional information.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

**END OF SECTION**



## SECTION 01 3543 ENVIRONMENTAL PROCEDURES

### Safety and Health and Related Environmental Requirements

The Contractor is required to meet all applicable OSHA, federal, state, and local safety, health, and related environmental requirements in addition to the City requirement listed in this table.

| Issue                                     | City Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Asbestos</b>                           | <p><i>Review of Facility Asbestos Survey:</i> Before any building maintenance, equipment installation, renovation, alteration, demolition, or other project begins, determine whether ACBM will be disturbed.</p> <p><i>Proper Work Practices:</i> If ACBM is present, follow proper control procedures and work practices.</p> <p><i>Consultation with Facility Asbestos Coordinator:</i> Consult with the facility manager or his or her designee before the start of any work likely to disturb ACBM. Disturbance means activities that crumble or pulverize ACBM or presumed asbestos-containing material (PACM) or generate visible debris. Operations may include drilling, abrading, cutting a hole, pulling cable, and crawling through tunnels or attics and spaces above the ceiling where asbestos is actively disturbed or asbestos-containing debris is actively disturbed.</p> <p><i>Asbestos Work Authorization:</i> You must have an approved Form 8210, <i>Work Authorization - Asbestos</i>, before work begins within any building containing asbestos.</p> |
| <b>Barricades, Barriers, and Warnings</b> | Your barricades must meet the OSHA requirements. In addition, you assume control of your work area during your activities unless otherwise specified in writing by the City Engineer (CE) or City Engineer's representative (CER).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Confined Spaces</b>                    | <p>Confined space work must meet the OSHA requirements. You must have a comprehensive confined space program that includes a written program, employee training, entry and testing equipment, and rescue capabilities.</p> <p>If you require access to confined space requiring a permit, then the trained, designated City representative must review and approve the project and permit. Entry into other confined spaces must be in accordance with OSHA regulations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Electrical Work</b>                    | Lock or rope off work areas involving exposed energized equipment or have an attendant present to prevent accidental contact by unqualified people. Refer to the Barricade section of this guideline for additional information.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Elevated Work and Fall Protection</b>  | Follow strictly the applicable OSHA fall protection requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Excavation</b>                         | <p>All excavations 4 feet or more in depth must be properly shored or sloped and meet all OSHA requirements.</p> <p>Before any digging or drilling commences, inform the City COR and call Dig Safe or its local equivalent to determine whether any underground utilities are in the work area. Submit documentation that these notifications have been performed. You must not begin digging or drilling until you have verified that underground utilities have been identified and are properly marked so that work may be accomplished in a safe manner.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Fire Protection</b>                    | <p>Do not block, remove, or otherwise prevent City fire extinguishers from being immediately accessible and usable.</p> <p>If a system must be impaired by a scheduled shutdown, notify the Engineer, and do not proceed without the Engineer's authorization.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Hazard Communication</b>               | Inform the Engineer before any chemicals are used. Before materials are brought on site, provide material safety data sheets (MSDSs) and an inventory of materials. For projects that are anticipated to use substantial quantities of hazardous materials, you may be required to provide a routing, storage, and waste disposal plan.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Hazardous Materials</b>                | <p>Follow all OSHA requirements regarding hazardous materials. Hazardous materials include, but are not limited to, flammable and combustible liquids, gasoline, diesel fuel, motor oil, lubricating oil, hydraulic oil, corrosive cleaners, and battery acid.</p> <p>Provide secondary containment for all containers of liquids that are over 5 gallons in capacity.</p> <p>Immediately report all hazardous material releases ("spills"), regardless of how small or where they occur, to the designated Engineer. Releases include solids, liquids, and gases.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Hot Work</b>                           | <p>Do not begin any hot work until the Engineer has completed and signed a City Hot Work Permit. The permit will be valid for only a single work shift. You must display the permit at the work site.</p> <p>You are prohibited from performing hot work (a) when the City has not authorized it, (b) in</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## SECTION 01 3543 ENVIRONMENTAL PROCEDURES

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           | locations in which fire protection systems have been impaired, (c) in the presence of explosive or flammable atmospheres, or (d) in locations where large quantities of flammable and combustible materials are unprotected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Powered Industrial Trucks</b>          | Powered industrial trucks and other mobile equipment must follow all traffic rules of the City facility. The maximum speed limit for in-plant powered vehicles is 5 miles per hour. Many work areas have posted speed limits that you must strictly follow. Perform refueling only in authorized locations following safe procedures.<br>As a rule, the City does not allow gas- or diesel-powered industrial equipment inside City facilities. Coordinate exceptions to the rule through the City safety office.                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Ladders</b>                            | Strictly follow all OSHA requirements regarding ladders. Barricade the ladder use area to prevent contact with mobile equipment and employees.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Lead-Based Paint</b>                   | <i>Review of Facility Lead Survey:</i> Before any construction, alterations, and/or repair activities begin, determine whether LBP will be disturbed. If the painted surface has not been tested, you must have it tested before beginning any activities that could potentially disturb LBP.<br><i>Proper Work Practices:</i> If LBP is present, follow proper control procedures and work practices.<br><i>Consultation with Engineer:</i> Consult with the Engineer before the start of any work likely to disturb LBP. Examples of activities that may affect LBP include paint removal by scraping, sanding, power tools, or heat guns; alterations that include removing drywall, structural steel, or other building materials coated with LBP; welding, cutting, or other hot work on coated metal surfaces; abrasive blasting of mailboxes and other equipment; and moving or cleaning of abrasive blasting enclosures. |
| <b>Lockout/Tagout</b>                     | Provide a copy of your lockout/tagout procedures, which must meet or exceed the OSHA Lockout/Tagout standard. You will be given access to and must review the City lockout/tagout program.<br>If you encounter a City lockout/tagout device that prevents the continuation of work, do not make any attempts to remove, tamper with, or bypass the devices. Contact the Engineer and plan to have the lockout device removed in accordance with City lockout removal policies.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Personal Protective Equipment</b>      | Before beginning work, evaluate the work area for hazards, determine whether contract employees will be required to use personal protective equipment (PPE) to protect themselves from these hazards, and document the hazard assessment.<br>Wear the PPE required regardless of your perception of hazard potential.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Regulated and Prohibited Materials</b> | <i>Pesticides.</i> The City has restricted the use of pesticides. Obtain prior approval of the City environmental compliance coordinator for special cases that may require the use of pesticide treatments.<br><i>Seventeen Chemical Prohibition.</i> Adhere to chemical prohibition policies. Do not use on City property any of the 17 chemicals prohibited by EPA unless the Engineer authorizes its use (each of these chemicals must be authorized separately). The district environmental compliance coordinator can supply the list.<br><i>Asbestos-Free Products.</i> Install no asbestos-containing products or materials in City facilities.<br><i>Lead.</i> Apply no lead-based paint in City facilities.                                                                                                                                                                                                            |
| <b>Scaffolding</b>                        | Follow strictly the applicable OSHA scaffolding requirements.<br>Provide adequate barrier protection around the scaffolding to prevent hazards to City staff.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Walking and Working Surfaces</b>       | If the project requires temporary modifications to the means of egress, inform the Engineer before performing such actions, provide appropriate alternative means of egress, and communicate these to all employees.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## SECTION 01 3543 ENVIRONMENTAL PROCEDURES

### Emergency Procedures

|                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Preparations for Emergency</b>           | <p>Be prepared for emergency situations.<br/>         Ensure that emergency telephone numbers are site specific, readily available, easily read, and communicated to all employees.<br/>         Train and authorize employees to implement emergency procedures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Medical Emergencies</b>                  | <p>Have procedures and medical supplies to provide emergency medical services for your own personnel.<br/>         Determine how to contact emergency medical services before work begins and have on-site capabilities to contact such services immediately.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Fires</b>                                | <p>See Fire Protection above.<br/>         In the event of a fire, you must:</p> <ul style="list-style-type: none"> <li>- Immediately remove personnel from the area or building following City evacuation procedures.</li> <li>- Immediately contact the nearest City employee and inform him or her of the fire. You may also activate an emergency alarm in the area. If no City employees are on-site, immediately contact the local fire department.</li> </ul> <p>Personnel trained in the use and limitations of fire extinguishers may attempt to extinguish the fire if it is safe to do so.</p>                                                                                                                           |
| <b>Chemical Releases</b>                    | <p>See Hazardous Materials above.<br/>         If the event of a hazardous material release, you must:</p> <ul style="list-style-type: none"> <li>- Immediately remove personnel from the area or building following City evacuation procedures.</li> <li>- Immediately contact the designated City representative and inform him or her of the release. You may also activate an emergency alarm in the area. If no City employees are on-site, immediately contact the local fire department.</li> </ul> <p>Contractor personnel should not respond to the release unless specifically trained and protected to perform hazardous material response.</p>                                                                          |
| <b>Power Outages</b>                        | <p>In the event of a power outage, you must:</p> <ul style="list-style-type: none"> <li>- Immediately stop work and assemble for a head count and possible facility egress.</li> <li>- Inform all contract employees that equipment may automatically restart when power resumes.</li> <li>- Immediately contact the designated City representative and inform him or her of the status of contract work and personnel head count. Relay at this time all hazards created due to the power outage.</li> </ul> <p>When power resumes evaluate the status of operations that were being performed relative to hazard potential. For example, the interruption of ventilation in confined spaces may generate atmospheric hazards.</p> |
| <b>Accident Investigation and Reporting</b> | <p>As soon as is practical after an accident, investigate and document an accident investigation. The documentation must describe the incident and identify the causes and the corrective actions that will prevent future incidents.<br/>         Report all accidents, whether or not they result in injury. Give the written report to the Engineer within 24 hours of the accident or incident.</p>                                                                                                                                                                                                                                                                                                                             |

**SECTION 01 3543  
ENVIRONMENTAL PROCEDURES**

**Certificate of Asbestos and Lead-Based Paint**  
(New Work)

To: City Engineer

Subject: Certification for new construction

City facility name: \_\_\_\_\_

City facility address: \_\_\_\_\_

**Certification for new construction:**

This Contractor/Owner hereby certifies that no asbestos-containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and no lead-based paint has been furnished or installed at the referenced project.

Contractor/Owner name: \_\_\_\_\_

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

Address: \_\_\_\_\_

\_\_\_\_\_

Telephone: \_\_\_\_\_

Date executed: \_\_\_\_\_

**SECTION 01 1000**  
**SUMMARY OF WORK**

**GENERAL**

**1.1 SCOPE**

- A. The Contractor shall provide all materials, labor, tools, plant, supplies, equipment, transportation, superintendence, temporary construction of every nature, and all other services and facilities necessary to complete the construction of the restroom facilities, including all incidental work described in the contract documents.
- B. The scope of work is contained in the contract documents.
- C. The scope of work includes, but is not limited to the following and for the building to provide ADA compliance throughout:
  - 1. Interior Scope of Work - **FIRST FLOOR:**
    - a. The renovation of a storage area into a new breakroom and dispatch area with new updated led lighting, two gender neutral restrooms (one which meets ADA standards), a new Kitchenette, a new dispatch window area, relocated dispatch mailboxes, refinished concrete floors, and window storefronts.
    - b. The renovation of the corridor includes updated led lighting, new lockers and benches, and a full height storage space.
    - c. The planning room must have a new storefront window
    - d. New exhaust fans for all restrooms
    - e. New finishes for the interior and exterior of the elevator entry
    - f. The renovation of the warehouse includes repolished
    - g. Concrete floors and updated led lighting.
    - h. The renovation of the foyer includes a new service counter, cabinetry, refinished interiors, polished concrete, and updated led lighting.
  - 2. Interior Scope of Work - **SECOND FLOOR:**
    - a. The renovation of common spaces with a new landing facade wall with a tv display, an updated drinking fountain, repolished concrete floors, updated led lighting, wall cabinetry for added storage, and updated outlets with USB fixtures
    - b. A new private office
    - c. A new kitchen layout with proper fixtures
    - d. New exhaust fans at all restrooms
    - e. A new open office with cubicles
    - f. New carpet, paint, and acoustics at existing offices
  - 3. Exterior Scope of Work
    - a. Provide new exterior aluminum storefront system with tempered glass, new aluminum storefront door & door hardware.

**SECTION 01 1000  
SUMMARY OF WORK**

- b. Infill exterior wall as needed and match existing exterior siding and trim work. Patch and repair siding as needed due to new storefront window openings.
- c. Provide new exterior wall cladding at elevator.
- d. Provide spandrel glass panels at storefront system to accommodate sprinkler valve piping's.

- D. All work shall be in accordance with applicable codes and local regulations that may apply. In case of conflict in or between the Contract Documents and a governing code or ordinance, the more stringent standard as determined by the Engineer shall apply.

**1.2 MISCELLANEOUS CONTRACT EXPENSES**

- A. The Contractor must include in its bid the cost fees or charges payable to State, local, or special community development agencies unless otherwise stated in the General Requirements. Contractor will be required to obtain building permits from the City's Building Department as this is a City Public Works Project.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

**END OF SECTION**

**SECTION 01 2513**  
**PRODUCT SUBSTITUTION PROCEDURES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This Section includes administrative and procedural requirements for handling requests for substitutions submitted 60 days after the date established in the Notice of Award and pursuant to Article 6.14 of the General Conditions.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 3300: Submittal Procedures.
- B. Section 01 6000: Product Requirements.
- C. Section 01 7000: Execution and Closeout Requirements.

**PART 2 - PRODUCTS (Not used)**

**PART 3 - EXECUTION**

**3.1 APPLICATION**

- A. CONTRACTOR proposed changes in products or materials required by the Contract Documents 60 days or more after the Notice of Award are requests for substitutions. CITY will consider requests for substitution if a product is no longer manufactured or the CITY and ARCHITECT, after a diligent search have verified that product or material is not available to CONTRACTOR. The following are not considered to be valid requests for substitutions:
  - 1. Revisions to the Contract Documents requested by Owner or ARCHITECT.
  - 2. Specified options of products included in the Contract Documents.
  - 3. Substitutions requested on a "or equal" basis.

**3.2 SUBMITTALS**

- A. Transmit submittals as described in related Sections for each request for substitution.
  - 1. Identify the product to be replaced in each request. Include related Specification Section and Drawing number.
  - 2. Provide complete documentation denoting compliance with the requirements for substitutions, and the following information, as appropriate.

**SECTION 01 2513**  
**PRODUCT SUBSTITUTION PROCEDURES**

- a. A detailed comparison of the significant qualities of the proposed substitution with those specified in the Contract Documents. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
  - b. Product Data, including Drawings, descriptions of products, fabrication, and installation procedures.
  - c. Samples, where applicable or requested.
  - d. CONTRACTOR certification the proposed substitution conforms to requirements of the Contract Documents in every respect and is appropriate for the applications indicated.
  - e. CONTRACTOR waiver of rights to an increase in the Contract Amount, Milestones and/or Contract Time that may subsequently become necessary because of the failure of the substitution to adequately perform.
3. If required, ARCHITECT will request additional information or documentation for evaluation. CITY will notify CONTRACTOR of acceptance or rejection of the substitution.
  4. ARCHITECT will review and consider request for substitution and provide a recommendation to CITY.
  5. Where a proposed substitution involves and/or affects more than one Subcontractor, CONTRACTOR shall ensure each Subcontractor cooperates with the other Subcontractor involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of all products.
  6. CONTRACTOR submittal and ARCHITECT review of Shop Drawings, Product Data, material lists or Samples do not constitute an acceptable or valid request for substitution.

**END OF SECTION**



**SECTION 01 2976**  
**PROGRESS PAYMENT PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section specifies administrative and procedural requirements for a certified Application for Payment.
  - 1. Coordinate the certified Schedule of Values and certified Application for Payment with, but not limited to, the Construction Schedule, submittal log, and list of Subcontractors.

**1.2 RELATED REQUIREMENTS:**

- A. Section 01 3300 – Submittal Procedures.
- B. Section 01 7704 – Closeout Procedures and Training.

**PART 2 - PRODUCTS (Not used)**

**PART 3 - EXECUTION**

**3.1 APPLICATION FOR PAYMENT**

- A. Each certified Application for Payment shall be consistent with previous applications and payments as reviewed by Engineer, paid for by City, and:
  - 1. The initial Application for Payment and Final Application for Payment at time of Substantial Completion involve additional requirements.
- B. Payment Application Times: The period of Work covered by each Application for Payment is payment date for each progress payment as specified in the General Conditions. The period covered by each Application for Payment is previous month.
- C. Payment Application Forms: Use City provided forms for the Application for Payment.
- D. Application Preparation: Complete every entry on the form. Include execution by a person authorized to sign legal documents on behalf of General Contractor. Engineer will return incomplete applications without action.
- E. Transmittal: Submit a minimum of four signed and original copies of each certified Application for Payment to Engineer. All copies shall be complete, including releases and similar attachments.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to Engineer.

**SECTION 01 2976**  
**PROGRESS PAYMENT PROCEDURES**

- F. Initial Application for Payment within 60 days of issuance of Notice to Proceed: Administrative actions and submittals that must precede or coincide with submittal for first certified Application for Payment include, but are not limited to, the following:
1. Certified Schedule of Values.
  2. Performance and payment bonds.
  3. List of principal suppliers and fabricators.
  4. Worker Compensation certificates, if applicable.
  5. Auto Insurance, if applicable.
  6. Hazardous Material Insurance Certificates, if applicable.
  7. Construction Schedule.
  8. Submittal Schedule.
  9. Emergency Contact List.
  10. Copies of authorizations and licenses from governing authorities for performance of Work.
  11. Certified Payroll (Submitted directly to Labor Compliance in electronic format as specified by City including hard copy).
- G. Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of Progress Applications for Payment include, but are not limited to, the following:
1. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by City including hard copy).
  2. Updated and current Project Record Drawings (as built).
  3. Monthly Construction Schedule (updated, submitted, and approved).
  4. Approved Schedule of Values.
  5. List of Subcontractors (Payments Summary).
- H. Final Application for Payment at Substantial Completion: Following Engineer issuance of certificate of Substantial Completion, submit an Application for Payment:
1. Administrative actions, submittals, and/or Work that shall precede or coincide with this application include:
    - a. Occupancy permits and similar approvals by authorities having legal jurisdiction over Work.
    - b. Removal of temporary facilities and services.
    - c. Testing, adjusting, and balance records.
    - d. Removal of surplus materials, rubbish, and similar elements.
    - e. Meter readings.
    - f. Start-up performance reports.
    - g. City personnel training and orientations.
    - h. Operating and maintenance instruction manuals.
    - i. Preliminary Warranties, guarantees, and maintenance agreements.
    - j. Delivery of extra materials, products and or stock.
    - k. Change over information related to City occupancy, use, operation, and maintenance.
    - l. Final cleaning.
    - m. Ensure that Work is completed.
    - n. Advise on shifting insurance coverage.

**SECTION 01 2976**  
**PROGRESS PAYMENT PROCEDURES**

- o. List of defective Work recognized as exceptions to certificate of Substantial Completion.
- p. Change of door locks, including keys, to City system.
- q. Certified Payroll (submitted directly to Labor Compliance in electronic format as specified by the City including hard copy).
- r. Certification that all benefit contributions due and owing to appropriate union trusts has been paid by General Contractor and Subcontractors, as specified by the Project Stabilization Agreement (PSA) and Article 6.49 of the General Conditions.
- s. Waivers and releases for General Contractor.

Payment amount to be based on actual quantities of work completed and unit bid prices. Total bid item quantities completed x unit bid price.

**END OF SECTION**

**SECTION 01 3119  
PROJECT MEETINGS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. This Section specifies administrative and procedural requirements for Project meetings, including but not limited to, the following:
  - 1. Job start meeting.
  - 2. Pre-installation conferences.
  - 3. Progress meetings.
  - 4. Meetings as required by Owner.

**1.2 RELATED REQUIREMENTS**

- A. Division 1

**PART 2 – PRODUCTS (Not used)**

**PART 3 - EXECUTION**

**3.1 JOB START MEETING**

- A. In accordance with General Conditions Article 2.6, Owner will schedule a job start meeting before starting the Work, at a time and date determined by Owner. Meeting shall be held at the Project site, or another location as determined by Owner. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.
- B. Authorized representatives of OWNER, INSPECTOR, ARCHITECT, CONTRACTOR, and other parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
- C. Agenda items shall include significant items which could affect progress of the Work, including, but not limited to the following:
  - 1. Preliminary Construction Schedule.
  - 2. Critical work sequencing.
  - 3. Designation of responsible personnel.
  - 4. Identification of Owner.

**SECTION 01 3119  
PROJECT MEETINGS**

5. Procedures for processing field decisions.
6. Request for Proposal.
7. Request for Clarification.
8. Construction Directive and Change Order.
9. Procedures for processing Applications for Payment.
10. Prevailing wages.
11. Submittal and review of Shop Drawings, Product Data, material lists, and Samples.
12. Preparation of project record documents.
13. Use of the Project site and/or premises.
14. Parking availability.
15. Office, work, and storage areas.
16. Equipment deliveries and priorities.
17. Safety procedures.
18. First Aid.
19. Security.
20. Housekeeping.
21. Working hours.
22. Contract Compliance Officer.
23. Insurance Services including OCIP.
24. Environmental Health and Safety.
25. Substantial Completion, Administrative Closeout and Contract Completion requirements and procedures.
26. Procedures for Mandatory Dispute and Claim Resolution.
27. Storm Water Pollution Prevention Plan (SWPPP).
28. CEQA Compliance.

**SECTION 01 3119  
PROJECT MEETINGS**

- D. Owner shall prepare and issue meeting minutes to attendees and interested parties no later than five calendar days after the meeting date.

**3.2 PRE-INSTALLATION CONFERENCES**

- A. CONTRACTOR shall coordinate and conduct pre-installation conferences at the Project site as required by related Sections of the Contract Documents.
- B. CONTRACTOR, manufacturers, and fabricators involved in or affected by the installation and its coordination or integration with other pre-ceding and/or subsequent installations of Work shall attend the meeting. CONTRACTOR shall advise Owner, INSPECTOR, and ARCHITECT of scheduled meeting dates in order to secure their attendance.

- 1. CONTRACTOR shall review the progress of construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

- a. Contract Documents.
- b. Options.
- c. Related Construction Directives and Change Orders.
- d. Purchases.
- e. Deliveries.
- f. Shop Drawings, Product Data, and quality-control samples.
- g. Review of mockups.
- h. Possible conflicts.
- i. Compatibility problems.
- j. Time schedules.
- k. Weather limitations.
- l. Manufacturer's recommendations.
- m. Warranty requirements.
- n. Compatibility of materials.
- o. Acceptability of substrates.
- p. Temporary facilities.

**SECTION 01 3119  
PROJECT MEETINGS**

- q. Space and access limitations.
  - r. Governing regulations.
  - s. Safety.
  - t. Inspecting and testing requirements.
  - u. Required performance results.
  - v. Recording requirements.
  - w. Protection.
2. CONTRACTOR shall record significant discussions and directives received from each conference. CONTRACTOR shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, Owner, INSPECTOR, and ARCHITECT.

**3.3 PROGRESS MEETINGS**

- A. Progress meetings will be held at the Project site at regular intervals, typically weekly, as determined by the Owner.
- B. In addition to representatives of CONTRACTOR, OWNER, and ARCHITECT, each Subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of the Work shall, if requested by Owner, be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to conclude all matters relating to the Work.
- C. Failure of CONTRACTOR to be so represented at any progress meeting which is held at a mutually agreed time or for which a written notice is given, shall not relieve CONTRACTOR from abiding by any and all Owner determinations or directives issued at such meeting.
- D. Owner will review and correct or approve minutes of the previous progress meeting and will review other significant items affecting progress. Topics for discussion as appropriate to the status of the Project include but are not limited to:
  - 1. Interface requirements.
  - 2. Construction Schedule.
  - 3. Sequence and coordination.
  - 4. Status of submittals / RFCs.
  - 5. Deliveries.

**SECTION 01 3119  
PROJECT MEETINGS**

6. Off-site fabrication.
  7. Access.
  8. Site utilization.
  9. Temporary Construction Facilities and Controls.
  10. Hours of work.
  11. Hazards and risks.
  12. Housekeeping.
  13. Quality of materials, fabrication, and execution.
  14. Unforeseen conditions.
  15. Testing and Inspection.
  16. Defective Work.
  17. Construction Directive.
  18. Request for Proposal.
  19. Change Order Proposals and Change Orders.
  20. Documentation of information for payment requests.
  21. Application for Payment.
  22. Other items as required or as brought forth.
  23. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration. (Article 12.2.1 of the General Conditions).
  24. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration (Article 12.2.2 of the General Conditions).
  25. Storm Water Pollution Prevention.
  26. CEQA Compliance.
- E. No later than three (3) calendar days after each progress meeting, Owner will prepare and distribute minutes of the meeting to each present and absent party.



**SECTION 01 3119  
PROJECT MEETINGS**

Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.

1. Schedule Updating: CONTRACTOR shall revise the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized and issue the revised schedule at the next scheduled progress meeting.

**3.4 ADDITIONAL MEETINGS**

- A. Owner, upon giving notice to the intended parties and without further obligation, may require additional meetings to discuss Work and/or Project related activities.

**3.5 OWNER'S RIGHT TO RECORD**

- A. CONTRACTOR agrees on behalf of itself and all its subcontractors that the OWNER may audiotape or videotape any meetings, training, and any work at any time during the Project

**END OF SECTION**

**SECTION 01 3300  
SUBMITTAL PROCEDURES**

**PART 1 - GENERAL**

**1.1 Schedule of Submittals**

- A. Within 30 days after receiving a Notice to Proceed, the Contractor must submit a Schedule of Submittals, in the format indicated below, in duplicate, listing all items that must be furnished for review and approval by the Engineer. The schedule must indicate the type of items (such as sample, shop drawings, catalog cut, and so forth) and include the scheduled dates of submittal. In preparing the schedule, adequate time (16 days or more exclusive of time in the mail) must be allowed for review and approval and possible resubmittal. Also, the schedule must be coordinated with the approved construction progress chart. The Contractor must revise and/or update the schedule monthly. Such revised schedules must be submitted to the Engineer for approval.
- B. Within 30 days after receiving a Notice to Proceed, the Contractor must complete and submit to the Engineer a listing of all subcontractors, including subcontractor's name, address, telephone number, fax number, and email address. Include an updated list with each progress payment request.
- C. Schedule of Submittals Format

Project \_\_\_\_\_

Contract No. \_\_\_\_\_

Project  
Description \_\_\_\_\_

| Spec.<br>Section | Spec.<br>Description | Paragraph<br>Number | *Submittal<br>Type | Date      |          | Action<br>Taken | Assigned<br>Number |
|------------------|----------------------|---------------------|--------------------|-----------|----------|-----------------|--------------------|
|                  |                      |                     |                    | Submittal | Returned |                 |                    |
|                  |                      |                     |                    |           |          |                 |                    |

\*Submittal Type:

C – Certificate

S – Sample

SD – Shop Drawing

CD – Catalog Data

PL – Spare Parts List

MM – Maintenance Manual

**SECTION 01 3300**  
**SUBMITTAL PROCEDURES**

**1.2 Shop Drawings and Related Data**

- A. Prior to submittal, the Contractor must stamp and sign the submittal to indicate that it is in accordance with the contract documents without deviation and has been reviewed and approved by the Contractor. The Contractor must make any corrections required by the Engineer. If the Contractor considers any correction indicated on the drawings to constitute a change to the contract drawings or specifications, notice must be given to the Engineer. Four prints of all approved shop drawings must be given to the Engineer. The approval of the drawings by the Engineer must not be construed as a complete check but indicates only that the submittal appears to comply with the contract documents. Approval of the shop drawings does not relieve the Contractor of responsibility for any error that may exist because the Contractor is responsible for the dimensions and for satisfactory construction of all work. The submission by the Contractor must be accompanied by a transmittal letter in a format approved by the Engineer.

**1.3 Material, Equipment, and Fixture Lists**

- A. When required by the technical provisions, lists of materials, equipment, and fixtures must be submitted by the Contractor in accordance with the requirements specified for shop drawings. The lists must be supported by sufficient descriptive material, such as catalogs, cuts, diagrams, and other data published by the manufacturer, as well as by evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements. Catalog numbers alone are not acceptable. The data must include the name and address of the nearest service and maintenance organization that regularly stocks repair parts. No consideration will be given to partial lists submitted from time to time. Approval of materials and equipment is tentative, subject to submission of complete shop drawings indicating compliance with the contract documents.

**1.4 Certificates of Compliance**

- A. Any certificates required for demonstrating proof of compliance of materials with specification requirements, including statements of application, and extended guarantees, must be signed and submitted in quadruplicate to the Engineer at least 10 days before delivery. The Contractor must review all certificates before submissions are made to the Engineer, to ensure compliance with the contract specification requirements and to ensure that the affidavit is properly signed. Each certificate must be signed by an official authorized to certify on behalf of the manufacturing company and must contain the name and address of the Contractor, the project name and location, and the quantity and date or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates must contain the name and address of the testing laboratory and the dates of tests to which the report applies. Certification must not be construed as relieving the Contractor from furnishing satisfactory material

## **SECTION 01 3300 SUBMITTAL PROCEDURES**

if, after tests are performed on selected samples, the material is found not to meet the specific requirements.

### **1.5 Review of Submittals**

- A. When submittals are reviewed by others, each submittal must be returned to the Engineer stamped and signed or marked in one of the following ways:
  - 1. A Action: The Contractor is advised that "A Action" means that fabrication, manufacture, or construction may proceed, provided the work complies with the contract documents.
  - 2. B Action: The Contractor is advised that "B Action" means that fabrication, manufacture, or construction may proceed, provided the work complies with the notations and the contract documents.
  - 3. C Action: The Contractor is advised that "C Action" means that no work may be fabricated, manufactured, or constructed and that the Contractor must make a new submittal. Any submission marked "C Action" is not permitted on the site.
- B. The "A Action" or "B Action" submittals must be returned to the Engineer. The Contractor is responsible for obtaining prints of them and for distributing them to the field and to subcontractors.
- C. In the case of shop drawings in the form of manufacturers' descriptive literature, catalog cuts, and brochures stamped "A Action" or "B Action," returned to the Engineer, the Contractor is responsible for distributing them to the field and to the subcontractors. If the shop drawings are stamped "C Action," the Engineer will provide copies to the Contractor, who must submit new shop drawings to the Engineer.
- D. In the case of samples stamped "A Action" or "B Action," the Engineer will provide one of the samples to the Contractor. In the case of samples stamped "C Action," all of the submitted samples must be returned.

### **1.6 Spare Parts Data**

- A. Spare parts data must be submitted in quadruplicate.

### **1.7 Schedule of Values**

- A. The Contractor must submit a construction cost breakdown using the attached Schedule of Values. When applicable, a separate cost breakdown form must be submitted for each separate building. However, the total cost of site work and building facility must be included in the cost estimate breakdown. The number of items provided on the Systems Construction Cost Estimate Breakdown form are the minimum required. Additional subdivision of these items may be used by the Contractor.

**SECTION 01 3300  
SUBMITTAL PROCEDURES**

- B. Submit the construction cost breakdown after contract award to the Engineer.
- C. Do not delete items from the Schedule of Values form. However, expand the schedule "Description of Work" as necessary to allow evaluation of work or to make progress payments.
- D. If the contract price changes, the Schedule of Values must be revised to reflect the change(s) and forwarded to the Engineer.
- E. A current Schedule of Values must accompany all Contractor Requests for Payment.

1.8 As-built plans.

- A. Contractor to submit as built plans.
- B. During construction, maintain as-built redline drawings for all drawings and final as-builds for contractor-generated coordination drawings. Update after completion of commissioning.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

3.1 PROCEDURE

- A. Timing of Submittals:
  - 1. In accordance with General Conditions, CONTRACTOR shall submit to ARCHITECT, with copy of transmittal to the Owner, those Shop Drawings, Product Data, diagrams, materials lists, Samples, and other submittals required by the Contract Documents.
  - 2. The scheduling of submittals shall be sequenced to support the progress of the Work, and shall be:
    - a. Submitted sufficiently in advance of construction, fabrication, or installation in order to allow time for transmittal, review, modification, correction, (and resubmission and re-review when required.)
    - b. Phased with adequate time between submittals in order to allow for proper review by the ARCHITECT without negative impact to the Milestones Schedule.
  - 3. CONTRACTOR shall coordinate submittal of related items and ARCHITECT reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received by ARCHITECT.
  - 4. CONTRACTOR shall revise, update, and submit submittal schedule to ARCHITECT and Owner on the first of each month, or as required by Owner.

**SECTION 01 3300**  
**SUBMITTAL PROCEDURES**

5. CONTRACTOR shall allow in the Construction Schedule at least sixteen working days for ARCHITECT review following ARCHITECT receipt of submittal. For mechanical, plumbing, electrical, low voltage, fire sprinklers, door and hardware, and other submittals requiring joint review with Owner, CONTRACTOR shall allow a minimum of eighteen days following ARCHITECT receipt of submittal. Deferred approval items shall be allowed additional time for city agencies review.
6. No adjustments to the Contract Time or Milestones will be authorized because of a failure to transmit submittals to ARCHITECT sufficiently in advance of the Work to permit review and processing or where CONTRACTOR fails to provide ARCHITECT submittals on related items.
7. In case of product substitution, Shop Drawing preparation shall not commence until such time as OWNER accepts or rejects the proposed substitution in accordance with the procedures described in the General Conditions.

**END OF SECTION**

**SECTION 01 4000**  
**QUALITY REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 Contractor Quality Control**

- A. Contractor Quality Control: The Contractor is responsible for the overall quality of all its own work and the work performed by their subcontractors working under this contract. The quality of any part of the work installed must not be less than that required by the technical divisions of this specification. If the Engineer determines that the quality of work does not conform to the applicable specifications and drawings, the Contractor will be advised in writing of the areas of nonconformance, and within 7 days the Contractor must correct the deficiencies and advise the Engineer in writing of the corrective action taken.
- B. Noncompliance with Quality Control Requirements: Failure of the Contractor to comply with the above requirements may be cause for termination for default as defined in the contract documents.

**1.2 Submittals**

- A. Prior to the start of on-site work, the Contractor must submit to the Engineer a Contractor Quality Control Plan that includes the following information:
  - 1. Procedures for reviewing coordination drawings, shop drawings, certificates, certifications, or other submittals.
  - 2. Testing and inspection schedule, keyed to Construction Schedule, indicating tests and inspections to be performed, names of persons responsible for inspection and testing for each segment of work including preparatory, initial, and follow-up.
  - 3. Proposed forms to be used including Contractor's Daily Report, Contractor Test and Inspection Report and Non-Compliance Check-Off List.

**1.3 Quality Control Procedures**

- A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturers, products, services, site conditions, and workmanship.
- B. Comply fully with manufacturer's published instructions, including each step-in sequence of installation.
- C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from the Engineer before proceeding.
- D. Comply with specified standards as a minimum quality for work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

**SECTION 01 4000**  
**QUALITY REQUIREMENTS**

- E. Perform work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.

**1.4 Contractor Field Inspection and Testing**

- A. Contractor: Test and Inspect work provided under this Contract to ensure work follows compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section and shall be performed as required by the City inspector.
- B. Preparatory Inspection: Performed prior to beginning work and prior to beginning each segment of work and includes:
  - 1. Review of Contract requirements.
  - 2. Review of shop drawings and other submittal data after return and approval.
  - 3. Examination to assure materials and equipment conform to Contract requirements.
  - 4. Examination to assure required preliminary or preparatory work is complete.
- C. Initial Inspection: Performed when representative portion of each segment of work is completed and includes:
  - 1. Quality of workmanship.
  - 2. Review for omissions or dimensional errors.
  - 3. Examination of products used, connections and supports.
  - 4. Approval or rejection of inspected segment of work.
- D. Follow-Up Inspections: Performed daily, and more frequently as necessary, to assure non-complying work has been corrected.

**1.5 Contractor's Daily Report**

- A. The Contractor shall maintain daily reports, and provide copies to the Engineer if requested, for days that work was performed. Include the following information:
  - 1. Date, weather, minimum, and maximum temperatures, rainfall, and other pertinent weather occurrences.
  - 2. Daily workforce of Contractor and subcontractors, by trades.
  - 3. Description of work started, ongoing work, and work completed by each subcontractor.
  - 4. Coordination implemented between various trades.
  - 5. Approval of substrates received from various trades.
  - 6. Nonconforming and unsatisfactory items to be corrected.
  - 7. Remarks

**1.6 Contractor's Test and Inspection Reports**

- A. Prepare and submit to the Engineer, a written report of each test or inspection signed by Contractor Quality Control Representative performing inspection within 2 days following day inspection was made.



**SECTION 01 4000  
QUALITY REQUIREMENTS**

- B. Include the following on written reports of inspection:
1. Cover sheet prominently identifying that inspection "CONFORMS" or "DOES NOT CONFORM" to Contract Documents.
  2. Date of inspection and date of report.
  3. Project name, location, solicitation number, and Contractor.
  4. Names and titles of individuals making inspection, if not Contractor's Project Field Superintendent.
  5. Description of Contract requirements for inspection by referencing Specification Section.
  6. Description of inspection made, interpretation of inspection results, and notification of significant conditions at time of inspection.
  7. Requirements for follow-up inspections.

1.7 Non-Compliance Check-Off List

- A. Maintain check-off list of work that does not comply with Contract Documents, stating specifically what is non-complying, date faulty work was originally discovered, and date work was corrected. No requirement to report deficiencies corrected same day it was discovered. Submit copy of Non-Compliance Check-Off List of non-complying work items to the Engineer on a weekly basis.

1.8 Completion and Inspection of Work

- A. Prior to final acceptance by the Engineer and issuance of a Certificate of Substantial Completion and/or Notice of Completion, submit a certification signed by Contractor to the Engineer stating that all work has been inspected and all work, except as specifically noted, is complete and in compliance with Contract Documents.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

**END OF SECTION**

**SECTION 01 5000**  
**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 - GENERAL**

**1.1 General**

- A. The Contractor must provide all temporary facilities and services required to complete the work and to comply with OSHA and other applicable regulations.
- B. The Contractor must maintain temporary facilities in a proper, safe, operating, and sanitary condition for the duration of this Contract. Upon completion of this Contract, all such temporary work and facilities shall be removed in their entirety.

**1.2 Project Sign**

- A. The Contractor must construct and erect a minimum of two hard hat signs at locations designated by the Engineer. The signs must be erected prior to the commencement of on-site work.

**1.3 Temporary Water**

- A. The City will provide water from the existing services required for construction under this project and will pay all costs in connection with them.

**1.4 Temporary Electricity**

- A. Service Required: The City will provide temporary electric power throughout the construction period from the existing service. Contractor shall be responsible for connection. Contractor to provide power centers for miscellaneous tools and equipment used in the construction work, lighting for safe and adequate working conditions throughout site (at least 1/4 watts of incandescent lighting per square foot, with a socket voltage of at least 110 volts and using 100 watt lamps minimum); power for construction building.
- B. Safety: The Contractor must provide and maintain lights and signs to prevent damage or injury and must illuminate all hazardous areas. Safety lights must be operational from dusk to dawn.
- C. Requirements of Regulatory Agencies: The Contractor must obtain permits as required by local government authorities, comply with the National Electrical Code, applicable local codes, and utility regulations.
- D. Use of Permanent System: The Contractor must regulate any part of the permanent electrical system that is used for construction purposes in order to prevent interference with safety and with the orderly progress of the work. The Contractor must leave permanent electrical services in a condition as good as new.

**SECTION 01 5000  
TEMPORARY FACILITIES AND CONTROLS**

- E. Materials: The materials may be new or used in the temporary works but must be adequate in capacity for the purposes intended and must not create unsafe conditions or violate the requirements of applicable codes. At the Contractor's option, patented specialty materials may be used if UL-approved.
- F. Conductors: The Contractor must use wire, cable, or busses of appropriate type, sized in accordance with the National Electrical Code for the applied loads. Use only UL-approved wire.
- G. Equipment: In compliance with NEMA standards, the Contractor must provide an appropriate enclosure for the environment in which the equipment is used.
- H. Installation: The Contractor must provide all required facilities, including transformers, conductors, poles, conduits, raceways, fuses, switches, fixtures, and lamps, located so as to avoid interference with cranes and materials-handling equipment, storage areas, traffic areas, and work under other contracts. The Contractor must install all work to have a neat and orderly appearance and to make it structurally sound throughout. The Contractor must maintain it to give continuous service and to provide safe working conditions. The Contractor must modify the service as required by the progress of the job.
- I. Removal: The Contractor must remove all temporary equipment and materials upon completion of construction, repair all damage caused by the installation. and restore the area to satisfactory condition.

**1.5 Temporary Water**

- A. The City will provide and maintain a temporary water supply system for building purposes.

**1.6 Sanitary Provisions**

- A. The Contractor must provide and keep in neat and sanitary condition conveniences and accommodations for the use of the construction personnel necessary to comply with the requirements and regulations of the local department of health and of other authorities having jurisdiction.

**1.7 Approaches and Exits**

- A. The Contractor must provide all necessary approaches and exits required to properly execute the work.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

**END OF SECTION**

**SECTION 01 6000**  
**PRODUCT REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 Product Options and Substitutions**

- A. Provide Products that comply with Contract Documents, which are undamaged and new at time of installation.
- B. Provide Products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.

**1.2 Product Delivery Requirements**

- A. Transport and handle Products in accordance with manufacturer's instructions, using means and methods that will prevent damage, deterioration, and loss, including theft.
- B. Schedule Product delivery to minimize long-term storage at the Project sites and prevent overcrowding of construction spaces.
- C. Coordinate Product delivery with installation schedule to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
- D. Deliver Products to Project site in undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
- E. Promptly inspect shipments to ensure that Products comply with project requirements, quantities are correct, Products are undamaged and properly protected.
- F. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

**1.3 Product Storage and Handling Requirements**

- A. Store and protect Products in accordance with manufacturers' published instructions, with seals and labels intact and legible.
- B. Store Products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's published instructions.
- C. For exterior storage of fabricated Products, place on sloped supports, above ground.

**SECTION 01 6000**  
**PRODUCT REQUIREMENTS**

- D. Provide off-site storage and protection when Project site does not permit on-site storage or protection.
- E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product.
- F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

**END OF SECTION**

## SECTION 01 7300 EXECUTION

### PART 1 - GENERAL

#### 1.1 Layout of Work

- A. The Contractor must lay out its work to match existing or from City-established base lines and benchmarks as indicated on the drawings. The Contractor shall be responsible for all measurements based on them. The Contractor must furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor as may be required in laying out any part of the work from the base lines and benchmarks established by the City. The Contractor is responsible for the execution of the work to those lines and grades established or indicated by the Engineer.

#### 1.2 Contractor's Temporary Use of Facilities and Equipment

- A. No new facilities or equipment intended for the permanent installation, including materials-handling vehicles, may be used for temporary purposes unless specified in the contract or unless the Contractor has the written permission of the Engineer.

#### 1.3 Cleaning

- A. Cleaning During Construction:
  - 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
  - 2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
  - 3. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.
  - 4. Collect and remove waste materials, debris, and rubbish from site as specified in the Environmental Compliance and Management Plan as required in Section 01 3543 - Environmental Procedures.
- B. Final Cleaning:
  - 1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
  - 2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
  - 3. Complete following cleaning operations before requesting the Engineer's inspection for Substantial Completion.
    - a. Clean Project Site, yard, and grounds if applicable, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

## **SECTION 01 7300 EXECUTION**

- Rake grounds that are neither planted nor paved, to a smooth even-textured surface.
- b. Remove tools, construction equipment, machinery, and surplus material from Project Site.
  - c. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - d. Broom clean concrete floors in unoccupied spaces.
  - e. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - f. Remove labels that are not permanent labels.
  - g. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.
  - h. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - i. Leave Project clean and ready for occupancy.
- 4. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.
  - 5. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.
    - a. Where extra materials of value remain after completion of construction have become City property, store these materials as directed by the Engineer.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

**END OF SECTION**

## **SECTION 01 7329 CUTTING AND PATCHING**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This Section specifies procedural requirements for cutting and patching.

#### **1.2 RELATED REQUIREMENTS**

- E. Section 01 3300 - Submittal Procedures.
- G. Section 01 7419 – Construction and Demolition Waste Management
- H. Section 01 7836 - Warranties.

#### **1.3 DEFINITIONS**

- A. Cutting. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.

#### **1.4 SUBMITTALS**

- A. Cutting and Patching Proposal: CONTRACTOR shall submit a proposal to PROJECT MANAGER as is required, describing procedures well in advance of the time cutting and patching will be performed if the Contract Documents requires approval of these procedures before proceeding. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building's appearance or other significant visual elements.
  - 3. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 4. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.



**SECTION 01 7329  
CUTTING AND PATCHING**

5. Review by ARCHITECT and City Building Department prior to proceeding with cutting and patching does not waive ARCHITECT right to later require complete removal and replacement of defective Work. Cutting and patching shall be reviewed by the ARCHITECT and the City Building Department if a structural elements are to remain.

**1.5 QUALITY ASSURANCE**

- A. Requirements for structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio. If the load carrying member is meant to be supported as part of the new Work, then the supporting members should be part of the City Building Department approved design. If shoring of a structural element is required to be cut and patched, then the CONTRACTOR is required to provide a City Building Department approved design.
  1. Obtain approval from ARCHITECT and City Building Department of the cutting and patching proposal before cutting and patching the following structural elements:
    - a. Foundation construction.
    - b. Bearing and retaining walls.
    - c. Structural concrete.
    - d. Structural steel.
    - e. Lintels.
    - f. Timber and primary wood framing.
    - g. Structural decking.
    - i. Miscellaneous structural metals.
    - k. Equipment supports.
- B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safely.
  1. Obtain review of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
    - a. Primary operational systems and equipment.
    - b. Air or smoke barriers.
    - c. Water, moisture, or vapor barriers.
    - d. Membranes and flashings.
    - e. Fire protection systems.
    - f. Noise and vibration control elements and systems.
    - g. Control systems.
    - h. Communication and/or data systems.
    - j. Electrical wiring systems.

**SECTION 01 7329  
CUTTING AND PATCHING**

- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the opinion of ARCHITECT, reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

**1.6 WARRANTY**

- A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

**PART 2 - PRODUCTS (Not applicable)**

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
  - 1. Before proceeding, meet at the Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

**3.2 PREPARATION**

- A. Temporary support: Provide adequate temporary support of existing improvements or Work to be cut.
- B. Protection: Protect existing improvements and Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of existing improvements or Work that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding or fastening of new Work. Utilize wet sand blasting for interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

**SECTION 01 7329  
CUTTING AND PATCHING**

**3.3 PERFORMANCE**

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for reuse into the Work. Verify compatibility and suitability of existing substrates before starting the Work.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.
  - 1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry.
  - 4. Woodwork: Cut and remove it to a panel or joint line.
  - 5. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.
  - 6. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.
  - 7. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove vinyl flooring for patching and repairing of existing vinyl flooring scheduled to remain.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.
  - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.
  - 2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.

## **SECTION 01 7329 CUTTING AND PATCHING**

3. Concrete: Maintain cut edges in a moist condition for twenty-four hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a compressive strength of 3,000 psi where installed to repair and match existing improvements, unless noted otherwise.
4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.
5. Sheet Metal: Replace removed or damaged sheet metal items for new Work.
6. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6-inch centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.
8. Flooring: Completely remove flooring and prepare substrate for new material.
9. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

### **3.4 CLEANING**

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged coverings to their original condition.
- B. Comply with waste disposal requirements in Section 01 7419 "Construction and Demolition Waste Management."

## **END OF SECTION**

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. Section includes Procedures for achieving the most environmentally conscious Work feasible within the limits of the Construction Schedule, Contract Sum, and available materials, equipment, and products.
  - 1. Participate in promoting efforts of the City to create an energy-efficient and environmentally sensitive structure.
  - 2. Use recycled-content, toxic-free, and environmentally sensitive materials, and equipment.
  - 3. Use environmentally sensitive procedures.
    - a. Protect the environment, both on-site and off-site, during demolition and construction operations.
    - b. Prevent environmental pollution and damage.
    - c. Effect optimum control of solid wastes.
- B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents and prevailing City Ordinances.
- C. Related Sections:
  - 1. Section 01 4000 - Quality Requirements: Contractor's Daily Report.
  - 2. Section 01 5000 - Temporary Facilities and Controls: Temporary ventilation, progress cleaning, and waste removal.
  - 3. Section 01 6000 - Product Requirements: Substitutions.
  - 4. Section 02 4116 - Demolition.

**1.2 DEFINITIONS**

- A. Adequate ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of dust fumes, vapors, or gases.
- B. Construction and demolition waste: Include solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
  - 1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, metal cans, and bones.
  - 2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.
- C. Chemical waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- D. Diversion: Redirection of waste ordinarily deposited in a municipal landfill to a recycling facility or to another destination for reuse.
- E. Environmental pollution and damage: The presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade the utility of the environment for aesthetic, cultural, or historical purposes.
- F. Hazardous materials: Includes pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- G. Municipal Solid Waste Landfill: A permitted facility that accepts solid, non-hazardous waste such as household, commercial, and industrial waste, including construction and demolition waste.
- H. Packaged dry products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging; including carpets, resilient flooring, ceiling tiles, and insulation.
- I. Sediment: Soil and other debris that has been eroded and transported by storm or well production runoff water.
- J. Sanitary wastes:
  - 1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
  - 2. Sewage: Domestic sanitary sewage.
- K. Wet products: Materials and products installed in wet form, including paints, sealants, adhesives, and special coatings.

**1.3 SUBMITTALS**

- A. Solid Waste Management and Environmental Protection Plan: Prepare and submit at the Preconstruction Meeting a Solid Waste Management and Environmental Protection Plan including, but not limited to, the following:
  - 1. Procedures for Recycling/Re-Use Program in compliance with the City recycling code.
  - 2. Revise and resubmit Solid Waste Management and Environmental Protection Plan as required by the City.
    - a. Approval of the Contractor's Solid Waste Management and Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures.

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- B. With each Contractor's Report as specified in Section 01 4000 – Quality Requirements, submit an updated Summary of Solid Waste Disposal and Diversion. Submit on form in Appendix A of this Section. Include manifests, weight tickets, receipts, and invoices specifically identifying the Project and waste material for:
  - 1. Municipal Solid Waste Landfills.
  - 2. Recycling/Reuse Facilities.
- C. With Record Submittals specified in Section 01 7704 - Closeout Procedures and Training, submit the following:
  - 1. Final Summary of Solid Waste Disposal and Diversion. Submit on form in Appendix A of this Section.
  - 2. Resource Conservation and Recovery Act Project Summary. Submit on form in Appendix B of this Section.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.1 RECYCLING AND REUSE**

- A. Collection: Implement a recycling/reuse program that includes separate collection of waste materials of the following types as appropriate to local and regional recycling/reuse facilities:
  - 1. Concrete
  - 2. Metal.
    - a. Ferrous.
    - b. Non-ferrous.
  - 3. Wood.
  - 4. Debris.
  - 5. Others as appropriate.
- B. Recycling/reuse centers: Contact governmental solid waste offices, Environmental Protection Agency (EPA) regional offices, and applicable non-profit organizations.
  - 1. Concrete
  - 2. Metal.
    - a. Ferrous.
    - b. Non-ferrous.
  - 3. Wood.
  - 4. Debris.
  - 5. Others as appropriate.
- C. Handling:
  - 1. Clean materials which are contaminated prior to placing them in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
  - 2. Arrange for collection by or delivery to the appropriate recycling or reuse facility.

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- D. Participate in re-use programs: identify local and regional re-use programs, including but not limited to non-profit organizations such as schools, local housing agencies, and public arts programs, which accept used materials. The following are examples for contractor's information only.
1. National materials exchange network, such as CAL-MAX, a free service provided by various state and regional offices, designed to help businesses find markets for materials that traditionally would be discarded. The premise of the program is that material discarded by one business may be a resource for another business.
    - a. Items and regions covered by materials exchange programs may vary. Contact the applicable regional materials exchange program. In California, contact CAL-MAX at (916) 255-2369.
  2. Habitat for Humanity, a non-profit housing organization that rehabilitates and builds housing for low income families.
    - a. Sites requiring donated materials vary. Contact the national hotline (800) HABITAT.
- E. Rebates, tax credits, and other savings obtained for recycled or re-used materials accrue to Contractor.

**3.2 ENVIRONMENTAL CONTROLS**

- A. Protection of natural resources: Preserve the natural resources within the Project boundaries and outside the limits of permanent Work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by the Engineer, upon completion of the Work.
1. Confine demolition and construction activities to work area limits indicated on the Drawings and as directed by the Engineer.
    - a. Temporary construction: As specified in Section 01 5000 - Temporary Facilities and Controls.
    - b. Demolition and salvage operations: As specified in Section 02 4119 - Selective Structure Demolition.
    - c. Disposal operations for demolished and waste materials that are not identified to be salvaged, recycled, or reused:
      - 1) Remove debris, rubbish, and other waste materials resulting from demolition and construction operations, from site.
      - 2) No burning permitted.
      - 3) Transport materials with appropriate vehicles and dispose off-site to areas which are approved for disposal by governing authorities having jurisdiction.
      - 4) Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways.
      - 5) Comply with applicable regulations.
  2. Water resources as follows:



**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- a. Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and the State Pollutant Discharge Elimination System (SPDES).
- b. Oily substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water.
  - 1) Store and service construction equipment at areas designated for collection of oil wastes.
- c. Mosquito abatement: Prevent ponding of stagnant water conducive to mosquito breeding habitat.
- d. Prevent run-off from site during demolition and construction operations.
3. Land resources: Prior to construction, identify land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, top soil, and landforms without permission from The City.
4. Air Resources: Prevent the creation of dust, air pollution, and odors.
  - a. Use water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
    - 1) Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
  - b. Store volatile liquids, including fuels and solvents, in closed containers.
  - c. Properly maintain equipment to reduce gaseous pollutant emissions.
  - d. Interior final finishes: Schedule construction operations involving wet products prior to packaged dry products to the greatest extent possible in accordance with The City approved Solid Waste Management and Environmental Protection Plan.
6. Noise Control: Perform demolition and construction operations to minimize noise. Perform noise producing work in less sensitive hours of the day or week as directed by the Engineer.
  - a. Repetitive, high level impact noise will be permitted only between the hours permitted in the City Noise Ordinance. Do not exceed the limitations specified by OSHA.
  - b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary for compliance.

**END OF SECTION**

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

Appendix A

**SUMMARY OF SOLID WASTE DISPOSAL AND DIVERSION**

Project Name: \_\_\_\_\_

Contractor Name: \_\_\_\_\_ License Number: \_\_\_\_\_

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

| <b>Solid Waste Material</b> | <b>Date Material Disposed/ Diverted</b> | <b>Amount Disposed/ Diverted (ton or cu.yd)</b> | <b>Municipal Solid Waste Facility (name, address, &amp; phone number)</b> | <b>Recycling/Reuse Facility (name, address, &amp; phone number)</b> | <b>Comments (if disposed, state why not diverted)</b> |
|-----------------------------|-----------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------------------------|
| Concrete                    |                                         |                                                 |                                                                           |                                                                     |                                                       |
| Metal                       |                                         |                                                 |                                                                           |                                                                     |                                                       |
| Wood                        |                                         |                                                 |                                                                           |                                                                     |                                                       |
| Debris                      |                                         |                                                 |                                                                           |                                                                     |                                                       |
| Other:                      |                                         |                                                 |                                                                           |                                                                     |                                                       |

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

Appendix B

RESOURCE CONSERVATION AND RECOVERY ACT - PROJECT SUMMARY.

Project Name: \_\_\_\_\_

Contractor Name: \_\_\_\_\_ License Number: \_\_\_\_\_

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

**1.0 EPA GUIDELINE ITEMS**

**A. Fly Ash:**

1. Total dollar amount of concrete and cement provided for this project.  
\$\_\_\_\_\_.
2. Total dollar amount of concrete and cement containing fly ash provided for this project. \$\_\_\_\_\_.
3. Were there any technical impediments to increasing the amount of concrete and cement containing fly ash provided for this project? \_\_\_\_\_.
  - a. If yes, please explain. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

**2.0 SPECIFICATIONS**

NOT USED

**3.0 SOLID WASTE PREVENTION**

- A. Total dollar amount of solid waste disposed of (landfill) for this project.  
\$\_\_\_\_\_.
- B. Total weight of solid waste disposed (landfill) for this project. \$\_\_\_\_\_.

**4.0 RECYCLING**

- A. Total dollar value of solid waste diverted from landfill and recycled or reused for this project. (Express as total dollar amount for solid waste disposal in landfill for equivalent type and amount of diverted waste.) \$\_\_\_\_\_.

**SECTION 01 7419**  
**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- B. Total weight of solid waste diverted from landfill and recycled or reused for this project. (Express as total weight for solid waste disposal in landfill for equivalent type and amount of diverted waste.) \$\_\_\_\_\_.

**5.0 COMMENTS**

- A. Comments and suggestions for increasing amount of recycled materials used in construction materials.

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- B. Comments and suggestions for improving solid waste prevention and recycling efforts during construction.

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Signature: \_\_\_\_\_ Date: \_\_\_\_\_

**SECTION 01 7704  
CLOSEOUT PROCEDURES AND TRAINING**

**PART 1 - GENERAL**

**1.1 Manuals**

- A. Purpose: Operation and maintenance manuals are for the training of and use by City employees in the operation and maintenance of the systems and related equipment as specified below. The manuals must consist of instruction on systems and equipment. A separate manual or chapter must be prepared for each of the following classes of equipment or system where applicable:
1. Doors & Windows.
  2. Lighting & Controls.
  3. Plumbing Systems.
  4. HVAC Systems.
  5. Storage Systems.
  6. Miscellaneous building equipment and systems.
- B. Content: Unless otherwise indicated, each chapter must contain the following, as applicable:
1. Introduction.
  2. Table of contents.
  3. Description of system (including design intent and considerations).
- C. Preparation: The outline below is intended as a general guide for preparing the manuals. The manuals must be prepared to provide for the optimum operation and maintenance of the various systems. The description of systems and general operating instructions for plumbing and electrical manuals may cover only complicated or unusual parts of these systems, such as sewage ejectors, transformers, high tension switchgear, and signal and alarm systems. Manufacturer's literature and data must be those of the actual equipment installed under contract for the facility. Further guidance is available in the ASHRAE Handbook, 1984, Systems Volume, Chapter 39, Mechanical Maintenance.
- D. Suggested Outline for Operation and Maintenance (O&M) Manuals: This is a suggested outline, with general requirements of O&M manuals. The outline is presented to indicate the extent of material to be covered and the individual items required in manuals for major facilities. The outline may be modified to suit specific installations; however, the purpose of the manual must be fulfilled. The manual is not intended to duplicate manufacturers' data, but proper references must be made in the text of the O&M manual to indicate that that information is applicable and where it is located.
1. Part I. Description and Design Intent
    - a. Introduction
      - 1) Provide a brief description of project and purpose of the maintenance manual. The following statements must be included: "Operation and maintenance of this equipment must be performed in accordance with this manual and posted instructions, subject to compliance with applicable technical guides and standards issued by the City. It is recognized that minor changes in control points and settings will be

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required, based on actual operating experience, to correct varying conditions and improve operation. When such changes appear necessary, they must be submitted to the maintenance manager for consideration. Upon approval of any changes, the applicable portions of all copies of the manual and proposed instructions must be revised and reissued, and any change in operating procedure brought to the attention of all operating personnel."

- 2) "This manual is specifically developed to assist the City official in charge at the facility to operate and maintain the building systems and equipment. Manufacturers' recommendations set forth for certain components must be followed during the complete warranty period for that equipment."
- 3) Contents of Manual. This portion of the introduction must explain that the manual is to contain complete operating, maintenance, and safety instructions for all equipment listed. It must also contain any other appropriate references as required to outline an explanation of the manuals and major categories of reference material required with the manuals.

b. Table of Contents

- 1) The table of contents must list numbers and titles of chapters, sections, and main paragraphs, with their page numbers. Each volume in a set of manuals must contain its own table of contents. Publications containing 10 or more illustrations or tables must include a list of illustrations or tables, as applicable. These lists must show number, title, and page number of each illustration and table. Following is a typical table of contents:

- a. Doors
  - 1.) Specialized hardware
- b. Electrical Systems
  - 1.) Incoming Service
  - 2.) Electrical power distribution
  - 3.) Lighting and lighting controls
- c. Miscellaneous Building Equipment

2. Part II. Operating Sequence and Procedures

- a. Contents: Each chapter must describe the procedures necessary for City personnel to operate the system and equipment covered in that chapter.
- b. Operating Procedures:
  - 1) Startup: Give complete instructions for energizing the equipment and making initial settings and adjustments whenever applicable.
  - 2) Operation: Give detailed instructions in proper sequence for each mode of operation.
  - 3) Emergency Operation: If some functions of the equipment can be operated while other functions are disabled, give instructions for operations under these conditions.

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- 4) Shutdown: Include instructions for stopping and securing the equipment after operation. If a sequence is required, give step-by-step instructions in that order.

3. Part III. Maintenance Instructions and Requirements

- a. Contents: Each chapter must describe the procedures necessary for City personnel to perform the maintenance on the systems and equipment covered in that chapter. Emphasis must be placed on the method of mechanical control of systems and equipment from a maintenance standpoint.
- b. Manufacturers' Brochures: Include manufacturers' descriptive literature covering devices used in the system, together with illustrations, exploded views, and renewal parts lists. This section must also include special devices manufactured by the Contractor.
- c. Special Maintenance: Provide information of a maintenance nature covering warranty items that have not been discussed elsewhere.
- d. Warranty: Include a copy of the "special" or extended warranty in the operation and maintenance manual.

E. Submittal, In both "hard" and electronic flash drive format:

1. Preliminary Submittal: Two draft copies of the completed manuscript for items in this outline must be submitted to the City Engineer for review within 30 days after approval of equipment to be provided. One copy will be returned to the Contractor within 15 days after submittal and, if required, must be revised, and resubmitted within 15 days.
2. Final Submittal: four complete sets of manuals must be furnished to the Engineer not later than 30 days before completion of the project.
3. Final Submittal must be accepted by the Engineer before training can begin.

1.2 Other Closeout Submittals

- A. Additional requirements for Systems Manuals, Operating Instructions, Training, and other deliverables are contained in individual Specification Sections. All closeout requirements must be provided to and accepted by the Engineer prior to requesting final payment. Examples of additional closeout requirements include, but are not limited to, the following

1. Final Punch-List with all items certified as complete.
2. Record "As Built" Drawings, the Contractor shall submit certified As-Built Record Drawings and Specifications in the quantities and media specified.
3. Warranty, the Contractor shall submit all transferable guarantees and warranties for equipment, materials and installations furnished by any manufacturer, supplier, or installer.
4. Wiring Diagrams.
5. Shop Drawings and Product Data.
6. Fixture Lamping schedule.
7. Signed Asbestos and Lead-Based Paint Certificate.

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8. Survey Report.
9. Material Safety Data Sheets
10. Signed and sealed Contractor Release of Claims.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

**END OF SECTION**



## **SECTION 01 7836 WARRANTIES**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. This Section includes administrative and procedural requirements for warranties, including manufacturers and installers' standard warranties on products and special product warranties.
  - 1. Refer to the General Conditions for terms of the guarantee period for the Work.

#### **1.2 RELATED REQUIREMENTS**

- A. Section 01 6000 - Product Requirements.
- B. Section 01 7329 - Cutting and Patching.
- C. Section 01 7704 – Closeout Procedures and Training.

### **PART 2 - PRODUCTS (Not applicable)**

### **PART 3 - EXECUTION**

#### **3.1 WARRANTY REQUIREMENTS**

- A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties shall not relieve CONTACTOR of the warranty of the Work incorporating such materials, products, and equipment. Manufacturer's disclaimers and limitations on warranties do not relieve suppliers, manufacturers, installers, and Subcontractors of the requirement to countersign special warranties with CONTRACTOR.
- B. Standard warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to OWNER.
- C. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for OWNER.
- D. Related Damages and Losses: When correcting failed or defective warranted Work, remove and replace Work that has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of warranted Work.

## **SECTION 01 7836 WARRANTIES**

- E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement with the reinstated warranty equal to the original warranty.
- F. Replacement Cost: Upon determination the Work covered by a warranty has failed and/or is defective, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. CONTRACTOR is responsible for the cost of replacing or rebuilding defective Work regardless of whether OWNER has benefited from use of the Work through a portion of its anticipated useful service life.
- G. OWNER Recourse: Expressed warranties made to OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which OWNER can enforce such other duties, obligations, rights, or remedies.
- H. Rejection of Warranties: The Project Engineer reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
- I. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, Project Engineer reserves the right to refuse to accept the Work until CONTRACTOR presents evidence the entities required to countersign such commitments have done so.

### **3.2 SUBMITTALS**

- A. Submit written preliminary warranties prior to Substantial Completion and final warranties prior to Contract Completion. If the certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, submit written warranties as set forth in the certificate of Substantial Completion.
  - 1. When a designated portion of the Work is partially used and/or occupied by OWNER, submit properly executed warranties to ARCHITECT within fifteen days of the Partial Use or Occupancy of the designated portion of the Work.
- B. When the Contract Documents require CONTRACTOR, or CONTRACTOR and a Subcontractor, installer, supplier or manufacturer to execute a special warranty, prepare a written document containing appropriate terms and identification, ready for execution by the required parties. Submit a draft to Project Engineer, through the ARCHITECT, for approval prior to final execution.
  - 1. Refer to Divisions 02 through 49 for specific content requirements and particular requirements for submitting special warranties.

**SECTION 01 7836**  
**WARRANTIES**

- C. Form of Submittal: Prior to Contract Completion, compile two copies of each required final warranty properly executed by CONTRACTOR, or by CONTRACTOR and Subcontractor, installer, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Specifications.
- D. Bind warranties and bonds in heavy-duty, commercial-quality, durable three ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8½ by 11 paper.
  - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the item or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the installer.
  - 2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title and/or name, and name of CONTRACTOR.
  - 3. When warranted Work requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

**END OF SECTION**

**SECTION 02 4116  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Furnishing labor, materials, and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, or required for completion of the Work. Includes items such as the following:
  - 1. Protection of existing improvements to remain.
  - 2. Cleaning existing improvements to remain.
  - 3. Disconnecting and capping utilities.
  - 4. Removing debris, waste materials, and equipment.
  - 5. Removal of items for performance of the Work.
  - 6. Salvageable items to be retained by the Owner.
- B. Related Requirements:
  - 1. Division 01 - General Requirements.
  - 2. Section 01 1100 - Summary of Work.
  - 3. Section 01 5000 - Construction Facilities and Temporary Controls.
  - 4. Section 01 7329 - Cutting and Patching.
  - 5. Section 01 7419 - Construction and Demolition Waste Management.
  - 6. Division 22 — Plumbing.
  - 7. Division 23 — HVAC.
  - 8. Division 26 — Electrical.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings indicating the extent of items and systems to be removed. Indicate items to be salvaged or items to be protected during demolition. Indicate locations of utility terminations and the extent of abandoned lines to be removed. Include details indicating methods and location of utility terminations.

**1.3 QUALITY ASSURANCE**

- A. Perform the Work of this section by workers skilled in the demolition of buildings and structures. Perform the Work of this section under direct superintendence at all times.
- B. Prior to commencement of Work, schedule a walkthrough with the City, to confirm City property items have been removed from scheduled Work areas. Identify and mark remaining property items and schedule their removal.
- C. Coordinate demolition for the correct sequence, limits, and methods. Schedule demolition Work to create least inconvenience to the public and facility operations.
- D. Related Standard: ANSI/ASSE A10.6.

## **SECTION 02 4116 DEMOLITION**

### **1.4 PROJECT CONDITIONS**

- A. Drawings may not indicate in detail all demolition Work to be performed. Examine existing conditions to determine the full extent of required demolition.
- B. Repair damage to existing improvements or damage due to excessive demolition.
- C. Provide all measures to avoid excessive damage from inadequate or improper means and methods, improper shoring, bracing or support.
- D. If conditions are encountered that varies from those indicated, promptly notify the Architect for clarification before proceeding.

### **PART 2 - PRODUCTS**

#### **2.1 HANDLING OF MATERIALS**

- A. Items scheduled for salvage by the City shall be delivered to a location designated by the City. Items shall be cleaned, packaged, and labeled for storage.
- B. Items scheduled for reuse shall be stored on the Project site and protected from damage, theft, and other deleterious conditions.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Protection:
  - 1. Do not commence demolition until safety partitions, barricades, warning signs and other forms of protection are installed. Refer to Section 01 50 00 - Construction Facilities and Temporary Controls.
  - 2. Provide safeguards, including warning signs, lights, and barricades, for protection of workers, occupants, and the public.
- B. If safety of existing construction is endangered, take immediate measures to correct such conditions; cease operations and immediately notify the City.

#### **3.2 DEMOLITION**

- A. Do not throw or drop materials. Furnish ramps or chutes as required by the Work.
- B. Remove existing construction only to extent necessary for proper installation of Work and interfacing with existing construction. Cut back finished surfaces to straight, plumb, or level lines as required for a smooth transition.
- C. Where openings are cut oversize or in improper locations, replace or repair to required condition.

#### **3.3 CUTTING EXISTING CONCRETE**

- A. Cutting of existing concrete shall be performed by skilled workers familiar with the requirements and space necessary for placing concrete. Perform concrete cutting with concrete cutting wheels and hand chisels. Do not damage concrete intended to remain.
- B. Extent of cutting of structural concrete shall be as indicated on Drawings. Cutting of non-structural concrete shall be as indicated on Drawings or as reviewed by the Architect or structural engineer. Replace concrete demolished in excess of amounts indicated.

**SECTION 02 4116  
DEMOLITION**

- C. Prior to cutting or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.

**3.4 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES**

- A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of the Work. Remove abandoned lines and cap unused portions of existing lines.

**3.5 REMOVAL OF OTHER MATERIALS**

- A. Woodwork: Cut or remove to a joint or panel line.
- B. Sheet Metal: Remove back to joint, lap, or connection. Secure loose and unfastened ends or edges and provide a watertight condition. Re-seal as required.
- C. Glass: Remove broken or damaged glass and clean rebates and stops of glazing channels.
- D. Modular materials such as acoustical ceiling panels, resilient tile, or ceramic tile: Remove to a natural joint without leaving damaged or defective Work where joining new Work. After flooring removal, clean substrates to remove setting materials and adhesives.
- E. Gypsum Board: Remove to a panel joint line on a stud or support line.
- F. Remove existing improvements not specifically indicated or required but necessary to perform Work. Cut to clean lines, allowing for installation of Work.

**3.6 PATCHING**

- A. Patch or repair materials to remain when damaged by the performance of the Work of this section. Finish material and appearance of patch and/or repair Work shall match existing.

**3.7 CLEANING**

- A. Clean existing materials to remain with appropriate tools and equipment.
- B. Protect existing improvements during cleaning operations.
- C. Debris shall be dampened by fog water spray prior to transporting by truck.
- D. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.
- E. Remove waste and debris, other than items to be salvaged. Turn over salvaged items to City, or store and protect them for reuse where required. Continuously clean up and remove items as demolition Work progresses.
- F. Remove rubbish, debris, and waste materials and legally dispose of them off the Project site.

END OF SECTION

**SECTION 03 1000**  
**CONCRETE FORMING AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Formwork for cast-in-place concrete as indicated.
2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 03 2000: Concrete Reinforcing.
3. Section 03 3000: Cast-In-Place Concrete.
4. Section 03 3543 – Bonded Abrasive Polished Concrete Floors
5. Section 03 3053 – Miscellaneous Concrete.

**1.2 REFERENCES**

**A. American Concrete Institute (ACI) Publication:**

1. ACI 318 – Building Code Requirements for Structural Concrete, Chapter 6, Formwork, Embedded Pipes, and Construction Joints.
2. ACI 347 – Guide to Formwork for Concrete.

**B. American Plywood Association (APA):**

1. Form No. V345 - Concrete Forming Design/Construction Guide.

**C. National Institute of Standards and Technology (NIST):**

1. NIST Voluntary Product Standard PS 1

**D. The Standard Specifications for Public Works Construction, “Greenbook,” latest edition, is referenced as if herein contained and the Contractor shall keep a copy at the project site. These Specifications shall supersede conflicts with information given in the “Greenbook,” unless otherwise determined by the City.**

**1.3 QUALITY ASSURANCE**

- A. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
- B. Manufacturer's directions, specifications, and detailed drawings shall be followed in all cases where articles used furnish directions covering points not delineated on the Plans or Specifications.
- C. The work included in this Section shall be done to the satisfaction of the Engineer. The decision by the Engineer as to the true construction meaning of the Plans and Specifications will be final

**1.4 SUBMITTAL**

- A. Submit detailed structural calculations and drawings approved and signed by a California registered Civil Engineer where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure

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exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or where provision for vehicular traffic through falsework or shoring occurs. For all other falsework and shoring submit layout signed by California registered Civil Engineer, manufacturer's authorized representative or a licensed contractor experienced in the usage and erection of falsework and vertical shoring. A copy of the plans and calculation shall be available at the jobsite at all times.

- B. Shop Drawings: Submit Shop Drawings indicating locations of forms, construction and expansion joints, embedded items, and accessories.
- C. Product Data: Submit manufacturer's Product Data for form materials and accessories.

**1.5 REGULATORY REQUIREMENTS**

- A. California Building Code (CBC), Chapter 19A.
- B. California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 4, Construction Safety Orders, Article 6, Excavations, Sections 1713 and 1717.

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Storage shall prevent damage and permit access to materials for inspection and identification.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.
- B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.
- C. Plywood: NIST Voluntary Product Standard PS 1, Group 1, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.
- D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Nox-crete", or equal.
- E. Tube Forms: Sonoco "Seamless Sonotubes," Ceme-Tube, Quik-Tube, or equal, of the type leaving no marks in concrete, one-piece lengths for required heights.
- F. Joist Forms: Code recognized steel or molded plastic types as required.
- G. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.
- H. For Exposed Concrete Finish:
  - 1. Plywood: New, waterproof, synthetic resin bonded, exterior type Douglas fir or Southern pine plywood manufactured especially for concrete formwork



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and conforming to NIST Voluntary Product Standard PS 1, Grade B-B grade, Class I.

2. Glass-Fiber-Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surfaces.
  3. Steel: Minimum 16 gage sheet, well matched, tight fitting, stiffened to support weight of concrete, without deflection detrimental to tolerances and appearances of finished concrete surfaces.
  4. Plywood: "Finland Form," "Combi Form" by North American Plywood Corporation, "Plyform" by Roy O. Martin, "ProForm" by Pacific Wood Laminates, or equal. The material shall be furnished with hard smooth birch face veneers with phenolic resin thermally fused onto panel sides. Edges shall be factory sealed.
- I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1 1/2-inch of concrete surface.
  - J. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Edoco/Dayton Superior, "Cast-Off" by Sonneborn/BASF Building Systems or equal. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.
  - K. Form Liner: Rigid or resilient type by L.M. Scofield, Symons, Greenstreak, or equal.
  - L. Void Forms: Manufactured by SureVoid Products, Inc., Sonotube, Void Form International, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.
  - M. Where finish concrete is below grade, plywood or sawed lumber formwork shall be constructed of substantial material as selected by the Contractor.
  - N. Where finished concrete is above grade and scheduled to be exposed, use Plyform Class I and II B-B, EXT-DFPA.
  - O. Form coating shall be a non-grain-raising and non-staining type that will not leave residual matter on the surface of the concrete or adversely affect bonding to concrete of paint, plaster, or other applied materials.
  - P. Portland cement shall be Type V, ion alkali and shall conform to ASTM C150.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged.
- B. Use form coating at all surfaces in contact with concrete.

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**CONCRETE FORMING AND ACCESSORIES**

- C. All concrete above grade shall be cast in plywood or sawed lumber forms.
- D. Concrete below grade may be poured directly against earth in open trenches.
- E. All forms shall be constructed true to line and level, sufficiently tight to prevent leakage of mortar, and shall conform exactly to the dimensions of the finished concrete as shown on the drawings. Forms for curved surfaces shall be so constructed and placed that the finished surface shall not deviate from the arc of the curve; flat spots will not be accepted.
- F. Where studs in formwork are spaced not over 12" o.c., 5/8" minimum plywood must be used. Where studs are spaced not over 16" o.c., 3/4" minimum plywood must be used.
- G. Place long dimension of plywood sheets perpendicular to direction of studs.
- H. Forms and metal reinforcement shall be checked and approved by the Engineer before concrete is placed.

**3.2 TOLERANCES**

- A. Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 feet length with a straightedge shall per ACI 347, Table 3.1:

| Class of Surface |          |          |        |
|------------------|----------|----------|--------|
| A                | B        | C        | D      |
| 1/8 inch         | 1/4 inch | 1/2 inch | 1 inch |

- 1. Class A: Use for concrete surfaces prominently exposed to public view.
- 2. Class B: Use for coarse-textured concrete-formed surfaces intended to receive plaster, stucco, or wainscoting.
- 3. Class C: Use as a general standard for permanently exposed surfaces where other finishes are not specified.
- 4. Class D: Use for surfaces where roughness is not objectionable and will be permanently concealed.

**3.3 ERECTION**

- A. Plywood must be installed with horizontal joints level, vertical joints plumb and with joints tight. Back joints by studs or solid blocking, and fill where necessary for smoothness. Reused plywood shall be thoroughly cleaned, damaged edges or surfaces repaired and both sides and edges oiled with colorless form oil. Nail plywood along edges, and to intermediate supports, with common wire nails spaced as necessary to maintain alignment and prevent warping.
- B. Openings for Cleaning: Provide temporary openings at points in formwork to facilitate cleaning and inspection. At base of walls and wide piers, bottom form board on one face for entire length shall be omitted until form has been cleaned and inspected.

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**CONCRETE FORMING AND ACCESSORIES**

- C. Chamfers: Provide 3/4 inch by 3/4 inch chamfer strips for all exposed concrete corners and edges unless otherwise indicated.
- D. Reglets and Rebates: As specified in Section 03 30 00: Cast-In-Place Concrete.

**3.4 REMOVAL OF FORMS**

- A. Forms shall not be removed until concrete is sufficiently hydrated to maintain its integrity and not be damaged by form removal operations. Unless noted otherwise and/or permitted by the Architect, columns and wall forms shall not be removed in less than five days, floor slabs in less than seven days, beams, and girders in less than 15 days, pan forms for joists may be removed after three days, but joist centering shall not be removed until after 15 days, and ramp, landing, steps, and floor slabs shall not be removed in less than seven days. Shoring shall not be removed until member has acquired sufficient strength to support its weight, load upon it, and added load of construction.
- B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens' representative of concrete location or members, as specified in Section 03 30 00: Cast-In-Place Concrete.

| ITEM                                          | FORMS  | SHORING |
|-----------------------------------------------|--------|---------|
| Sides of walls and edge of slabs and footings | 3 days | 5 days  |

**3.5 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**3.6 CLEAN UP**

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**END OF SECTION**

## SECTION 03 2000 CONCRETE REINFORCEMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Reinforcing steel bars.
  - 2. Reinforcement accessories.
- B. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
  - 1. Section 03 3000 - Cast-in-Place Concrete: Coordination between concrete placement and reinforcing.

#### 1.2 REFERENCES

- A. American Concrete Institute (ACI):
  - 1. ACI 301 - Structural Concrete for Buildings.
  - 2. ACI 318 - Building Code Requirements for Reinforced Concrete.
  - 3. ACI SP-66 - American Concrete Institute - Detailing Manual.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 184 - Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
  - 2. ASTM A 615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
  - 3. ASTM A 704 - Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
- C. American Welding Society (AWS):
  - 1. AWS D 1.4 – Structural Welding Code for Reinforcing Steel.
- D. Concrete Reinforcing Steel Institute (CRSI):
  - 1. CRSI - Manual of Practice.
  - 2. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.
  - 3. CRSI 65 - Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

#### 1.3 SUBMITTALS

- A. Submittal Procedures:
  - 1. Shop Drawings: Indicate bar sizes, spacing's, locations, and quantities of reinforcing steel [and wire fabric, bending and cutting schedules, and supporting and spacing device. Include special reinforcement required for openings through concrete structures.

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CONCRETE REINFORCEMENT**

2. Assurance/Control Submittals.
  - a. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - b. Submit certified copies of mill test report of reinforcement materials analysis.
3. Weld Procedure Specifications: Provide for bars to be welded in accordance with AWS D1.4-11
4. All WPS's shall be submitted to the Structural Engineer of Record (SEOR) for review and approval prior to use.
5. For WPS's that have been qualified by test, the supporting Procedure Qualification Record (PQR) shall be submitted to the Engineer for review and approval.

**1.4 QUALITY ASSURANCE**

- A. Perform Work in accordance with CRSI 63, 65 and Manual of Practice ACI 301, ACI SP-66, ACI 318, and ASTM A 184.
- B. Reinforcement design is provided by the Structural Engineer of Record, experienced in design of this work, and licensed in the State where the Project is located.
- C. Source Quality Control: Testing Laboratory shall perform following conformance testing, shall select test samples of bars, ties, and stirrups from the material at the site or from place of distribution, each sampling including at least two 18" long pieces, and perform the following tests in accordance with ASTM A706.
- D. Identified Bars: If samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with Identification Certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when samples are selected.
- E. Unidentified Bars: When positive identification of reinforcing bars cannot be made and when random samples are obtained; perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.
- F. Certification of Welders: All welding both in shop and in field shall be performed by certified welding operators per AWS D1.4.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Comply with pertinent provisions of Division 01 Section 01 60 00 "Product Requirements," delivering materials in a timely manner to ensure uninterrupted progress.
- B. Bundle bars, tag with identification, transport, and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

**SECTION 03 2000  
CONCRETE REINFORCEMENT**

**1.6 EXTRA MATERIAL:**

- A. Provide an allowance of an additional 10% of the total reinforcing steel tonnage in addition to quantities shown on drawings. This additional steel shall be installed at the discretion of, and in the locations directed by the Structural Engineer. Provide unit price for the purpose of adjusting contract price to reflect quantity of extra material actually used. All unused material shall be credited to the City based upon the agreed unit prices.

**PART 2 - PRODUCTS**

**2.1 STEEL REINFORCEMENT**

- A. Reinforcing Steel: ASTM A 706, 60 ksi yield grade; deformed billet steel bars, unfinished.
- B. Reinforcing bars for welding: ASTM A706, Grade 60.
- C. Reinforcing mesh: ASTM A185, mesh size and gauge as shown 60 ksi minimum tensile strength. Provide mesh in flat sheets only.
- D. Tie wire: ASTM A82, Annealed copper-bearing steel, 16 gauge minimum.
- E. Chairs and similar support items:
  - 1. Standard manufactured products conforming to Concrete Reinforcing Steel Institute, "Manual of Standard Practice," latest edition.
- F. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.
- G. Welding electrodes: AWS D1.4-11, Table 5.1 and Table 5.3, low hydrogen electrodes, E8018 for A706 Grade 60 steel.

**2.2 ACCESSORIES**

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor barrier puncture.
- C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic coated steel type (CRSI, Class 1) or stainless steel protected (CRSI, Class 2); size and shape as required.

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**CONCRETE REINFORCEMENT**

**2.3 FABRICATION**

- A. Comply with Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice," latest edition, for fabrication of reinforcing steel.
- B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are subject to rejection. Use only tested and approved bar materials.
- C. Welding: Use only ASTM A706 steel where welding is proposed. Perform welding, where shown or approved, by the direct electric arc process in accordance with AWS D1.4-11 using specified low-hydrogen electrodes. Preheat 6" each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is prohibited. Do not tack weld bars. Welding shall not be done on or within two bar diameters of any bend portion of the bar that has been bent cold. Welding of crossing bars shall not be permitted for assembly of reinforcement unless authorized by the Engineer. Clean metal surfaces to be welded of all loose scale and foreign material. Clean welds each time electrode is changed, and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds found defective with chisel and replace with proper welding. Fillet welds may be considered prequalified per AWS D1.4, section 6.1.2. Other welds are to be qualified per AWS D1.4, section 6.1.2. . Where ASTM A615 steel is to be used or occurs in existing elements and is to be welded, complete chemical analyses shall be performed to determine chemical composition and, for new bar, provided in the mill certifications to determine weldability in accordance with ACI 318 Section 3.5.2 with modifications per AWS D1.4. The carbon equivalency (CE) shall be clearly defined and bars with a CE above 0.75 shall not be welded. Welding Procedure Specifications and supporting Procedure Qualification Records with required testing per AWS D1.4, shall be provided for review and approval prior to welding. These WPS's and PQR's shall be specific to the CE as determined above, and shall, in addition to the other AWS requirements, include minimum and maximum preheat and interpass temperatures that are specific to the CE. This preheat and interpass temperature shall be strictly enforced in the field. If separate shipments of bars vary the weldability, the process listed in the requirements above shall be repeated for these new bars.
- D. Prequalification of welds shall be in accordance with AWS D1.4.

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CONCRETE REINFORCEMENT**

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verification of Conditions: Verify that field measurements, surfaces, and conditions are as required, and ready to receive Work.
- B. Report in writing to the Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**3.2 PLACEMENT**

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Do not displace or damage vapor barrier.
- C. Accommodate placement of formed openings.
- D. Maintain concrete cover around reinforcing in accordance with ACI 318.

**3.3 FIELD QUALITY CONTROL**

- A. Section 01 4000 - Quality Requirements: Field inspection.
- B. Inspect reinforcing locations, bar types and sizes, wire ties, and welding (if applicable).

**END OF SECTION**



**SECTION 03 3000  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Cast-in-place normal weight placement and finishing.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 03 1000: Concrete Forming and Accessories.
3. Section 03 2000: Concrete Reinforcing.
4. Section 07 2600: Vapor Barriers.

**1.2 REFERENCES**

**A. American Concrete Institute (ACI) Publication:**

1. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 – Specifications for Structural Concrete.
3. ACI 302.1R – Guide for Concrete Floor and Slab Construction.
4. ACI 305R - Specification for Hot Weather Concreting.
5. ACI 306.1 – Standard Specification for Cold Weather Concreting.
6. ACI 308R – Guide to External Curing of Concrete.
7. ACI 318 - Building Code Requirements for Structural Concrete, as modified by CBC Sections 1903A and 1905A.

**B. American Society for Testing and Materials (ASTM) Standards:**

1. ASTM C31 – Standard Specification for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulphate or Magnesium Sulphate.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

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8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C156 – Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete.
10. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete.
12. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
14. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
15. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
16. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
17. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
18. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.
19. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
20. ASTM C845 - Standard Specification for Expansive Hydraulic Cement
21. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
24. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
25. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
26. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
27. ASTM C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

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28. ASTM D1751 - Standard Test Method for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
29. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
30. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
31. ASTM E1155 - Standard Test Method for Determining  $F_F$  Floor Flatness and  $F_L$  Floor Levelness Numbers.
32. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
33. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
34. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
35. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
36. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probe.
37. ASTM F3010 – Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use under Resilient Floor Coverings.

**1.3 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.
- B. Mix Design Data: Submit concrete mix designs as specified herein and in Article 2.02.
  1. Submit name, address, and telephone number of the concrete production facility which the contractor intends to engage in designing the concrete mixes. Submit name and qualifications of the proposed concrete technologist.
  2. Mix Design: Submit a concrete mix design for each strength and type of concrete indicated in the drawings or specified. Include water/cement ratio, source, size and amount of coarse aggregate and admixtures. Predict minimum compressive strength, maximum slump, and air content percentage. Clearly indicate locations where each mix design will be used.
    - a. Water/cement ration for concrete slabs on grade shall be 0.50 maximum.

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3. Test Reports: Submit copies of test reports showing that the proposed mixes produce concrete with the strengths and properties specified. Include tests for cement, aggregates, and admixtures. Provide gradation analysis.
- C. Material Samples: Submit Samples illustrating concrete finishes and hardeners, minimum 12-inch by 12-inch.
- D. Certificates: Submit certification that each of the following conforms to the standards indicated:
  1. Portland cement: ASTM C150.
  2. Normal weight concrete aggregates: ASTM C33.
  3. Aggregates: Submit evidence that the aggregate is not reactive in the presence of cement alkalis. In the absence of evidence, aggregate shall be tested by one of the methods in ASTM C33 Appendix XI, Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. . Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official, in accordance with CBC Section 1903A5A.
  4. Curing materials: ASTM C171.
- E. Admixtures: Submit product data for proposed concrete admixtures.

**1.4 QUALITY ASSURANCE**

- A. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.
- B. Inspection shall be performed by a representative of a testing laboratory selected by the city. City will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.
- C. CONTRACTOR shall assist the testing laboratory in obtaining and handling samples at the project site and at the source of materials.
- D. Continuous batch plant inspection requirement may be waived in accordance with CBC Section 1705A.3.3.1. Waiver shall be in writing, including city approval. When batch plant inspection is waived by the city, the following requirements shall be met:
  1. Approved inspector of the testing laboratory shall check the first batching at the start of work and furnish mix proportions to the licensed weightmaster.
  2. Licensed weightmaster shall positively identify materials as to quantity and certify each load by a ticket.
  3. Tickets shall be transmitted to the Inspector by a truck driver with load identified thereon. The Inspector will not accept the load without a load ticket

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identifying the mix and will keep a daily record of placements, identifying each truck, its load and time of receipt and approximate location of deposit in the structure and will transmit a copy of the daily record to the city.

4. At the end of the project, the weightmaster shall furnish an affidavit to the city certifying that all concrete furnished conforms in every particular to proportions established by mixed designs.
- E. Special Inspections and Tests shall be in accordance with CBC Chapter 17A, Reinforcement and Anchor testing per CBC Section 1910A and Specification Section 01 45 23.

### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.
- B. Packaged materials shall bear the manufacturers and brand name label and shall be stored in their original unbroken package in a weather tight place until ready for use in the work.

### 1.6 PROJECT CONDITIONS

- A. Jobsite Requirements:
  1. Conform to ACI 305 R when placing concrete during hot weather.
  2. Conform to ACI 306 R when placing concrete during cold weather.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cement: ASTM C150. Portland Cement.
- B. Aggregates: Conform to the following standards:
  1. Normal weight concrete: ASTM C33.
  2. Lightweight concrete: ASTM C330, with fine aggregates per ASTM C33.
  3. Aggregate shall be tested for Potential Alkali Reactivity of Cement-Aggregate Combinations per ASTM C289.
  4. Nominal maximum size of coarse aggregate shall be no larger than:
    - a. 1/5 the narrowest dimension between sides of forms, nor
    - b. 1/3 the depth of slabs, nor
    - c. 3/4 the clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, or ducts.
    - d. CONTRACTOR may request the ARCHITECT, and the city waiver of the above limitations reported per ACI 318, provided that the workability and methods of consolidation are such that the concrete can be placed without honeycombs or voids.
- C. Water: Water for concrete mixes, curing and cleaning shall be potable and free from deleterious matter.

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- D. Admixtures: Shall be shown capable of maintaining the same composition and performance throughout the work as the product used in establishing concrete proportions in accordance with ACI 318, Section 3.6.
1. Admixtures containing chlorides or sulfides are not permitted.
  2. Air-entraining admixtures shall comply with ASTM C260. Air-entrained admixtures shall not be used for floor slabs to receive steel trowel finish.
  3. Admixtures for water reduction and setting time modification shall conform to ASTM C494.
  4. Admixtures for producing flowing concrete shall conform to ASTM C1017.
  5. Fly ash, pozzolan and ground granulated blast-furnace slag: Modify ACI 318 Sections 3.6.6 and 3.6.7 as follows:
    - a. Fly ash or other pozzolan used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
      - 1) Shall conform to ASTM C618 for Class N or F materials (Class C is not permitted).
    - b. Ground-granulated blast-furnace slag used as a partial substitution for ASTM C150 Portland cement shall meet the following requirements:
      - 1) Shall conform to ASTM C989.
  6. Admixtures containing ASTM C845 expansive cements shall be compatible with the cement and produce no deleterious effects.
  7. Silica fumes used as an admixture shall conform to ASTM C1240.
- E. Reinforcement Fibers: Chop strands of alkali-resistant polypropylene or nylon fibers added to the concrete mix for protection against shrinkage cracks.
- F. Expansion Joint Fillers: Preformed strips, non-extruding, and resilient bituminous type, of thickness indicated, conforming to ASTM D1751.
- G. Curing:
1. Curing Paper: Shall conform to ASTM C171 and consist of two sheets of kraft paper cemented together with a bituminous material in which are embedded cords or strands of fiber running in both directions. The paper shall be light in color, shall be free of visible defects, with uniform appearance.
  2. Elevated slabs and slabs on grade may be cured at CONTRACTOR's option with curing and proactive water vapor emission and alkalinity control system. Products shall be approved by the city.
    - a. VaporSeal 309, by Floor Seal Technology, Inc., or equal.
      - 1) ASTM C156: 0.39 kg/m<sup>2</sup>.
      - 2) ASTM C309: Exceeds requirements.
      - 3) ASTM C1315: Exceeds requirements.

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- 4) ACI 308R-01 Compliant.
- b. Remedial Treatment: Water vapor emission and alkalinity control treatment, MES 100 by Floor Seal Technology, Inc. or equal.
  - 1) ASTM E96: <0.1 Perms.
  - 2) ASTM D1308: 14pH Resistant.
  - 3) ASTM D7234: 500+psi 100% concrete failure.
  - 4) ASTM F2170: 100%RH resistant.
  - 5) VOC Content: <100 g/L, meets SCAQMD Rule #1113.
  - 6) ASTM F3010: Meets Requirements.
- c. Self-leveling Compounds: Ardex Engineered Cements, K15, or V1200, Schonox ZM Rapid, US Self Leveler Armstrong, S-194, or equal.
- H. Floor Hardener: Water soluble, inorganic, silicate-based curing, hardening, sealing, and dustproofing compound. Aquaseal W20 by Monopole Inc., Kure-N-Harden by BASF, Chem Hard by L&M, Liqui-Hard by W. R. Meadows, or equal.
- I. Underlayment: Two component latex underlayment for filling low spots in concrete for both interior and exterior applications, from featheredge to a maximum of 3/8 inch in thickness. Underlayment shall be non-shrink and suitable for repairing exposed concrete surfaces and for underlayment of carpet, resilient, tile and quarry floor coverings. La-O-Tex by TexRite, Underlay C, RS by Mer-Krete Systems, Underlayment 962 by C-Cure, or equal.
- J. Vapor Barrier: Refer to Section 07 2600, Vapor Barriers.
- K. Stair Treads and Nosings: Two part stair tread and nosing with ribbed abrasive bars. Fabricated from 6063-T5 or 6063-T6 extruded aluminum, mill finish. Anti-slip abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Color shall extend uniformly throughout filler.
  - 1. American Safety Tread: TP-311R.
  - 2. Balco Inc.: DST-330.
  - 3. Nystrom: STTB-P3.375E.
  - 4. Wooster Products Inc.: WP-RN3SG.
  - 5. Equal.
- L. Grout: ASTM C1107, non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 7 days; of consistency suitable for application and a 30 minute working time.

**2.2 CONCRETE MIX**

- A. Mix shall be signed and sealed by a Civil or Structural Engineer currently registered in the State of California.

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- B. Strength of Concrete: Strengths and types of concretes shall be as indicated in the Drawings. Unless otherwise indicated or specified, concrete shall be provided with minimum 28-day strength of 3000 psi (f'c).
- C. Concrete mix shall meet the durability requirements of ACI 318, Chapter 4.
- D. Concrete proportioning shall be determined on the basis of field experience and/or trial mixtures shall in accordance with ACI 318, Section 5.3. Proportions of materials shall provide workability and consistency to permit concrete to be placed readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.
- E. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ASTM C94.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Surfaces to receive concrete shall be free of debris, standing water, and any other deleterious substances before start of concrete placing.
- B. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the Inspector at least 24 hours before placing concrete; do not place concrete until inspected by the Project Inspector.
- C. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by city inspector and the ARCHITECT.

**3.3 PREPARATION**

- A. For installation of vapor barrier refer to Section 07 2600, Vapor Barriers.
- B. Reglets and Rebates:
  - 1. Form reglets and rebates in concrete to receive flashing, frames, and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.
  - 2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

**3.4 INSTALLATION**

- A. Conveying and Placing:



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1. Concrete shall be placed only under direct observation of the Project Inspector. Do not place concrete outside of regular working hours unless the Inspector has been notified at least 48 hours in advance.
2. Concrete shall be conveyed from mixer to location of final placement by methods that will prevent separation or loss of materials.
3. Concrete shall be placed as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.
4. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.
5. Concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms.
6. Where conditions make consolidation difficult or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

**B. Cold Weather:**

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. All ground with which concrete is to come in contact shall be free from frost. No frozen materials or materials containing ice shall be used.
2. The temperature of concrete at the time of placement shall not be below the minimum temperatures given in Table 3.1 of ACI 306.1.
3. Concrete shall be maintained at a temperature of at least 50° F. for not less than 72 hours after placing or until it has thoroughly hardened. Cover concrete and provide sufficient heat as required. When necessary, aggregates shall be heated before mixing. Special precautions shall be taken for protection of transit-mixed concrete.

**C. Hot Weather:**

1. Concrete to be placed during hot weather shall comply with the requirements of ACI 318, Section 5.13.
2. Maintain concrete temperatures indicated in Table 2.1.5 of ACI 305R to prevent the evaporation rate from exceeding 0.2 pound of water per square feet of exposed concrete per hour.
3. Cool concrete using methods indicated in ACI 305R Appendix B.
4. Place and cure concrete as specified in ACI 305R Chapter 4.

**D. Compaction and Screeding:**

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1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.
  2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.
- E. Floating and Troweling:
1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply fine mist of water frequently with an atomizing type of fog sprayer. Omit troweling for slabs to receive a separate cement finish.
  2. For interior finish slabs, final troweling shall provide hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within tolerances indicated in Article 3.02. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

**3.5 CURING**

- A. Length of time, temperature and moisture conditions for curing concrete shall be in accordance with ACI 318, Section 5.11.
- B. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.
- C. If weather is hot or surface has dried out, spray surface of concrete slabs and pavement with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.
- D. Immediately after finishing, monolithic floor slabs shall be covered with curing paper. Paper shall be lapped 4 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.
- E. When curing slabs with proactive water vapor emission and alkalinity control system:
  1. Coordinate and schedule application of curing compound with concrete pour schedule, while conforming to manufacturer's application instructions.
  2. When the surface of the concrete has hardened sufficiently to sustain foot traffic pre-cure slabs with liquefied product application following manufacturer's written instructions. Application shall be by trained applicators.

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3. Monitor Environmental Conditions: Set up weather station 20 to 30 inches above freshly placed concrete. Record temperature, humidity, and wind velocity measurements at 15 minute maximum intervals.
4. Calculate Evaporation Rate: Use recorded weather information in combination with nomograph per ACI 308R, Figure 4.1, Guide to Curing Concrete, to evaluate relevant evaporation rate.
5. When the bleed water rate of the concrete is equal to the surface water evaporation rate, spray curing compound material throughout surface of slabs and decks, following manufacturer's written instructions. Application shall be by trained applicators.
6. Perform the following tests at least 28 days after placement of concrete and prior to floor covering installation. Submit to owner test results indicating locations that do not comply with scheduled flooring installation requirements.
  - a. Calcium chloride testing per ASTM F1869.
  - b. Relative humidity testing per ASTM F2170.
  - c. Alkalinity testing per ASTM F710.
  - d. Perform concrete bond layer humidity meter testing to determine substrate surface acceptability.
7. Areas emitting moisture and alkalinity at rates exceeding floor covering manufacturer's published ASTM F1869 limits, shall receive a corrective coating, at no cost to the city, as follows:
  - a) Mask and protect adjacent walls and floor surfaces from effects of scarification and application of remedial treatment.
  - b) Scarify slab surface in area of application by shot blasting or other method acceptable to corrective coating manufacturer.
  - c) Prepare and fill cracks, control joints, and cold joints.
  - d) Apply two-component modified epoxy penetrant and coating with roller and squeegee over required treatment area; saturate surfaces to ensure a through mechanical bond.
  - e) Clean and fill divots, chips, voids, and other surface irregularities with one hundred percent Portland cement based patching compound or cementitious fill.
  - f) Apply cementitious surfacing overcoating in areas to receive resilient and wood floor coverings to facilitate adhesion; apply to a thickness of 1/8 inch.

**3.6 FILLING, LEVELING AND PATCHING**

- A. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to require tolerances. Low spots shall

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be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

- B. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.
- C. Cement Base: Cement base shall be of height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemical inert mineral oxide pigment in the mix.

### 3.8 EXPANSION AND CONSTRUCTION JOINTS

- A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:
  - 1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
  - 2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wet and coated with a neat cement grout immediately before placing of new concrete.
  - 3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.
- B. Expansion Joints: Provide expansion joints that were indicated in walks and exterior slabs. Space approximately 20 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.
- C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

### 3.9 TESTING

- A. Molded Cylinder Tests:
  - 1. Inspector or testing lab personnel will prepare cylinders and perform slump tests. Samples for concrete strength shall be taken in accordance with ASTM C172. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

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2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of three days, seven days, and 28 days. A strength test shall be the average of the compressive strength of two cylinders, obtained from the same sample of concrete, and tested at 28 days or at test age designated for determination of  $f'_c$ .
  3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.
- B. Core Test: At request of the ARCHITECT, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C42.
1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the ARCHITECT.
  2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores in total for each Project.
  3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.
- C. Concrete Consistency: Measure consistency according to ASTM C143. Test twice each day or partial day's run of the mixer.
- D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, falls below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.
- E. Air Content Testing: Measure in accordance with ASTM C173 or ASTM C231, for each composite sample taken in accordance with ASTM C172.
- F. Defective Concrete:
1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the ARCHITECT and City inspector.
  2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood, or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work, shall be removed, and replaced.
- G. Concrete for Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall have a minimum  $f'_c = 3,000$  psi. Exposed concrete shall be provided with a hand trowel finish with radius corners and edges. Form and place concrete where necessary as described in Section 03 10 00 Concrete Forming and

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Accessories and reinforced as described in Section 03 20 00 Concrete Reinforcing. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch maximum aggregate.

3.10 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

3.11 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

**END OF SECTION**

**SECTION 03 3543**  
**BONDED ABRASIVE POLISHED CONCRETE FLOORS**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Section Includes: Products and procedures for bonded abrasive polished concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete polishing.

**1.2 DEFINITIONS**

- A. Terminology: As defined by Concrete Polishing Council (CPC) glossary.
- B. Polished Concrete: The act of changing a concrete floor surface, with or without surface exposure of aggregate, to achieve a specified level of appearance.
- C. Bonded Abrasive Polished Concrete: The multi-step operation of mechanically grinding, honing, and polishing a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of appearance as defined by the CPC.

**1.3 SUBMITTALS**

- A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.
- B. Installer Qualifications: Data for company, principal personnel, experience, and training specified in PART 1 "Quality Assurance" Article.
- C. Maintenance Data: For inclusion in maintenance manual required by Division 01.
  - 1. Include instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
  - 2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

**1.4 QUALITY ASSURANCE**

- A. Polisher Qualifications:
  - 1. Experience: Company that has successfully completed five projects similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
  - 2. Supervision: Maintain a competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman -

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Level I or higher by CPAA, CPC Craftsman, or equivalent.

3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.
- B. Field Mock-up/Sample: Before performing work of this Section, provide following field mock-up/sample to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents unless Architect specifically approves deviations in writing.
1. Form, reinforce, and cast concrete slab for 10-foot square field mock-up.
  2. Mock-up shall be representative of work to be expected.
  3. Perform grinding, honing, and polishing work as scheduled for Project using same personnel as will perform work for Project.
  4. Approval is for following aesthetic qualities:
    - a. Compliance with approved submittals.
    - b. Compliance with specified aggregate exposure class.
    - c. Compliance with specified appearance level.
    - d. Compliance with specified color.
  5. Obtain Architect's approval before starting work on Project.
  6. Protect and maintain approved field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
  7. Upon completion of mock-up; owner to review and approve desired outcome and sign off. Mock-up to be used as a reference throughout the polishing phases of the project.
- C. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
    - a. Owner.
    - b. Architect.
    - c. Contractor, including supervisor.
    - d. Concrete producer.
    - e. Concrete finisher, including supervisor.
    - f. Concrete polisher, including supervisor.
    - g. Technical representative of liquid applied product manufacturers.
  2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
    - a. Tour field mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
    - b. Review Contract Document requirements.
    - c. Review approved submittals and field mock-up.



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- d. Protection of concrete substrate during construction and prior to polishing process.
  - e. Project phasing and scheduling for each step of grinding, honing and polishing operations including, but not limited to:
    - i. Quality of qualified personnel committed to project.
    - ii. Quality and size of grinders committed to project.
    - iii. Proper disposal of concrete slurry and/or concrete dust.
  - f. Details of each step of grinding, honing, and polishing operations.
    - i. Application of color.
    - ii. Application of liquid applied products.
    - iii. Protecting polished concrete floors after polishing work is complete.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

**1.5 FIELD CONDITIONS**

- A. Damage and Stain Prevention: It is the responsibility of others to prevent damage and staining of concrete surfaces to be polished.
- 1. Prohibit the use of markers, spray paint, and soapstone.
  - 2. Prohibit improper application of liquid membrane film forming curing compounds.
  - 3. Prohibit vehicle parking over concrete surfaces.
  - 4. Prohibit pipe-cutting operations over concrete surfaces.
  - 5. Prohibit storage of any items over concrete surfaces for not less than 28 days after concrete placement.
  - 6. Prohibit ferrous metals storage over concrete surfaces.
  - 7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces.
  - 8. Protect from acids and acidic detergents contacting concrete surfaces.
  - 9. Protect from painting activities over concrete surfaces.
- B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

**PART 2 – PRODUCTS**

**2.1 LIQUID APPLIED PRODUCTS**

- A. Liquid Densifier: An aqueous solution of silicon dioxide dissolved in one of the following hydroxides that penetrates into the concrete surface and reacts with the calcium hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete.
- 1. Sodium Silicate

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2. Potassium Silicate
  3. Lithium Silicate
  4. Alkali solution of Colloidal Silicates or Silica
- B. Dye: Non-film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration of a concrete floor surface without a chemical reaction.
- C. Pigmented Micro Stains: Fine pigment particles suspended in water- based silicate solution that penetrates concrete and reacts with calcium hydroxide to lock in color particles.
- D. Acid Stain: Reactive solution of one or more metal salts stabilized by acid that produces coloration in a concrete substrate by neutralization of acid followed by precipitation of metal hydroxides or oxides.

## **2.2 ACCESSORIES**

- A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate.
- B. Material: Acceptable products shall be: **Clear Epoxy OR Vinyl Ester premium adhesion, light and translucent color, polishable, for laminating, seaming & chip repair such as Stone Pro or Approved Equal.**

## **2.3 POLISHING EQUIPMENT**

- A. Field Grinding and Polishing Equipment:
1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
  2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments to meet OSHA requirements.
  3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.
- B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces the same results, without noticeable differences, as field grinding and polishing equipment.
- C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.
- D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc.) that are attached to rotating heads to

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refine the concrete substrate.

1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e., hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, and thermoplastic-phenolic) that is attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.
4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

#### **A. Acceptance of Surfaces and Conditions:**

1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
  - a. Concrete finished floor flatness according to applicable

#### **B. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.**

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- C. Starting work within a particular area will be construed as acceptance of surface conditions.

**3.2 PREPARATION**

A. Cleaning New Concrete Surfaces:

1. Prepare and clean concrete surfaces.
2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

**3.4 COLORING CONCRETE FLOORS**

A. Dye or Pigmented Micro Stain Application:

1. Follow manufacturer's recommendation.

**3.5 POLISHING CONCRETE FLOORS**

- A. Perform all polishing procedures to ensure a consistent visual appearance from wall to wall.

B. Initial Grinding:

1. Use grinding equipment with metal or semi-metal bonded tooling.
2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Continue grinding until aggregate surface exposure matches approved field mock-up.

C. Treating Surface Imperfections:

1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
3. Work compound and treatment until color differences between concrete surface and filled surface imperfections, compared to mockup, are not noticeable when viewed from 20 feet away under lighting conditions that will be present after construction.

- D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow curing according to manufacturer's instructions.

E. Grout Grinding:

1. Use grinding equipment and appropriate grit and bond diamond tooling.

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2. Apply clear epoxy into cracks of the concrete slab to fill surface imperfections.
3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

**F. Honing:**

1. Use grinding equipment with hybrid or resin bonded tooling.
2. Hone concrete in one direction starting with 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

**G. Polishing:**

1. Use polishing equipment with resin-bonded tooling.
2. Begin polishing in one direction starting with 800 grit tooling.
3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of appearance has been achieved.
4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
6. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.
7. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

**H. Final Polished Concrete Floor Finish:**

1. Aggregate Exposure Class B – Fine Aggregate: Surface exposure of 85 to 95% fine aggregate and 5 to 15% cement fines and coarse aggregate based on visual observation of the overall area of the polished floor.
2. Appearance Level 3 – Polished:
  - a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
  - b. Measurement: Determine the Image Clarity Value, %, and the Haze Index:
    - 1) Image Clarity Value, %: An average value of 40 to 69 measured in accordance with ASTM D5767 prior to the application of sealers.
    - 2) Haze Index: An average value less than 10 measured in accordance with ASTM D4039 prior to the application of sealers.

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- 3) The minimum number of tests distributed across the polished surface should be three, for areas up to 1000 ft<sup>2</sup> and one additional test for each 1000 ft<sup>2</sup> or fraction thereof. This applies to both the Image Clarity Value and Haze Index.

**3.6 PROTECTION**

- A. Protection is the responsibility of others.

**END OF SECTION**

**SECTION 05 5000  
METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Steel Angle
- B. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

**1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A123, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
  - 2. ASTM A153, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
  - 3. ASTM A307, "Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."
  - 4. ASTM A568, "Specification for General Requirements for Steel Sheet, Carbon, and High-Strength, Low Alloy Hot-Rolled and Cold Rolled."
  - 5. ASTM A627, "Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications."
  - 6. ASTM A780, "Practice for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings."
- B. American Welding Society (AWS):
  - 1. AWS D1.1 - Structural Welding Code.
- C. Steel Structures Painting Council Specification (SSPC):
  - 1. Steel Structures Painting Manual.

**1.3 SUBMITTALS**

- A. Division 1 - Submittal Procedures: Procedures for submittals.
  - 1. Product Data:
    - a. Submit complete descriptive data for all stock items.
  - 2. Shop Drawings:
    - a. Prepare Shop Drawings under seal of professional structural engineer registered in state where Project is located for products requiring structural engineering.
    - b. Include profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories, erection drawings, elevations, welded connections using standard AWS welding symbol with net weld lengths.

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- c. Take field measurements prior to preparation of shop drawings and fabrication when possible. Allow for trimming and fitting whenever taking of field measurements before fabrication might delay construction.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Steel plates, angles, and other structural shapes shall conform to ASTM A36.
- B. Steel pipe shall conform to ASTM A53, Grade B, Schedule 40.
- C. Galvanized steel pipe and tube shall conform to ASTM A53.
- D. Steel Tubing shall conform to ASTM A500.
- E. Sheet Steel Galvanized: ASTM A446.
- F. Sheet and Strip Steel Hot Rolled: ASTM A568.
- G. Welding Materials: AWS D1.1; type required for materials being welded.
- H. Stainless Steel Sheet: ASTM A 240/A 240M, type 304 with #4 finish.
- I. Anchors
  - 1. Threaded Type Concrete Inserts: Galvanized malleable iron or cast steel capable of receiving 3/4-inch diameter machine bolts.
  - 2. Slotted Type Concrete Inserts: Welded box type fabricated with minimum 1/8-inch-thick galvanized pressed steel plate with slot to receive 3/4-inch diameter square head bolt and knockout cover.
  - 3. Expansion Shield for Masonry Anchorage: FS FF-2-325.
  - 4. Toggle Bolts: FS FF-B-588.
- J. Fasteners
  - 1. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
  - 2. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.
  - 3. Bolts, Round Head: ANSI B-18.5



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4. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
5. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-84.

K. Primers:

1. Primer for Painting: One of following:
  - a. Tnemec, Kansas City, MO, (816) 474-3400: No. 99 red primer.
  - b. Chessman-Elliot Company: Ceco No. 15 Primox.
  - c. Rowe Products, Inc.: No. 7-C-19.
  - d. Section 01 60 00 – Product Requirements. Substitutions: Permitted.
2. Touch-Up Primer for Galvanized Surfaces: FS TT-P-641.

**2.2 FABRICATION**

- A. Fabricate steel items according to approved shop drawings and to applicable portions of AISC Specifications. Conceal welds where possible; grind exposed welds smoothly and flush with adjacent finished surface. Ease exposed edges to small uniform radius.
- B. Pre-assemble products in shop to greatest extent possible. Disassemble units to extent necessary for shipping and handling. Clearly mark units for re-assemble and installation.
- C. For exposed to view fabrications, use materials which are smooth and free of surface blemishes including pitting, seams marks, roller marks, roller trade names, and roughness. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.
- D. Fabricate items with joints tightly fitted and secured.
- E. Fit and shop assemble in largest practical sections for delivery to Project site.
- F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
- G. Make exposed joints butt tight, flush and hairline.
- H. Fabricate anchorage and related components of same material and finish as metal fabrication, unless indicated otherwise.

**2.3 ROUGH HARDWARE**

- A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

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- B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

**2.4 MISCELLANEOUS STEEL TRIM**

- A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.
- B. Galvanize miscellaneous framing and supports in the following locations:
  - 1. Exterior locations.

**2.5 FINISHES, GENERAL**

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish metal fabrications after assembly.

**2.6 STEEL AND IRON FINISHES**

- A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
  - 1. ASTM A153 for galvanizing iron and steel hardware.
  - 2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning":
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

**2.7 SHOP PAINTING AND PROTECTIVE COATING**

**SECTION 05 5000  
METAL FABRICATIONS**

- A. Conform to Steel Structures Painting Council Specification 15-68T, Type 1, including preparation for painting.
- B. Hot-Dip galvanizing and zinc coatings applied on products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strips shall comply with ASTM Specification A123. Galvanized surfaces for which a shop coat of paint is specified shall be chemically treated to provide a bond for the paint. Except for bolts and nuts, all galvanizing shall be done after fabrication.
- C. Clean surfaces of rust, scale, grease, and foreign matter in accordance with SSPC SP-1 solvent cleaning, prior to finishing. Prepare surfaces for painting in accordance with SSPC-SP2 Hand Tool Cleaning, SSPC-SP3 Power Tool Cleaning or SSPC SP-7 Brush Off Blast Cleaning.
- D. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- E. Prime paint items scheduled with one coat.
- F. Protect aluminum surfaces in contact with steel with zinc chromate primer.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 7000 - Execution and Closeout Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- C. Report in writing to Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**3.2 PREPARATION**

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

## **SECTION 05 5000 METAL FABRICATIONS**

### **3.3 INSTALLATION**

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of *exterior* units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

### **3.4 ADJUSTING AND CLEANING**

- A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
  - 1. Apply it with brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

**END OF SECTION**

**SECTION 06 4023**  
**INTERIOR ARCHITECTURAL WOODWORK**

**PART 1 - GENERAL**

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Plastic-laminated cabinets.
  - 2. Plastic-laminate lockers and storage assemblies.
  - 3. Solid-surfacing-material countertops and splashes.
  - 4. Shop finishing of interior woodwork.
  - 5. Plastic-laminate paneling system.
- B. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

**1.3 DEFINITIONS**

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

**1.4 REFERENCES**

- A. American Woodworking Institute (AWI)
- B. Woodwork Institute of California (WIC)

**1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with WIC custom quality.

**1.6 SUBMITTALS**

- A. Product Data: Accessories and casework, high pressure decorative laminate, adhesive for bonding plastic laminate, solid surfacing material, 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. Drawings shall show each type of cabinet, with sufficient details to clearly indicate all features of construction and attachment to structure. Drawings will include, as minimum, the following:

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1. Show indication of material and grades.
2. Scaled plans or plan section of each item, showing location and layout of units with relation to surrounding walls, doors, windows, and other building components, fully dimensioned.
3. Scaled elevations of each cabinet type, fully dimensioned.
4. Scaled sections to clarify special conditions, and locations and details or anchorage.
5. Fixed dimensions, with provisions of insertion of field dimensions.
6. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
7. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.
8. Coordinate with other work involved and show on Shop Drawings.
9. Reproduction of Contract Documents to be used as Shop Drawings is not acceptable.
10. Conform to WIC custom grade, WIC Certificate not required. Provide compliance label to first page of Shop Drawings.
11. Keying Schedule: Indicate keying system for cabinet and fixture locks.

C. Samples for Initial Selection:

1. Plastic Laminates.
2. PVC edge material.
3. Thermoset decorative panels.
4. Solid-surfacing materials.

D. Samples for Verifications

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
2. Plastic Laminate Panel System, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.

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3. Solid-surfacing materials, 6 inches square.
4. Exposed cabinet hardware and accessories, one unit for each type and finish.

**1.7 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. Cabinets: Cabinets shall be handled carefully and set or stored inside on a level floor. Care shall be taken to protect exposed finished portions from bumping, scratching, etc. Under no circumstances shall cabinets or countertops be used for "work benches" or convenient places to store other materials.
  2. Countertops: Countertops shall be stacked flat, at least four inches off the floor, with protective covering under the bottom unit, and covered on top to protect surfaces from scratching. Strips of wood or other suitable materials shall be placed between tops. Care shall be taken to prevent breakage. Under no circumstance can hall countertops be stood or stacked on end against a wall where they can be broken or damaged by falling.
- B. Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the State's Representative and at no additional cost to the State.

Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

**1.8 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.
- B. Plumbing Fixture Coordination: Coordinate Shop Drawings and fabrication of countertops with sinks and lavatories specified in Division 22- "Plumbing."

**PART 2- PRODUCTS**

**2.1 MATERIALS**

- A. General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

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B. Wood Products: Comply with the following:

1. Softwood Plywood: DOC PS 1, Medium Density Overlay, 3/4 inch thick.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
  - a. Formica Corporation.
  - b. Lamin-Art, Inc.
  - c. Nevamar Company, LLC; Decorative Products Div.
  - d. Wilsonart International; Div. of Premark International, Inc.
  - e. Or Approved Equal.

D. Solid-Surfacing Material SS-1: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2. See section 06 6116.

E. Edge Bands:

3mm PVC banding at exposed edges and 1 mm PVC banding at semi-exposed edge ad case body to be machine applied with waterproof hot melt adhesive.

**2.2 CABINET HARDWARE AND ACCESSORIES**

A. General: Provide cabinet **heavy duty hardware** and accessory materials associated with architectural cabinets.

B. Frameless Concealed Hinges: BHMA A156.9, B01602, 107 degrees of opening (90-95 degrees at corners), self-closing and having passed 100,000 cycle tests.

1. Equal to: Blum Modul Hinge series with 170-degree opening.
2. Hinge shall have a lifetime warranty as offered by the hinge manufacturer.
3. Hinges shall be heavy duty wrap-around offset for overlay doors with non-removable pin.
4. Hinge shall not be clipping type.
5. Hinges shall be securely anchored to the cabinet and door. Do not screw hinges into holes drilled for adjustable shelf brackets.



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6. Number of hinges per door shall be as follows:
  - a. Door height 0"-36": 2 hinges per door
  - b. Doors greater than 36" high and locker doors: Provide heavy duty piano type or continuous hinges.
- C. Provide 4 types of heavy-duty sample of pulls for casework for architect approval.
- D. Catches: Magnetic catches, BHMA A156.9, C03141.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with self-rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with self-hold-down clip.
- G. Drawer Slides heavy duty type: BHA A156.9, B05091, side-mounted; full-extension type, zinc-plated steel ball bearing slides, equal to Accuride #7432, and rated for the following loads:
  1. File Drawer Slides: Grade 1HD-200 (200 lbf); for all drawers.
- H. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets, and matching plastic caps with slot for wire passage.
  1. Product: Subject to compliance with requirements, provide "SG series" by Doug Mockett & Company, Inc.
  2. Color: As selected by Architect from manufacturer's full range.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

Satin Chromium Plated: BHMA 626 for brass or bronze base; CHMA 652 for steel base.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- K. Bumpers: Provide rubber bumpers on inside corners of all doors to prevent laminate to laminate contact.
- L. Lock Keying: Cabinet lock to be coordinated with Owner for various tiers of security.

**2.3 MISCELLANEOUS MATERIALS**

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

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- 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.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 1. Wood Glues: 30g/L.
  - 2. Contact Adhesive: 250 g/L.
- E. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement or Contact cement.
- H. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

**2.4 FABRICATION, GENERAL**

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with 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 dimension, profiles and details indicated. Ease edge to radius indicated for the following:

Corners of Cabinets and Edges of Solid-Wood (Lumber) Members  $\frac{3}{4}$  inch thick:  $\frac{1}{8}$  inch.
- D. Complete fabrication, including assembly, finishing 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. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

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F. Shop-cut opening 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.

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

**2.5 PLASTIC-LAMINATE CABINETS**

A. Grade: Custom.

B. WI Construction Style: Style A, Frameless.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other Than Tops: Grade HGS.

2. Post formed Surfaces: Grade HGP.

3. Vertical Surfaces; Grade VGS.

4. Edges: PVC edge banding, 0.12-inch-thick, matching laminate in color, pattern, and finish.

F. Materials for Semi exposed Surfaces, including cabinet interior, interior door faces, and surface of shelving:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS, or cabinet liner.

a. Edges of Plastic-laminate shelves: PVC T-mold matching laminate in color, pattern, and finish.

b. For semi exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.

2. Drawer Sides and Backs: See Paragraph 2.4.I.(1).

3. Drawer Bottoms: See Paragraph 2.4.I.(2).

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

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H. Fabrication: Ends and Divisions: Cabinet ends and divisions shall be a minimum of 0.745" in thickness. The visible top edge of the ends of cabinets 6'-0" or more from the floor do not require an edge band but shall have all voids filled and sanded.

1. Joinery:

- a. All cabinet members shall be securely fastened together.
- b. All joints shall be securely glued.
- c. All exposed and semi-exposed joints shall be tight and true.
- d. To assemble cabinet bodies and components, the use of finish nails is allowed. They shall be a maximum of 4" on center (except face frames – 8" on center) with a minimum of two (2) fasteners per joint for cabinet body and drawer construction. Staples, screws, and T nails are not permitted for exposed surfaces.
- e. For custom and premium grades, at the option of the manufacturer, construction joinery shall be as follows.
  - 1) Dadoes or Lock Joints: plows or rabbets.
  - 2) Doweled Joints: The dowels shall be a minimum of 8mm x 30mm with a minimum of two (2) dowels per joint. The first dowel shall be spaced a maximum of 37mm from each edge or end, and the second dowel shall be a maximum of 32mm on center from the first dowel. Subsequent dowels shall be spaced a maximum of 128mm on center. All dowel construction shall be glued and clamped.
  - 3) Confirmat Type Screws: Maximum of 37mm from each end with subsequent screw being spaced 28mm on center. Glue is not required with this system.
  - 4) Lamello Type Jointing Plates: The plates shall be a maximum of two (2) inches from each edge or end to the center of the plate. Subsequent plates shall be spaced a maximum of six (6) inches on center. All joints shall be glued and clamped.
  - 5) Mod-eez Type Fastening Systems: The fasteners shall be a maximum of 16" on center and 4" from any edge or end. They shall be fastened with 10 full thread sheet metal screws for cabinet body construction. Glue is not required with this system.
  - 6) No exposed fastening is permitted, except for access panel.
- f. Vertical or horizontal divisions shall be dadoed or tenoned into adjoining members.

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2. Backs: Backs are required and shall be plywood or tempered and sealed hardboard a minimum of 1/4" in thickness. Color to match interior. Backs shall be securely nailed, stapled or dadoed to the case body and intermediate members. Backs shall be rabbeted or dadoed into exposed ends unless a plant-on end is used.

Wood Anchor Strips: Suitable wood anchor strips are required and shall be a minimum of 1/2 "x 2-1/2" in thickness and provided at the top and bottom of the cabinet back.

3. Tops and Bottoms: Tops and bottoms shall be plywood with a minimum of 3/4" in thickness.
4. Bases: Cabinet bases may be constructed with either separate or integral base. Continuous top-set vinyl base with formed interior and exterior corners, or integral sheet vinyl base to match adjacent room base.

I. Drawers

1. Drawer Boxes: Construct subfront sides and back with 1/2" minimum 7 ply Baltic Birch plywood. All corner joints at sides to subfront and back shall be lock jointed and glued together. Drawer sides, subfront and back shall be plowed to receive bottom, which shall be glued, or glued blocked to form a rigid unit. Hardwood shall have a clear factory finish. Provide drawers with metal slides as specified.
2. Drawer bottoms shall be 1/4" thick sound hardwood plywood with cabinet liner on the exposed interior face.
3. Drawer finish fronts shall be 3/4" plywood with plastic laminate or wood veneer finish on exposed surface and cabinet liner on interior surface. Corners shall be eased, and all four edges shall receive 3mm PVC edge with joint on bottom. Secure finish front to drawer box subfront from the inside with #12 particle board screws, 1-1/2" from each side, bottom, and top edge of front and 12" O.C. minimum horizontally for the full drawer width.

- J. Doors: Cabinet doors shall be plywood core a minimum of 0.745" in thickness. The interior faces of cabinet doors including faces shelving shall be 0.030" minimum thickness high pressure thermoplastic cabinet liner. All four edges shall be banded with color to match exterior. Clear distance between doors shall be between 3/32" to 5/32", width of a nickel. Overlay type, hinged to swing flat against the face of adjoining cabinet or the side of cabinet, with eased corners, and 3mm PVC with joint hidden under hinge. Do not notch door or cabinet ends, or divisions to receive hinge.

1. Provide edge bands per paragraph 2.1.E.
2. Provide door hinges per paragraph 2.2.B.
3. Provide door pulls per paragraph 2.2.C.

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4. Provide metal strike plates at all cabinet door lock locations.
  5. Provide catches per 2.2.D.
  6. Provide bumpers per 2.2.K.
  7. Provide locks per 1.5.B.(11) and 2.2.L.
- K. Cabinet Shelves:  $\frac{3}{4}$ " thick plywood core for spans up to 35 inches and 1" thick for spans over 35 inches and up to 48 inches, and adjustable to 1-inch centers. Comply with WIC Technical Bulletin adjustable shelf loading/deflection requirement. Do not recess metal shelf standards into the end panels, notch shelving to clear standards. Provide edge bands per Paragraph 2.1.E.
- L. Finish for Toe Kick Base: To match new cabinets.
- M. Visible Edges: All visible edges, exposed or semi-exposed, or ends, tops, bottoms, shelves, webs, stretchers, divisions or partitions, and top edges of drawer sides and backs, top of splash, shall be banded with one of materials listed in Paragraph 2.1.E. Only the front edges of adjustable shelves are required to be banded.
- N. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements.
1. Match color, pattern, and finish as indicated by manufacturer's designations.
  2. As selected by Architect from laminate manufacturer's full range in the following categories:
    - a. Solid colors, matte finish.
    - b. Solid colors with core same color as surface, matte finish.
    - c. Wood grains, matte finish.
    - d. Patterns, matte finish.

**2.6 SOLID-SURFACING-MATERIAL COUNTERTOPS AND SPLASHES**

- A. Grade: Custom.
- B. Solid-Surfacing-Material Thickness:  $\frac{3}{4}$  inch.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid surfacing material complying with the following requirements:
1. Match color, pattern, and finish as indicated by manufacturer's designations.
  2. As selected by Architect from manufacturer's full range.

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- D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
  - 2. Fabricate tops with loose backsplashes for field application.
- E. Seal joint between countertop and splashes and between splashes and walls with sealant as specified in Division 07 "Joint Sealants."
- F. Edge treatment: As indicated.
- G. Drill holes in countertops for plumbing fittings and soap dispenses in shop.

**2.7 SHOP FINISHING**

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. Preparation 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.

Back priming: 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 back priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

**PART 3 – EXECUTION**

**3.1 PREPARATION**

- A. Before Installation, condition woodwork to average prevailing humidity conditions installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

**3.2 INSTALLATION**

- A. GRADE: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

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- B. Assemble woodwork and complete fabrication at Project site comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. 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.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish cuts.
- E. 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.
- F. 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.
- G. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
- H. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches O.C. with No.10 wafer-head screw sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
- J. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smoothly, remove surface scratches, and clean entire surface.
  - 1. Install countertops with no more than 1/8 inch in 96-inche 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.
- K. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

**3.3 CAULKING**

All horizontal and vertical joints up 6" under sink cabinets shall be caulked with a silicone based caulking compound to provide protection in case of plumbing failure.



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**INTERIOR ARCHITECTURAL WOODWORK**

**3.4    ANDJUSTING 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 semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

**END OF SECTION**

**SECTION 06 6116**  
**SOLID SURFACING FABRICATIONS**

**PART 1 - GENERAL**

**1.1 GENERAL REQUIREMENTS**

- A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

**1.2 SECTION INCLUDES**

- A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the solid surfacing fabrications as shown on the drawings and/or specified herein, including, but not limited to, the following:
  - 1. Solid surface material countertops.

**1.3 RELATED SECTIONS**

- A. Quality Requirements - Section 01 4000 for Mock-ups.
- B. Architectural Woodwork - Section 06 4023.
- C. Division 22 Plumbing Section.

**1.4 REFERENCES**

- A. ASTM D 256 - Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
- B. ASTM D 570 - Standard Test Method for Water Absorption.
- C. ASTM D 638 - Standard Test Method for Tensile Properties.
- D. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C. And 30 degrees C.
- E. ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
- F. ASTM D 790 - Standard Test Methods for Flexural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
- G. ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
- H. ASTM G 22 - Standard Practice for Determining Resistance of Plastics to Bacteria.
- I. NEMA - National Electrical Manufacturers Association.
- J. NSF - National Sanitation Foundation.

**1.5 SUBMITTALS**

- A. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions, and coordination requirements with adjacent work.
- B. Samples: Submit three (3) minimum 12" x 12" samples of each type of solid surface specified. Indicate full range of color and pattern variation. Samples must have outside corner/nosing/edging as shown on drawings and fully finished

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as if it were the final end-product. Approved samples will be retained as a standard for work.

- C. Product Data: Indicate product description, fabrication information, and compliance with specified performance requirements.
- D. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in the project closeout documents.

**1.6 QUALITY ASSURANCE**

A. Applicable Standards: Standards of the following, as referenced herein:

- 1. American National Standards Institute (ANSI).
- 2. American Society for Testing and Materials (ASTM).

B. Allowable Tolerances:

- 1. Variation in Component Size: + 1/8".
- 2. Location of Openings: + 1/8" from indicated location.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver no components to project site until areas are ready for installation. Store indoors.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

**1.8 WARRANTY**

- A. Warranty: The manufacturer shall warrant to the Owner that the manufacturer will, at his option, repair or replace without charge, such product if it fails due to a manufacturing defect during the first 10 years after initial installation. This includes all labor charges needed to repair or replace the product covered hereunder.

**PART 2 - PRODUCTS**

**2.1 SOLID SURFACING MATERIAL**

- A. Material: Cast, filled, acrylic; not coated, laminated or of composite construction, meeting ANSI Z124-1980, Type Six, and ISS FA-2.01 "Classification and Standards Publication of Solid Surfacing Material" as published by the International Solid Surface Fabricators Association (ISSFA).
- B. Material shall conform to the published performance characteristics of ISSFA-2-01.
- C. Performance Standards

| <u>PROPERTY</u>  | <u>REQUIREMENT</u> | <u>TEST PROCEDURE</u> |
|------------------|--------------------|-----------------------|
| Tensile Strength | 6000 psi           | ASTM D 638-84         |
| Tensile Modulus  | 1.5 x 106 psi      | ASTM D 638-84         |
| Elongation       | 0.4% min.          | ASTM D 638-84         |
| Hardness         | 94                 | Rockwell "M" scale    |

## SECTION 06 6116 SOLID SURFACING FABRICATIONS

|                       |                      |                                                             |
|-----------------------|----------------------|-------------------------------------------------------------|
| Gloss (60 degree)     | 56<br>5-20           | Barcol Impressor<br>ANSI Z124-1980<br>HUD Bulletin UM-73-84 |
| Color Stability       | No change, 200 hours | NEMA LD3                                                    |
| Wear and Clean        | Passes               | ANSI Z124-1980<br>HUD Bulletin UM-73-84                     |
| Flammability          |                      | ASTM E 84-84a                                               |
| Flame Spread          | 25                   |                                                             |
| Smoke Developed       | 25                   |                                                             |
| Class                 | I                    |                                                             |
| Water Absorption      | 24 hrs. Long Term    | ASTM D 570-81                                               |
| Weight (% Max.)       | 0.09 0.80 (1/4")     |                                                             |
| Izod Impact           | 0.28 ft.-lbs./in.    | ASTM D 256-084                                              |
| Impact Resistance     | No fracture          | NEMA LD3                                                    |
| Sheets                | 1/4" slab-36" drop   | 1/2 lb. ball                                                |
| Boiling Water Surface |                      |                                                             |
| Resistance            | No visible change    | NEMA LD3                                                    |
| Stain Resistance      | Passes               | ANSI Z124-1980<br>HUD Bulletin UM-73-84                     |

- D. Counters: Provide 3/4" thick solid surface counters with cut-outs and without cutouts for sinks, and with integral vanity sinks, where indicated on the drawings.
1. Edge treatment: 1/4" Beveled
  2. Backsplash: Applied.
  3. Sidesplash: Applied.
- E. Solid Surface Schedule: (Basis of Design)
- SS-1      Manufacture: Corian or approved equal by Wilsonart or Formica.  
                  Color: Per approved drawings material schedule.  
                  Thickness: 3/4," see details on approved drawings.
- F. Counters shall be adhesively joined with no exposed seams, having edge details shown on drawings.
- G. Finish:
1. Provide a surface with a uniform finish
    - a. Per approved drawings material schedule Matte: Hi-Gloss finish.

### 2.2 ACCESSORY PRODUCTS

- A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints.
- B. Adhesive: Manufacturer's standard neoprene-based adhesive meeting ANSI A146.1-1967 and UL listed.
- C. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in colors matching components.

### 2.3 FABRICATION

- A. Fabricator must be approved by the solid surfacing material manufacturer.

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**SOLID SURFACING FABRICATIONS**

- B. Factory fabricates components exactly to sizes and shapes indicated, in accordance with approved shop drawings. Contractor shall verify in the field all installation conditions, prior to fabrication.
- C. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints. No joints or seams will be permitted other than those shown on the approved shop drawings, unless specifically approved by the Architect.
- D. Provide factory cutouts for plumbing fittings and accessories as indicated on the drawings.
- E. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.
- F. Provide all custom sizes, shapes, curves, configurations, reveals, and edgings as called for and shown on the drawings in the dimension and thicknesses noted.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and product installation data.
- B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
- C. All surfaces, other than those surfaces that are the mounting/gluing surfaces, must be fully polished to match the finished face of all components. Unfinished surfaces will be rejected.
- D. Final finished surfaces must be fully and evenly polished with manufacturer's recommended finishing products. Unfinished surfaces will be rejected.
- E. Keep components and hands clean during installation. Remove adhesives, sealants, and other stains. Keep clean until Date of Substantial Completion. Replace stained components.
- F. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work that cannot be repaired to Architect's satisfaction.

**END OF SECTION**

**SECTION 07 2100**  
**THERMAL INSULATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Batt Insulation in ceiling construction.
  - 2. Vapor retardant.
  - 3. Air infiltration seal.
- B. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

**1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - 2. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - 3. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 4. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. Federal Specifications (FS):
  - 1. FS HH-I-1972/GEN - Insulation Board, Thermal, Faced, Polyurethane or Polyisocyanurate.

**1.3 SUBMITTALS**

- A. Division 1 - Submittals: Procedures for submittals.
  - a. Product Data: Indicate product characteristics, performance criteria, and limitations.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Conform to insulation flame spread and smoke developed requirements of local authority having jurisdiction.
- B. Certification: For projects California provides Products certified by manufacturer that meet California Quality Standards for Insulating Materials.

**SECTION 07 2100  
THERMAL INSULATION**

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Protect insulation from moisture, soiling, and other damaging items.
- C. Store in dry location protected from sunlight.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- A. Resource Management:
  - 1. Recycled Content: Provide fiberglass insulation manufactured from minimum 30 percent recycled glass.
- B. Environmental Impact:
  - 1. Only Greenguard indoor air quality certified products will be permitted.
  - 2. Chlorofluorocarbons (CFCs): Products and equipment requiring or using CFCs during the manufacturing process will not be permitted.

**PART 2 - PRODUCTS**

**2.1 BATT INSULATION**

- A. Manufacturers:
  - 1. Johns Manville Corporation, Denver, Co (800) 654-3103.
  - 2. Knauf Fiberglass, Shelbyville, IN (317) 398-4434, (800) 825-4434.
  - 3. Owens-Corning Fiberglass Corporation, Toledo, OH (419) 248-8000, (800) 438-7465.
  - 4. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Materials: Mineral Fiberglass insulation manufactured from minimum 30 percent recycled glass.
  - 1. Unfaced Glass Fiber: ASTM C 665, Type I, unfaced. Thermal resistance R-value as indicated on Drawings.
  - 2. Faced Glass Fiber: ASTM C 665, Type III, Class A, with reflective covering one side. Thermal resistance R-value as indicated on Drawings.

**2.2 VAPOR RETARDANT**

- A. ASTM D 4397, 6 mils thick, maximum permeance rating of 0.13 perm.
- B. Vapor Retardant Tape: Pressure-sensitive type recommended by vapor retardant manufacturer for sealing joints and penetrations in vapor retardant.

**SECTION 07 2100  
THERMAL INSULATION**

**2.3 AIR INFILTRATION SEAL**

- A. Manufacturer:
  - 1. Tenneco Building Products, Smyrna, GA (800) 241-4402.
  - 2. DuPont, Wilmington, DE (800) 448-9835.
  - 3. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Materials: One of the following two types of materials:
  - 1. 15-pound, type 1, grade D, 10-minute unperforated asphalt saturated organic felt in accordance with ASTM D22.
  - 2. Coated, cross-woven polyethylene or polypropylene fabric:
    - a. Tenneco: Amowrap Housewrap.
    - b. DuPont: Tyvek Housewrap.
    - c. Air Infiltration Seal Tape: Pressure sensitive type recommended by vapor retardant manufacturer for sealing joints and penetrations in air infiltration seal.

**2.4 ACCESSORIES**

- A. Tape: Polyethylene or polyester self-adhering type; 2 inches (5.08 cm) wide.
- B. Adhesive: Waterproof type, acceptable to manufacturer of insulation board.
- C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 7300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  - 1. Batt Insulation:
    - a. Verify adjacent materials are dry and ready to receive installation.
    - b. Verify mechanical and electrical services within walls have been installed and tested.
- C. Report in writing to Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the client/city.



**SECTION 07 2100**  
**THERMAL INSULATION**

**3.2     INSTALLATION - BATT INSULATION**

- A.    Install batt insulation in accordance with manufacturer's instructions, without gaps or voids.
- B.    Trim insulation neatly to fit spaces. Use batts free of damage. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation.
- C.    Install insulation with factory applied membrane facing warm side of building spaces. Lap ends and side flanges of membrane. Attach insulation in place to framing; tape seal butt ends and lapped side flanges. Tape seal tears or cuts in membrane.

**3.3     INSTALLATION - VAPOR RETARDANT AIR INFILTRATION SEAL**

- A.    Install vapor retardant air infiltration seal over entire building exterior walls and adjacent surfaces
- B.    Seal vertical joints over framing by lapping minimum 2 stud spaces. Fasten to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
- C.    Seal joints caused by pipes, conduits, electrical boxes, and similar items with manufacturer's sealing tape. Seal penetrations airtight.

**END OF SECTION**

## **SECTION 07 2600 VAPOR BARRIERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Vapor barrier and accessories for installation under concrete slabs.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 03 3000: Cast-in-Place Concrete.
3. Division 09: Finishes; flooring sections.

#### **1.2 REFERENCES**

**A. American Concrete Institute (ACI) Publication:**

1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

**B. ASTM International (ASTM):**

1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
2. ASTM D1709 - Standard Test Methods of Impact Resistance of Plastic Film by the Free-Falling Dart Method.
3. ASTM E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs.
4. ASTM E1643 - Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
5. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

#### **1.3 SUBMITTALS**

**A. Product Data:** Submit manufacturer's product data and installation instructions for vapor barrier and accessories.

**B. Samples:**

1. 12 inch by 12 inch vapor barrier samples.
2. Pressure-Sensitive Tape: 12 inch long sample.

**C. Test Reports:** Conducted by nationally recognized independent testing agency indicating conformance with specified performance requirements.

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

**A. Deliver, store, handle and protect in accordance with manufacturer's instructions and recommendations.**

## **SECTION 07 2600 VAPOR BARRIERS**

- B. Deliver materials in manufacturer's packaging with labels intact.
- C. Store materials in a clean and dry area.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Multi-layer plastic extrusion manufactured with high grade prime, virgin, polyolefin resins. Thickness shall be 15 mils minimum.
  - 1. Stego Wrap by Stego Industries LLC.
  - 2. Perminator by W.R. Meadows.
  - 3. Ecoshield-E by Epro.
  - 4. Husky Yellow Guard by Poly-America.
  - 5. Equal.
- B. Physical Properties:
  - 1. Maintain permeance of less than 0.01 Perms [grains/(ft<sup>2</sup> · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
  - 2. Class Rating per ASTM E1745: Class A.
  - 3. Puncture resistance per ASTM D1709: 2200 g or higher.
  - 4. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
- C. Accessories: Provide manufacturer recommended accessories for seams, penetrations, and perimeter edges, including tapes, mastics, termination for a complete vapor barrier installation per ASTM E1643.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Examine subsoil and notify Owner of deficiencies detrimental to proper vapor barrier installation; do not proceed until corrected.

#### **3.2 INSTALLATION**

- A. Install vapor barrier in accordance ASTM E1643 and manufacturer's instructions.
  - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
  - 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise, where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself using manufacturer ASTM E1643

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VAPOR BARRIERS**

compliant accessory designed to adhere to concrete. Seam tape shall not be used for sealing the vapor barrier to the foundation wall, grade beam, or slab.

3. Overlap joints 6 inches and seal with manufacturer's seam tape.
  4. Seal vapor barrier penetrations per manufacturer's instructions.
  5. Avoid the use of non-permanent stakes driven through the vapor barrier.
- B. Prior to concrete placement inspect vapor barrier for damage. Clean damaged areas and with vapor barrier material cut a minimum 6 inches larger than damaged area on all sides. Seal the main vapor barrier with continuous seam tape.

**3.3 CLEAN UP**

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**3.4 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**END OF SECTION**

**SECTION 07 2719**  
**PLASTIC SHEET AIR BARRIERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Mechanically attached permeable flexible plastic sheet air barriers.
2. Flexible flashing of openings, penetrations, joints, and terminations of exterior walls and taping of seams.

**B. Related Requirements:**

1. Section 07 6000 – Flashing and Sheet Metal.
2. Section 07 9200 – Joint Sealants.
3. Section 08 4113 - Aluminum Entrances and Storefronts.
4. Section 09 2216 - Non-Structural Metal Framing.

**1.2 REFERENCES**

**A. ASTM International:**

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E1677 - Standard Specification for an Air Barrier (AB) Material or System for Low-Rise Framed Building Walls.
3. ASTM E2178 – Standard Test Method for Air Permeance of Building Materials.

**B. International Code Council (ICC):**

1. ICC-ES Evaluation Reports.

**1.3 SUBMITTALS**

**A. Product Data:** Submit manufacturer's product data for each material and component proposed for installation.

**B. Shop Drawings:** Dimensioned plans and elevations indicating:

1. Complete information as to size and location of openings, sleeves, conduits, ducts, boxes, inserts, attachments, and structural interferences.

**SECTION 07 2719**  
**PLASTIC SHEET AIR BARRIERS**

2. Layout of air barrier showing sheet lapping, cutting, flashing, and taping, with references to enlarged details.
- C. Installation Instructions: Submit detailed manufacturer's installation instructions.
- D. Material Samples: Submit minimum 8-1/2-inch by 11-inch samples of air barrier, and 12 inch long flashing.
- E. Test Reports: Submit Test Reports showing performance characteristics equaling or exceeding those specified.
- F. Evaluation Reports: Submit ICC-ES Evaluation Report demonstrating conformance of plastic sheet air barrier to CBC 1404.2, for use as water-resistive barrier.
- G. Qualification Statements:
  1. Installer: Statement from plastic sheet air barrier manufacturer indicating installer is approved, certified, or has been trained for the installation of their products.
- H. Commissioning Services Provider (CxSP) will review the Submittals of this Section as part of the Commissioning of Thermal and Moisture Protection.

**1.4 QUALITY ASSURANCE**

- A. Manufacturer:
  1. Plastic sheet air barrier components and accessories shall be from a single source.
  2. Manufacturer shall have a minimum of five years of continued experience in the manufacture of the specified products.
- B. Installer:
  1. Minimum five years in the installation of air/weather barriers.
  2. Trained or certified by manufacturer for the installation of their products.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials to the job site in undamaged and original packaging.
- B. Store materials in a clean, dry, protected location and within temperature range required by plastic sheet air barrier manufacturer. Protect stored materials from direct sunlight.
- C. Handle materials in accordance with Manufacturer's recommendations.

**SECTION 07 2719**  
**PLASTIC SHEET AIR BARRIERS**

**1.6 WARRANTY**

- A. Provide a ten-year manufacturer's standard material warranty for replacement of plastic sheet air barriers that fail due to material defects.
- B. Installation Warranty: Provide a two-year installation warranty for the plastic sheet air barrier, including accessories, against loss of water-tight seal and loss of attachment.
- C. Warranty shall start on the day of Substantial Completion.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Manufacturer and Products:
  - 1. DuPont (E. I. du Pont de Nemours and Company): Tyvek CommercialWrap.
  - 2. Polymer Group Inc., TyparMetroWrap.
  - 3. Equal.
- B. Properties:
  - 1. Plastic sheet air barrier shall be Type I in accordance to ASTM E1677.
  - 2. Air Permeance: shall not exceed 0.004 cfm/ft<sup>2</sup>, under a pressure differential of 0.3 in w.g. (1.57 psf) (0.02 L/m<sup>2</sup> at 75 Pa), when tested in accordance with ASTM E2178.
  - 3. Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance to ASTM E84.

**2.2 MISCELLANEOUS MATERIALS**

- A. Flashing: Self-adhesive butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
  - 1. DuPont (E. I. du Pont de Nemours and Company); FlexWrap and StraightFlash.
  - 2. Polymer Group Inc.; Flashing Flex and Flashing AT.
  - 3. Equal.
- B. Fasteners: Manufacturer approved fasteners.

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**PLASTIC SHEET AIR BARRIERS**

- C. Tape: Three-inch-wide seam tape. Pressure-sensitive plastic tape recommended by air barrier manufacturer for sealing joints and penetrations in air barrier.
- D. Sealants and Adhesive Primers: Compatible with plastic sheet air barrier and flashings system and approved by OWNER's Office of Environmental Health and Safety (OEHS).
  - 1. Sealant: Dow Corning 732.
  - 2. Spray Adhesive: Design Polymerics DP77.
  - 3. Equal.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions under which plastic sheet air barrier will be installed.
- B. Verify that substrate to receive air barrier has been completed and inspected before commencement of work.
- C. For the installation of flashing and tape, surface shall be smooth, clean, dry, and free from voids, loose substrate, protrusions, or any material that would hinder adhesion.

**3.2 INSTALLATION**

- A. Install plastic sheet air barrier in accordance to manufacturer's installation guidelines, providing continuity throughout exterior walls. Install plastic sheet air barrier with drainage plane surface pattern in vertical position for proper drainage.
- B. Install plastic sheet air barrier starting from the bottom of the building up to ensure proper overlapping of vertical and horizontal seams. Upper layer of plastic sheet air barrier shall overlap bottom layer by a minimum of six inches. Plastic sheet air barrier shall extend over the weep screed by two inches and be taped down.
- C. Secure plastic sheet air barrier by fastening into studs at 12 to 18 inches on center vertically.
- D. Unroll plastic sheet air barrier directly over windows and doors rough openings. Do not install fasteners within six inches of the sills and jambs of the openings and within nine inches of the header, plastic sheet air barrier shall be fastened at these locations during flashing installation.
- E. Horizontal joints shall be overlapped a minimum of six inches with upper courses overlapping lower courses in water-shedding fashion. Vertical seams shall be overlapped a minimum of six inches. Overlap corners of building a minimum of 12 inches.



**SECTION 07 2719**  
**PLASTIC SHEET AIR BARRIERS**

- F. Tape vertical and horizontal seams using adhesive tape recommended by manufacturer. Seal tears and cuts with adhesive tape as recommended by manufacturer.
- G. Place patch or strip of self-adhered flashing over plastic sheet air barrier where base plates, metal channels, z-girts, or other hardware will be installed.

**3.3 FLASHING**

- A. Cut air barrier from door and window openings along jambs and sill. Cut a header flap at 45 degree angle to expose eight inches of plastic sheet air barrier to allow for head flashing installation. Install sill flashing per manufacturer instructions, overlapping up the jambs a minimum of six inches on each side.
- B. Wrap flashing around interior jamb, wall face, and exterior jamb, overlapping the vertical portion of the sill flashing by at least two inches.
- C. Adhere flashing to the head following manufacturer's instructions. Flashing shall wrap jamb flashings by a minimum of two inches.
- D. Flash piping, conduit, duct and similar penetrations through walls, and flashing ledgers and sills as recommended by manufacturer.

**3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's technical representative shall inspect the work and submit a statement indicating that the installation has been done in conformance to manufacturer's installation instructions.

**3.5 CLEANING**

- A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

**3.6 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**END OF SECTION**

**SECTION 07 6000  
FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Miscellaneous metal flashing as required except where provided under Divisions 22, Plumbing, 23, HVAC, or 26, Electrical.
2. Roof pipe flashings.
3. Other sheet metal items, not necessarily specified herein or in other sections, but required to prevent penetration of water into building.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 07 9200 - Joint Sealants.
3. Division 8 - Openings.
4. Division 22 – Plumbing.
5. Division 23 - HVAC.
6. Division 26 - Electrical.

**1.2 SUBMITTALS**

- A. Shop Drawings:** Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring, and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.
- B. Samples:** Submit Samples for materials or assemblies as requested.
- C. Product Data:** Submit brochures of manufactured items.

**1.3 QUALITY ASSURANCE**

- A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.**
- B. Materials shall conform to following standards:**
1. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  2. ASTM A653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  3. ASTM B370 - Copper Sheet and Strip for Building Construction.
- C. Pre-installation Meetings:** Refer to Division 07 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

**1.4 DELIVERY, STORAGE AND HANDLING**

**SECTION 07 6000  
FLASHING AND SHEET METAL**

- A. Do not install bent or otherwise damaged materials.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Galvanized Sheet Steel: ASTM A653, coating designation G90, hot-dip galvanized.
- B. Fastenings:
1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.
- C. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, lead, and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.
- D. Solder: ASTM B32, Grade 5A, composed of 95-5 tin-antimony. Name of product manufacturer and grade designation shall be labeled, stamped, or cast onto each coil or bar.

**2.2 FABRICATION**

- A. General:
1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a ½ inch minimum hemmed edge.
  2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Fill joint completely with solder. Clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smoothly. Lock seam work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.
  3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.
- B. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed. At wood construction, nail flashing to framing before paper backed lath is installed.
- C. Roof Pipe Flashings: Provide PVC flashings or prefabricated welded or seamless flashings.

**SECTION 07 6000  
FLASHING AND SHEET METAL**

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with two coats of aluminum paint or one coat of heavy-bodied bituminous paint.

**3.3 TESTING**

- A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

**3.4 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**3.5 CLEANING**

- A. Remove rubbish, debris, and waste materials and legally dispose of them off the Project site.

**END OF SECTION**

## **SECTION 07 9200 JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Joint sealants.
  - 2. Preparation for application of sealants.
- B. Related Requirements:
  - 1. Division 01 - General Requirements.
  - 2. Section 06 2000 - Finish Carpentry.
  - 3. Section 07 6000 - Flashing and Sheet Metal.
  - 4. Division 08 - Openings.
  - 5. Division 09 - Finishes.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings indicating sealant joint locations, with full-size sealant joint details.
- B. Product Data: Submit manufacturer's literature for each sealant material.
- C. Material Samples: Submit Samples indicating color range available for each sealant material intended for installation in exposed locations.
- D. Certifications: Submit manufacturer's certification materials comply with requirements specified.
- E. Site Samples: At locations required, provide a Sample of sealant for each typical installation, approximately 24 inches long, including joint preparation, backing, sealant, and tooling. Allow backing to extend 6 inches beyond end of sealant for inspection of substrate.
- F. Test Reports: Submit manufacturer's adhesion compatibility test reports according to ASTM C794 for each substrate.

#### **1.3 QUALITY ASSURANCE**

- A. Qualifications of Installer: The Work of this section shall be installed by a firm which has been in the business of installing similar materials for at least five consecutive years; and can show evidence of satisfactory completion of five projects of similar size and scope. Installer shall have applicators trained and approved by manufacturer for performing this Work.

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

- A. Store in accordance with manufacturer's recommendations. Provide a uniform ambient temperature between 60- and 80-degrees F.

**SECTION 07 9200  
JOINT SEALANTS**

**1.5 WARRANTY**

- A. Manufacturer: five-year material warranty.
- B. Installer: two-year installation/application warranty.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Furnish sealants meeting following in-service requirements:
  - 1. Normal curing schedules are permitted.
  - 2. Non-staining, color fastness (resistance to color change), and durability when subjected to intense actinic (ultraviolet) radiation are required.
- B. Furnish the products of only one manufacturer unless otherwise required, sealant colors as selected to match the adjoining surfaces.

**2.2 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated into the work include the following:
  - 1. Bostik, Inc.
  - 2. Dow Corning.
  - 3. GE Silicones.
  - 4. Mameco International.
  - 5. W.R. Meadows, Inc.
  - 6. Nomaco, Inc.
  - 7. Pecora Corporation.
  - 8. Sika Corporation.
  - 9. Sonneborn Building Products Div. ChemRex, Inc.
  - 10. Tremco.
  - 11. USG Corp.
  - 12. Or approved equal.

**2.3 MATERIALS**

- A. Sealants:
  - 1. Sealant 1: Acrylic latex, one-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C834, Type S, Grade NS, formulated to be paintable.
    - a. Tremco Inc., Acrylic Latex Caulk.
    - b. Pecora Corporation, AC-20.
    - c. Equal.
  - 2. Sealant 2: Butyl sealant, one-part, non-sag, solvent-release-curing sealant complying with ASTM C1311, gun grade and formulated with a minimum of 75 percent solids.
    - a. Tremco Inc., Tremco Butyl Sealant.

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- b. Pecora Corp., BC-158.
    - c. Equal.
  - 3. Sealant 3: Silicone sealant, one-part non-acid-curing silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25.
    - a. Dow Corning Corp., Dow Corning 790, 791, 795.
    - b. General Electric Co., Silpruf.
    - c. Tremco, Inc., Spectrem 1.
    - d. Pecora Corp., 864.
    - e. Equal.
  - 4. Sealant 4: One-part mildew-resistant silicone sealant, complying with ASTM C920, Type S, Grade NS, Class 25.
    - a. Dow Corning Corp., Dow Corning 786.
    - b. General Electric Co., Sanitary 1700.
    - c. Tremco, Inc., Proglaze White.
    - d. Equal.
  - 5. Sealant 6: Multi-part pouring urethane sealant, complying with ASTM C920, Type M, Grade P, Class 25.
    - a. Sika Corporation, Sikaflex 2C NS/SL.
    - b. Equal.
  - 6. Sealant 7: Acoustical sealant, non-drying, non-hardening permanently flexible conforming to ASTM D217.
    - a. Pecora Corp., BA-98 Acoustical Sealant.
    - b. Equal.
- B. See 07 8413 - Penetration Firestopping for rated sealants.
- C. Joint Backing: ASTM D1056; round, closed cell Polyethylene Foam Rod; oversized 30 to 50 percent larger than joint width, reticulated polyolefin foam.
- D. Primer: Non-Staining Type. Provide primer as required and shall be product of manufacturer of installed sealant.
- E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer.
- F. Sealants shall have normal curing schedules, shall be non-staining, color fast and shall resist deterioration due to ultraviolet radiation.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that joint openings are ready to receive Work and field tolerances are within the guidelines recommended by sealant manufacturer.

## SECTION 07 9200 JOINT SEALANTS

### 3.2 SURFACE PREPARATION

- A. Joints and spaces to be sealed shall be completely cleaned of all dirt, dust, mortar, oil, and other foreign materials which might adversely affect sealing Work. Where necessary, degrease with a solvent or commercial degreasing agent. Surfaces shall be thoroughly dry before application of sealants.
- B. If recommended by manufacturer, remove paint and other protective coatings from surfaces to be sealed before priming and installation of sealants.
- C. Preparation of surfaces to receive sealant shall conform to the sealant manufacturer's specifications. Provide air pressure or other methods to achieve required results. Provide masking tape to keep sealants off surfaces that will be exposed in finished Work.
- D. Etch concrete or masonry surfaces to remove excess alkalinity unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.
- E. Perform preparation in accordance with ASTM C804 for solvent release sealants, and ASTM C962 for elastomeric sealants.
- F. Protect elements surrounding Work of this section from damage or disfiguration.

### 3.3 SEALANT APPLICATION SCHEDULE

|    | <u>Location</u>                                                                                                 | <u>Type</u> | <u>Color</u>               |
|----|-----------------------------------------------------------------------------------------------------------------|-------------|----------------------------|
| A. | Exterior and Interior joints in horizontal surfaces of concrete; between metal and concrete masonry and mortar. | Sealant 6   | To match adjacent material |
| B. | Joints within glazed curtain wall system. Skylight framing system. Aluminum entrance system glass and glazing.  | Sealant 3   | Translucent or Black       |
| C. | Interior joints in ceramic tile and at plumbing fixtures.                                                       | Sealant 4   | Translucent or White       |
| D. | Under thresholds.                                                                                               | Sealant 2   | Black                      |
| E. | All interior joints not otherwise, scheduled                                                                    | Sealant 1   | To Match Adjacent Surfaces |
| F. | Heads and sills, perimeters of frames and other openings in insulated partitions                                | Sealant 7   | Match Adjacent Surfaces    |



## SECTION 07 9200 JOINT SEALANTS

### 3.4 APPLICATION

- A. Provide sealant around all openings in exterior walls, and any other locations indicated or required for structure weatherproofing and/or waterproofing.
- B. Sealants shall be installed by experienced mechanics using specified materials and proper tools. Preparatory Work (cleaning, etc.) and installation of sealant shall be as specified and in accordance with manufacturer's printed instructions and recommendations.
- C. Concrete, masonry, and other porous surfaces, and any other surfaces recommended by manufacturer, shall be primed before installing sealants. Primer shall be installed with a brush that will reach all parts of joints to be filled with sealant.
- D. Sealants shall be stored and installed at temperatures as recommended by manufacturer. Sealants shall not be installed when they become too jelled to be discharged in a continuous flow from gun. Modification of sealants by addition of liquids, solvents, or powders is not permitted.
- E. Sealants shall be installed with guns furnished with proper size nozzles. Sufficient pressure shall be furnished to fill all voids and joints solid. In sealing around openings, include entire perimeter of each opening, unless indicated or specified otherwise. Where gun installation is impracticable, suitable hand tools shall be provided.
- F. Sealed joints shall be neatly pointed on flush surfaces with beading tool, and internal corners with a special tool. Excess material shall be cleanly removed. Sealant, where exposed, shall be free of wrinkles and uniformly smooth. Sealing shall be complete before final coats of paint are installed.
- G. Comply with sealant manufacturer's printed instructions except where more stringent requirements are indicated on Drawings or specified.
- H. Partially fill joints with joint backing material, furnishing only compatible materials, until joint depth does not exceed 1/2-inch joint width. Minimum joint width for metal-to-metal joints shall be 1/4 inch. Joint depth shall be not less than 1/4 inch and not greater than 1/2 inch.
- I. Install sealant under sufficient pressure to completely fill voids. Finish exposed joints smooth, flush with surfaces or recessed as indicated. Install non-tracking sealant to concrete expansion joints subject to foot or vehicular traffic.
- J. Where joint depth prevents installation of standard bond breaker backing rod, furnish non-adhering tape covering to prevent bonding of sealant to back of joint. Under no circumstances shall sealant depth exceed 1/2 inch maximum, unless specifically indicated on Drawings.
- K. Prime porous surfaces after cleaning. Pack joints deeper than 3/4 inch with joint backing to within 3/4 inch of surface. Completely fill joints and spaces with gun applied compound, forming a neat, smooth bead.

### 3.5 MISCELLANEOUS WORK

- A. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to Drawings for condition and related parts of Work.

**SECTION 07 9200  
JOINT SEALANTS**

- B. Install sealants to depths as indicated or, if not indicated, as recommended by sealant manufacturer but within following general limitations:
  - 1. For joints in concrete walks, slab and paving subject to traffic, fill joints to a depth equal to 75 percent of joint width, but not more than 3/4 inch deep or less than 3/8 inch deep, depending on joint width.
  - 2. For building joints, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.

**3.6 CLEANING**

- A. Remove rubbish, debris, and waste materials and legally dispose of them off the Project site.

**3.7 CURING**

- A. Sealants shall cure in accordance with manufacturer's printed recommendations. Do not disturb seal until completely cured.

**3.8 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**END OF SECTION**

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Hollow Metal doors and frames.
- B. Related Documents: The Contract Documents, as defined in Section 01 10 00 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
  - 1. Section 08 7100 - Door Hardware: Hardware coordination.
  - 2. Section 09 9123 – Interior Painting: Field painting and finishing of doors and frames.

**1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 152 - Methods for Fire Tests of Door Assemblies.
  - 2. ASTM A 653/A 653M - Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 1996.
- B. Door Hardware Institute (DHI):
  - 1. DHI - The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.
  - 2. DHI A115 Series - Specifications for Steel Doors and Frame Preparation for Hardware.
- C. Steel Door Institute (SDI):
  - 1. SDI-100 - Recommended Specifications Standard Steel Doors and Frames.
  - 2. SDI-105 - Recommended Erection Instructions for Steel Frames.

**1.3 SUBMITTALS**

- A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
  - 1. Product Data: Indicate door materials, gauges, configurations, and location of cut-outs hardware reinforcement, and finish.
    - a. Shop Drawings: Indicate door elevations, internal reinforcement, closure method, and cut-outs for louvers.

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

**1.4 DELIVERY, STORAGE AND PROTECTION**

- A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect products.
- B. Protect doors and frames with resilient packaging.
- C. Break seal on-site to permit ventilation.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturers offering items which may be incorporated in the Work include the following:
  - 1. Amweld Building Products, Incorporated,
  - 2. Ceco Door Products,
  - 3. Curries Company,
  - 4. Republic Builders Products,
  - 5. Steelcraft,
  - 6. Or approved equal

**2.2 FRAME CONSTRUCTION**

- A. General: Provide fully welded steel frames with integral stops and trim for doors, transoms, sidelights, borrowed lights, and other openings, and with details indicated for type and profile. Use concealed fastenings, unless otherwise indicated. Steel shall be free of scale, pitting, coil breaks, or other surface blemishes, and free of buckles, waves, or other defects.
- B. Metal Thickness of Frames (minimum):
  - 1. Interior hollow metal frames up to 4-foot wide 16-gage; steel knock down S-series Frames with Trim for installation in wood stud gypsum board partitions. Commercial quality Carbon Steel ASTM A1008.
- C. Supports and Anchors: Fabricate from at least 16-gage, galvanized steel sheet. Frame anchors shall comply with fire rated label requirements of opening.
  - 1. Floor Anchors:
    - a. Minimum thickness: 12 gage galvanized steel sheet or bent steel plate, securely fastened inside each jamb, with two holes in anchor at each jamb for 3/8-inch floor anchorage fasteners. For preframed wood stud walls provide an additional wood stud anchor located as close to the bottom of the jamb as is practical.

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

- b. Where required at sloping and uneven floor conditions, or to coordinate adjustments for trim alignments, provide adjustable floor anchors, providing at least 2-inch height adjustments.
- 2. Jamb Anchors:
  - a. Locate anchors near top and bottom and at intermediate points not to exceed 24 inches on center. Provide two anchors per head for openings up to 48 inches wide; over 48 inches wide provide anchors at 24 inches on center maximum.
  - b. Anchors in masonry construction: Provide manufacturers standard jamb anchors. Steel wire complying with ASTM A510, 0.177 inch in diameter, may be furnished.
  - c. Anchors in Stud Partitions: Provide steel anchors, 16 gage minimum sheet steel of design to suit partition construction, securely welded inside each jamb.
  - d. Through-Frame Anchors: At frames indicated to be anchored with bolts through frame, provide countersunk holes for bolts with 16-gauge minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.
- D. Inserts, Bolts, and Fasteners: Provide manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A153 Class C or D as required.
- E. Head Reinforcing: Refer to Detail #2 of this section. Reinforcing shall not act as lintel or load-carrying member and shall comply with fire rating requirements. Provide frames regardless of whether a closer is called for.
- F. Hardware Reinforcement and Accessories:
  - 1. Butt Hinge: 7 gage minimum.
  - 2. Head assemblies: Reinforced internally with full length, 10 gage angles on each side of frame and bar at bottom of stop for closer reinforcement in frames as shown in Detail #2 of this section.
  - 3. Reinforcing for other items of finish hardware shall be accomplished according to ANSI A250.6.
  - 4. Plaster Guards: Provide 26 gage galvanized steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

**SECTION 08 1113**  
**HOLLOW METAL DOORS AND FRAMES**

5. Door Silencers: Except for exterior doors, drill, and punch frames for three silencers at lock jamb of single swing doors or in double doors with astragal and one silencer per leaf in heads of doubled door frames.

**2.3 DOORS CONSTRUCTION**

- A. General: Custom-made, flush-panel "seamless type" with one-piece face panels; continuous weld, seamless edge construction with no visible seams or joints on faces or on vertical edges.
  1. Doors: SDI-100, Level II - Heavy-Duty - 1-3/4-inch, Model 1 - Full Flush Design, 16 gage cold-rolled steel.
    - a. Interior Doors: Kraft Honeycomb, Phenolic treated.

**2.4 ACCESSORIES**

- A. Rubber Silencers: Resilient rubber.

**2.5 PROTECTIVE COATINGS**

- A. Bituminous Coating: Fibered asphalt emulsion.
- B. Primer: Exposed surfaces shall be cleaned, treated with Bonderite chemical, and given one baked-on shop coat of grey rust inhibiting primer.

**2.6 FABRICATION**

- A. Fabricate unit is rigid, neat, and free from warp or buckle. Fabricate KD or welded as specified. Weld exposed joints continuously; grind, dress, and make smooth, flush, and invisible.
- B. Reinforce units to receive surface applied finish hardware.
- C. Prepare frame for silencers. Provide three single rubber silencers for single doors and two single silencers on frame head at double doors without mullions.
- D. Primer: Air dried.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

- A. Section 01 7300 - Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- C. Report in writing to the Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**3.2 INSTALLATION**

- A. Install frames in accordance with SDI-105.
- B. Install doors in accordance with DHI.
- C. Install doors in accordance with manufacturer's published instructions, of size, and at locations indicated.
- D. Coordinate with adjacent wall construction for anchor placement.
- E. Field paint doors and frames as specified in Section 09 9113.
- F. The frame is to be mounted to the studding in such a manner to prevent a spreading of the frame from the studs of less than 1/2 inch.

**3.3 CONSTRUCTION**

- A. Interface with Other Work:
  - 1. Coordinate frame installation with size, location, and installation.
  - 2. Coordinate with door opening construction, door frame, and door hardware installation.
- B. Site Tolerances:
  - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

**3.4 FIELD QUALITY CONTROL**

- A. Section 01 4000 - Quality Requirements: Field inspection.

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

- B. Inspect metal door and frame installation, alignment, attachment to structure, and operation.

**3.5 ADJUSTING AND CLEANING**

- A. Adjust hardware for smooth and balanced door movement.
- B. Section 01 7300 - Execution: Cleaning installed Work.

Payment for items of work covered under Division 8 of the plans and these specifications shall be based on the lump sum bid pricing identified in the Bid Schedule. No additional compensation will be allowed.

**END OF SECTION**



**SECTION 08 3100**  
**ACCESS DOORS AND PANELS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Fire-resistive rated access door and frame units.
  - 2. Non-fire-resistive rated access door and frame units.
  - 3. Wall and ceiling locations.
- B. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

**1.2 SUBMITTALS**

- A. Division 1 - Submittal Procedures: Procedures for submittals.
  - 1. Product Data: Sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
  - 2. Shop Drawings: Indicate the exact position of all access door units.
- B. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.
  - 1. Project Record Documents: Accurately record the following:
    - a. Actual locations of all access units.

**1.3 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
  - 2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect Products.

**SECTION 08 3100**  
**ACCESS DOORS AND PANELS**

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturer's offering Products which may be incorporated in the Work include the following:
  - 1. J.L. Industries, Bloomington, MN (612) 835-6850. (800) 554-6077.
  - 2. Karp, Maspeth, NY (800) 888-4212.
  - 3. Larsen's Manufacturing Company, Minneapolis, MN (800) 527-7367.
  - 4. Milcor, Holland, OH (800) 861-6452.
- B. Section 01 6000 - Product Requirements: Product options and substitutions. Substitutions: Permitted.

**2.2 ACCESS DOORS**

- A. Non-Fire-Rated: 20-gage recessed steel panel doors to accept field finish of drywall.
- B. Fire-Rated Models: 14-gage recessed steel panel doors to accept field finish of drywall.

**2.3 FABRICATION**

- A. Fabricate frames and flanges of 0.058-inch steel.
- B. Fabricate door panels of 0.070-inch single thickness steel sheet.
- C. Weld, fill, and grind joints to ensure flush and square unit.
- D. Hardware:
  - 1. Hinge: 175-degree stainless steel piano hinge heavy duty type concealed constant force closure spring type.
  - 2. Lock: Screwdriver slot for quarter turn cam lock unit.

**2.4 FINISHES**

- A. Base Metal Protection: Prime coat units with alkyd primer. Color as noted on drawings.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 7300 - Execution: Verification of existing conditions before starting work.

**SECTION 08 3100**  
**ACCESS DOORS AND PANELS**

- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  - 1. Verify that rough openings for door and frame are correctly sized and located.
- C. Report in writing to Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**3.2 INSTALLATION**

- A. Install units in accordance with manufacturer's published instructions where indicated on Drawings and required for access.
- B. Install frames plumb and level in opening. Secure rigidly in place.
- C. Position unit to provide convenient access to concealed work requiring access.

**3.3 CONSTRUCTION**

- A. Interface with Other Work: Coordinate with mechanical, electrical, and other Work requiring access units.

**END OF SECTION**

**SECTION 08 4113**  
**ALUMINUM ENTRANCES AND STOREFRONTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Aluminum framed entrances and storefronts.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 07 2719 – Plastic Sheet Air Barriers.
3. Section 07 9200 - Joint Sealants.
4. Section 08 7100 - Door Hardware.
5. Section 08 8000 - Glazing.

**1.2 REFERENCES**

**A. ASTM International (ASTM):**

1. ASTM B221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and tubes.
2. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.
3. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
4. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
5. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage through Installed Windows and Doors.
6. ASTM E1105 Standard test Method for Field Determination of Water Penetration of Installed Exterior Windows, Curtain Walls, and Doors by Uniform or Cyclic Static Air Pressure Difference.

**B. American Architectural Manufacturers Association (AAMA):**

1. AAMA 611 – Voluntary Specification for Anodized Architectural aluminum.

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**ALUMINUM ENTRANCES AND STOREFRONTS**

2. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- C. National Fenestration Council Rating (NFRC):
  1. Component Modeling Approach (CMA), CMA Software Tool (CMAST).
  2. NFRC-100- Standard Procedure for Determining Fenestration Product U-factors.
  3. NFRC-200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
- D. Code of Federal Regulations, Title 16, Part 1201 (16 CFR 1201):
  1. Consumer Product Safety Commission Safety Standard for Architectural Glazing Materials.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Water-Resistance test: In accordance with ASTM E331. No water leakage when tested at 8 PSF (pounds per square foot) static pressure differential.
- B. Air-Infiltration: In accordance with ASTM E283. Air infiltration shall not exceed 0.06 cfm/SF at a static air pressure difference of 6.24 psf.
- C. Structural Performance: In accordance with ASTM E330. Deflection under design load shall not exceed L/175 of the clear span.
- D. Energy-Related Performance Ratings:
  1. Thermal Performance U-Factor: 0.41
  2. Solar Heat Gain Coefficient (SHGC): 0.26
  3. Visible Transmittance (VT): 0.46

**1.4 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings for the Work of this section, prepared and reviewed before fabrication. Include plans, elevations, opening, identification symbols, sizes, and complete details for materials, finishes, sizes, profiles, moldings, dimensioned locations of hardware items with reinforcement, methods of anchoring, assembly, installation, isolation, glazing procedure as well as reglazing procedures, materials, flashing, and caulking.
- B. Product Data: Submit manufacturer's Product Data.
- C. Test Reports: Submit test reports from AAMA accredited laboratories certifying the performance requirements of Article 1.03.

**SECTION 08 4113**  
**ALUMINUM ENTRANCES AND STOREFRONTS**

- D. Material Samples: Submit the following:
1. Storefront, door and frame sections with specified finish, fasteners, and accessories.
  2. Cured sealant colors.
- E. Energy Performance: Submit a report or calculation for each system and glass type listing the frame, glazing and spacer components and indicating the U-Factor, solar heat gain coefficient (SHGC) and visible transmittance (VT) of the storefront assembly demonstrating conformance to project energy calculations.
1. Insulated Storefronts: Submit NFRC CMAST Fenestration Calculation Report / Bid Report:
  2. Non-Insulated Storefronts: Submit energy calculations.
- F. CxSP will review the Submittals of this Section as part of the Commissioning of Thermal and Moisture Protection.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Except for more stringent requirements specified in this Section, manufactured aluminum windows shall comply with the requirements of the CBC Part 6, California Energy Code, Section 110.6, Mandatory Requirements for Fenestration Products and Exterior Doors.
  2. Windows shall be designed to withstand the minimum loads prescribed in CBC Section 1609A.
- B. Field applied products that release VOC's, such as sealants, caulking, adhesives, primers, and paints, shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).
- C. Installer Qualifications:
1. Minimum five-year experience installing windows of the type specified by this Section.
  2. Installer shall be approved by the window manufacturer as an approved installer.
- D. Manufacturer Qualifications: Minimum 5-year experience in producing aluminum windows of the type specified. Window manufacturer technical representative shall provide field services to verify window installation is in accordance with manufacturer's written instructions.

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**ALUMINUM ENTRANCES AND STOREFRONTS**

- E. Mock-ups: Provide mock-up of one typical door and window unit for review by the ARCHITECT.
- F. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference in accordance with Section 01 3119, Project Meetings, to review the progress of construction activities and preparations for the installation of storefronts and other related work of this Section.

**1.6 WARRANTY**

- A. Manufacturer shall provide a 10-year material warranty for aluminum storefront.
- B. Manufacturer shall provide a 10-year material warranty for doors.
- C. Anodized finish of storefronts, doors and related components shall be warranted for 10 years against cracking, crazing, flaking, or blistering,

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Centered Glazing:
  - 1. Arcadia AG-601T Series.
  - 2. EFCO Series 406 (T).
  - 3. Kawneer Co. Trifab VersaGlaze 601T.
  - 4. Equal.

**2.2 MATERIALS**

- A. Extrusions shall be 6063-T6 alloy and temper, per ASTM B221.
- B. Fasteners: Aluminum, stainless steel, or zinc-plated steel at exposed conditions. Perimeter anchors shall be aluminum or steel. Steel anchors shall be isolated from aluminum members.
- C. Glazing Gaskets: EPDM elastomeric extrusions or vinyl reinforced with fiberglass cord.
- D. Glazing Sealants: As recommended by manufacturer for joint type.
- E. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- F. Joint Sealants: For installation at perimeter of storefront system shall be as specified in Section 07 9200, Joint Sealants.

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- G. Hardware: Finish hardware shall be as specified in Section 08 7100 - Door Hardware.
- H. Glazing: Glazing shall be as specified in Section 08 8000, Glazing.

**2.3 FABRICATION**

- A. Framing sections must match existing 2 inches by 4-inch thermally broken by one inch glazing; contractor to field verify size prior to ordering framing.
  - 1. Major portions of door sections, except glazing beads, shall be nominal 0.125 inch.
  - 2. Wall thickness of frame members shall be nominal 0.093 inch.
- B. Framing system shall provide continuous head and sill channels spliced together with formed brake metal sleeves at center of vertical mullions. The framing system shall provide for flush glazing on sides with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension and overall depth as noted above. Diverters shall be provided to collect water infiltration and divert them to the exterior.
- C. Door framing members shall match storefront framing appearance. Door stiles and rails shall be tubular sections, accurately joined at corners with heavy concealed reinforcement brackets secured with bolts and screws and shall be metal inert gas (MIG) welded. Doors shall be furnished with snap-in stops with bulb glazing gasket both sides of glass. Exposed screws are not permitted. Each door leaf shall be furnished with an adjusting mechanism, located in the top rail near the lock stile, which provides for minor clearance adjustments after installation. A hard-backed poly-pile weatherstrip shall be installed in both stiles of center hung single doors.
- D. Doors with panic hardware shall be provided with a mid-rail. Panel below mid rail shall consist of a composite infill panel with a polystyrene core and 0.032 aluminum sheet on each side, by Mapes Architectural Panels, Alucabond, or equal.

**2.4 FINISH**

- A. Storefronts and accessories shall be furnished with an electronically deposited color anodic finish-Class AAM10C22A44. Thickness shall be 0.7 mil minimum thickness conforming to AAMA 611.
- B. Color: Black Anodize to match existing. Contractor to field verify color prior to purchasing it.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine openings, substrates, structural support, anchorage, and conditions, for compliance with requirements for installation tolerances and other conditions



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affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, air barriers, and other built-in components to ensure a coordinated, weather tight aluminum framed storefront installation.

**3.2 INSTALLATION**

- A. Install storefronts in accordance with approved shop drawings and manufacturers installation instructions. Installation shall be level, square, plumb and in proper relation to wall flashing and adjacent construction.
- B. Apply sealants to provide a weather tight installation at joints, intersections, and opening perimeters. Tool sealants to fill the joint and provide a smooth finished surface.
- C. Install security glazing with Dow 795 sealant as required by Security Glazing.

**3.3 FIELD QUALITY CONTROL**

- A. CONTRACTOR shall retain and pay a testing agency to conduct on-site air and water infiltration tests. On-site tests shall be conducted with CONTRACTOR, storefront manufacturer's representative, OWNER, Project Inspector and ARCHITECT present. The Owner will select the units to be tested.
- B. Ten percent of installed storefront panels will be selected for air and water testing. If one or more windows fail, an additional ten percent of windows (not including the ones previously tested) will be selected for further testing. Selection of additional ten percent of units and retesting will be performed until no leaks occur.
- C. Water-Infiltration Test: Test will be conducted according to requirements of ASTM E1105. No water leakage is permitted. Windows will be tested at 6 pounds per square foot test pressure differential.
- D. Air-Infiltration Test: Test will be conducted according to requirements of ASTM E783. Allowable infiltration shall not exceed 0.9 cfm/SF when tested at 6.24 pounds per square foot field test pressure differential.
- E. Windows within storefronts will be tested per the requirements of Section 08 5113, Aluminum Windows.
- F. Field Test report will be submitted to the OWNER, CONTRACTOR, and ARCHITECT. Field Test report will include the following:
  - 1. Name of the testing agency and testing agency's credentials.
  - 2. Date of test.
  - 3. Standards complied with during testing.
  - 4. Number and locations of specimens tested.

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- 5. Thorough analysis of test result indicating passing or failing of specimens at pressures specified.
- 6. Photos illustrating conditions of failed compliance at pressures required.
- G. CONTRACTOR shall perform field adhesion tests of sealants in accordance with manufacturer's instructions and ASTM C1521, Method A, Tail Procedure. Remove sealants that fail adhesion testing; clean substrates, reapply sealants, and re-test. Test sealants adjacent to failed sealants. Submit field adhesion test report indicating tests, locations, dates, results, and remedial actions taken. Number of tests shall be per ASTM C1521, Destructive Procedure.

3.4 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

3.5 CLEAN UP

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**END OF SECTION**

**SECTION 08 7100  
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. Section includes:

- 1. Mechanical door hardware for:

- a. Swinging doors.
    - b. Sliding doors.
    - c. Gates.

- B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

- 1. Windows
  - 2. Cabinets (casework), including locks in cabinets
  - 3. Signage
  - 4. Toilet accessories
  - 5. Overhead doors
  - 6. Installation.
  - 7. Rough hardware.
  - 8. Conduit, junction boxes & wiring.
  - 9. Access doors and panels, except cylinders where detailed.

- C. Related Sections:

- 1. Division 01 Section "Alternates" for alternates affecting this section.
  - 2. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
  - 3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.

**1.3 REFERENCES**

- A. UL - Underwriters Laboratories

- 1. UL 10B - Fire Test of Door Assemblies
  - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
  - 3. UL 1784 - Air Leakage Tests of Door Assemblies
  - 4. UL 305 - Panic Hardware

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B. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

C. California Code of Regulations

1. Title 24: California Building Standards Code

1.4 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.

B. Action Submittals:

1. Product Data: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.
  - a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
3. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:
  - a. Door Index; include door number, heading number, and Architects hardware set number.
  - b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
  - c. Type, style, function, size, and finish of each hardware item.
  - d. Name and manufacturer of each item.
  - e. Fastenings and other pertinent information.
  - f. Location of each hardware set cross-referenced to indications on Drawings.
  - g. Explanation of all abbreviations, symbols, and codes contained in schedule.
  - h. Mounting locations for hardware.
  - i. Door and frame sizes and materials.
  - j. Name and phone number for local manufacturer's representative for each product.

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- k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
    - 1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.
  - 4. Key Schedule:
    - a. Initiate and conduct meeting(s) with Owner representatives and hardware supplier to determine system keyway(s), keybow styles, structure, stamping, degree of physical security and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner.
    - b. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used, and door numbers controlled.
    - c. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
    - d. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
    - e. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
    - f. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      - 1) Forward bitting list, key cuts, and key system schematic directly to Owner, by means as directed by Owner.
  - 5. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.
- C. Informational Submittals:
- 1. Qualification Data: For Supplier and Installer.
  - 2. Product Certificates for electrified door hardware, signed by manufacturer:
    - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
  - 3. Certificates of Compliance:

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- a. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in "QUALITY ASSURANCE" article, herein.

4. Warranty: Special warranty specified in this Section.

**D. Closeout Submittals:**

- 1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:
  - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
  - b. Catalog pages for each product.
  - c. Name, address, and phone number of local representative for each manufacturer.
  - d. Final approved hardware schedule, edited to reflect conditions as-installed.
  - e. Final keying schedule
  - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
  - g. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

**1.5 QUALITY ASSURANCE**

- A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
  - 1. Where specific manufacturer's product is named and accompanied by "No Substitute," including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)
    - a. Where no additional products or manufacturers are listed in product category, requirements for "No Substitute" govern product selection.
  - 2. Where products indicate "acceptable manufacturers" or "acceptable manufacturers and products," provide product from specified manufacturers, subject to compliance with specified requirements and "Single Source Responsibility" requirements stated herein.
- B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
  - 1. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  - 2. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of

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manufacturer's standard units in assemblies similar to those indicated for this Project.

3. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
- C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.
- D. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
  1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- F. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- G. Means of Egress Doors: Latches do not require more than 5 lbs. (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.
  1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbs. (22.2 N).
  2. Maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbs. (22.2 N) applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbs. (22.2 N) applied parallel to door at latch.
    - c. Fire Doors: The minimum opening force allowable by the appropriate administrative authority, not to exceed 15 lbs. (66.7N).
  3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

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4. Adjust closer so that the time required to move the door from the 90 degree position to 12 degrees from the latch is 5 seconds minimum.
- I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01.
  1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Inspect and discuss preparatory work performed by other trades.
  3. Inspect and discuss electrical roughing-in for electrified door hardware.
  4. Review sequence of operation for each type of electrified door hardware.
  5. Review required testing, inspecting, and certifying procedures.
- J. Coordination Conferences:
  1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.
    - a. Attendees: Door hardware supplier, door hardware installer, Contractor.
    - b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.
    - c. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

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

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
  1. Deliver each article of hardware in manufacturer's original packaging.
- C. Project Conditions:
  1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
  2. Provide secure lock-up for door hardware delivered to Project but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Protection and Damage:
  1. Promptly replace products damaged during shipping.
  2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace, or repair products damaged during Work.



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- 3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- E. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

**1.7 COORDINATION**

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. 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. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Existing Openings:
  - 1. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
  - 2. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.
- E. Direct shipments not permitted, unless approved by Contractor.

**1.8 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. Warranty Period: Years from date of Substantial Completion, for durations indicated.
    - a. Closers:
      - 1) Mechanical: 30 years.
    - b. Exit Devices:
      - 1) Mechanical: 3 years.
    - c. Locksets:
      - 1) Mechanical: 3 years.
    - d. Continuous Hinges: Lifetime warranty

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- e. Key Blanks: Lifetime
- 2. Warranty does not cover damage or faulty operation due to improper installation, improper use, or abuse.

**1.9 MAINTENANCE**

**A. Maintenance Tools:**

- 1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturer" in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- E. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

**2.2 MATERIALS**

**A. Fasteners**

- 1. Provide hardware manufactured to conform to published templates, prepared for machine screw installation.
- 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
- 3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on

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opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.

4. Install hardware with fasteners provided by hardware manufacturer.
- B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.
  1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
  2. Use materials which match materials of adjacent modified areas.
  3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.
- C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
  1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

### 2.3 HINGES

#### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series

#### B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
  - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
  - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
  - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
4. 2 inches or thicker doors:
  - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
  - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.

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6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
  - a. Steel Hinges: Steel pins
  - b. Non-Ferrous Hinges: Stainless steel pins
  - c. Out-Swinging Exterior Doors: Non-removable pins
  - d. Out-Swinging Interior Lockable Doors: Non-removable pins
  - e. Interior Non-lockable Doors: Non-rising pins
8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.
12. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.

### 2.4 CONTINUOUS HINGES

#### A. Stainless Steel

1. Manufacturers:
  - a. Scheduled Manufacturer: Ives
2. Requirements:
  - a. Provide pin and barrel continuous hinges conforming to ANSI/BHMA A156.26, Grade 2.
  - b. Provide pin and barrel continuous hinges fabricated from 14 gauge, type 304 stainless steel.
  - c. Provide twin self-lubricated nylon bearings at each hinge knuckle, with 0.25-inch (6 mm) diameter stainless steel pin.
  - d. Provide hinges capable of supporting door weights up to 600 pounds and successfully tested for 1,500,000 cycles.
  - e. On fire-rated doors, provide pin and barrel continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.

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- f. Provide pin and barrel continuous hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

### B. Cold-Rolled Steel

#### 1. Manufacturers:

- a. Scheduled Manufacturer: Ives

#### 2. Requirements:

- a. Provide pin and barrel continuous hinges conforming to ANSI/BHMA A156.26, Grade 2.
- b. Provide pin and barrel continuous hinges fabricated from type 1012 cold rolled steel.
- c. Provide twin self-lubricated nylon bearings at each hinge knuckle, with 0.25-inch (6 mm) diameter stainless steel pin.
- d. Provide hinges capable of supporting door weights up to 600 pounds and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide pin and barrel continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Provide pin and barrel continuous hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

### C. Aluminum Geared

#### 1. Manufacturers:

- a. Scheduled Manufacturer: Ives.

#### 2. Requirements:

- a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
- b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
- c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.

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- d. Provide hinges capable of supporting door weights up to 450 pounds and successfully tested for 1,500,000 cycles.
- e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
- f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
- g. Install hinges with fasteners supplied by manufacturer.
- h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

### **2.5 FLUSH BOLTS**

#### **A. Manufacturers:**

- 1. Scheduled Manufacturer: Ives

#### **B. Requirements:**

- 1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

### **2.6 SURFACE BOLTS**

#### **A. Manufacturers:**

- 1. Scheduled Manufacturer: Ives

#### **B. Requirements:**

- 1. Surface bolt s to have 1" throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy duty steel and cUL listed up to three (3) hours when used on the inactive door of a pair up to 8' in height.

### **2.7 COORDINATORS**

#### **A. Manufacturers:**

- 1. Scheduled Manufacturer: Ives

#### **B. Requirements:**

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1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

### 2.8 MORTISE LOCKS

#### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage L9000 series

#### B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latch bolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
  - a. UL Listed – 3 hour fire door
4. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
  - a. Lever Design: As scheduled.
  - b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

### 2.9 EXIT DEVICES

#### A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Von Duprin 98/35 series

#### B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.

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2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.
10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
  - a. Lever Style: Match lever style of locksets.
12. Accessibility: Maximum 5lbs force to retract latch bolt per CBC Chapter 11B.

"AX" feature: touchpad directly retracts the latchbolt with 5 lb. or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb. requirement.
13. Provide UL labeled fire exit hardware for fire rated openings.
14. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
15. Provide electrified options as scheduled.

### 2.10 CYLINDERS

#### A. Manufacturers:

1. Scheduled Manufacturer: Existing keying system.
2. Consult Building Locksmith for existing keying system information.

#### B. Requirements:



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1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.
  - a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
    - 1) 3 construction control keys
    - 2) 12 construction change (day) keys.
  - b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

**2.11 KEYING**

- A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
  1. Firm Name:
  2. Contact Person:
  3. Telephone:
- C. Requirements:
  1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
    - a. Master Keying system as directed by the Owner.
  2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
  3. Provide keys with the following features:
    - a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
  4. Identification:
    - a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.
    - b. Identification stamping provisions must be approved by the Architect and Owner.
    - c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped

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with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.

- d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
  - e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
5. Quantity: Furnish in the following quantities.
- a. Change (Day) Keys: 3 per cylinder/core.
  - b. Permanent Control Keys: 3.
  - c. Master Keys: 6.

### 2.12 KEY CONTROL SYSTEM

#### A. Manufacturers:

- 1. Scheduled Manufacturer: Telkee
- 2. Acceptable Manufacturers: HPC, Lund

#### B. Requirements:

- 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
  - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
  - b. Provide hinged-panel type cabinet for wall mounting.

### 2.13 DOOR CLOSERS

#### A. Manufacturers and Products:

- 1. Scheduled Manufacturer and Product: LCN 4040XP series.

#### B. Requirements:

- 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
- 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
- 3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter **double heat-treated pinion journal. QR code with a direct link to maintenance instructions.**

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4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes and providing reduced opening force as required by accessibility codes and standards. **Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.**
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. **Provide positive stop on reg valve that prevents reg screw from being backed out.**
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. **Pressure Relief Valve (PRV) Technology: Not permitted.**
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117 or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

### 2.14 DOOR TRIM

#### A. Manufacturers:

1. Scheduled Manufacturer: Ives

#### B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter, and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter, and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter, and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter, and length as scheduled.

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8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

**2.15 PROTECTION PLATES**

**A. Manufacturers:**

1. Scheduled Manufacturer: Ives

**B. Requirements:**

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:
  - a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
  - c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

**2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS**

**A. Manufacturers:**

1. Scheduled Manufacturers: Glynn-Johnson

**B. Requirements:**

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

**2.17 DOOR STOPS AND HOLDERS**

**A. Manufacturers:**

1. Scheduled Manufacturer: Ives

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B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

**2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING**

A. Manufacturers:

1. Scheduled Manufacturer: Zero International

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:
  - a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
  - b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

**2.19 SILENCERS**

A. Manufacturers:

1. Scheduled Manufacturer: Ives

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

**2.20 KEY FOB SYSTEM**

A. Manufacturers:

1. Scheduled Manufacturer: ASSA Abloy, LCN, Avigilon, OR Approved Equal.

B. Requirements:

## **SECTION 08 7100 DOOR HARDWARE**

1. Provide wall keycard reader & door release. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open.
2. Electrical service to door operators shall be provided under Division 16 Electrical. Minimum service to be 120 VAC, 5 amps.

### **2.21 LATCH PROTECTORS**

#### **A. Manufacturers:**

1. Scheduled Manufacturer: Ives

- #### **B. Provide stainless steel latch protectors of type required to function with specified lock.**

### **2.22 FINISHES**

#### **A. Finish: BHMA 626/652 (US26D); except:**

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 630 (US32D)
3. Continuous Hinges: BHMA 628 (US28)
4. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
5. Protection Plates: BHMA 630 (US32D)
6. Overhead Stops and Holders: BHMA 630 (US32D)
7. Door Closers: Powder Coat to Match
8. Wall Stops: BHMA 630 (US32D)
9. Latch Protectors: BHMA 630 (US32D)
10. Weatherstripping: Clear Anodized Aluminum
11. Thresholds: Mill Finish Aluminum

### **2.23 SPECIAL FINISHES**

#### **A. Antimicrobial coatings**

1. Furnish with antimicrobial coated hardware items designed with AM suffix to the finish, 626AM and /or 630AM. The non-toxic coating to be natural inorganic silver-ion based antimicrobial added to the clear coating. The powder coat containing the antimicrobial compound to be electro-statically applied to a minimum thickness of 1.5 mils. The antimicrobial coatings are to protect the surface of the hardware item by inhibiting the growth of bacteria, mold, mildew, and odor. The antimicrobial coating shall pass the BHMA clear coat requirements and be registered with the EPA and FDA listed.

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DOOR HARDWARE**

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated 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.
- D. Existing frames and doors to be retrofitted with new hardware:
  - 1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
  - 2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smoothly.
  - 3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.
  - 4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.

**3.2 PREPARATION**

- A. Where on-site modification of doors and frames is required:
  - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
  - 2. Field modify and prepare existing door and frame for new hardware being installed.
  - 3. When modifications are exposed to view, use concealed fasteners, when possible.
  - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
    - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
    - b. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

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**3.3 INSTALLATION**

- A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Custom Steel Doors and Frames: HMMA 831.
- B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- E. Door Operators: Connect door operators to electrical power distribution system as specified in Division 16 Sections.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- I. Lock Cylinders: Install construction cores to secure building and areas during construction period.
  - 1. Replace construction cores with permanent cores as indicated in keying section.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- N. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.



## **SECTION 08 7100 DOOR HARDWARE**

- O. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- P. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- Q. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- R. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- S. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.
- T. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.
- U. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

### **3.4 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. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### **3.5 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 door hardware is without damage or deterioration at time of Substantial Completion.

## SECTION 08 7100 DOOR HARDWARE

### 3.6 DEMONSTRATION

- A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

### 3.7 DOOR HARDWARE SCHEDULE

- A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type, and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.
- C. Hardware Sets: **PENDING**

Inspection of fire door assemblies and means-of-egress panic-hardware doors: Per 2019 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware. Certification, Testing and Quality Control shall be in accordance with Division 01 4523 Testing and Inspection services. All doors hardware and installation will be inspected by a third party selected by the city project manager/owner

Div 01 4523:

Per 2019 NFPA-80 5.2.1: Use a third party inspector not associated with the construction, supply, or installation of this project to develop a field survey of the doors and hardware. Survey is to be done by a member certified as a FDAI (Fire Door Assembly Inspector), Certified AHC (Architectural Hardware Consultant) or a certified testing laboratory: UL or Intertek. Certified Inspectors may be found at DHI.org, Intertek, or CAFDI.org.

**End of Section**

## SECTION 08 8000 GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Insulated tempered glass units, low E.
  - 2. Tempered glass units, low E.
- B. Related Documents: The Contract Documents, as defined in Section 01 1000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
  - 1. Section 08 1113 – Hollow Metal Doors and Frames.
  - 2. Section 08 4113 – Aluminum Entrances and Storefront.

#### 1.2 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
  - 2. ASTM C1036 - Standard Specification for Flat Glass.
  - 3. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
  - 4. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
  - 5. ASTM F1233 - Standard Test Method for Security Glazing Materials and Systems.
- C. Consumer Product Safety Standards for Architectural Glazing. CPSC 16 CFR, Part 1201.
- D. Flat Glass Marketing Association (FGMA):
  - 1. FGMA - Glazing Manual and Glazing Sealing Systems Manual.

#### 1.3 SUBMITTALS

- A. Section 01 3300 – Submittal Procedures: Procedures for submittals.
  - 1. Product Data:

## SECTION 08 8000 GLAZING

- a. Glass: Structural, physical, and environmental characteristics, size limitations, special handling, or installation requirements.
- b. Glazing compound: Provide chemical, functional, and environmental characteristics, limitations, special application requirements.
- 2. Samples:
  - a. Glazing: Submit one sample 12 x 12 inches (300 x 300 mm) in size of each type of glazing, illustrating tinting, and finish of glazing materials. Label each sample indicating kind, quality, and manufacturer.
- 3. Assurance/Control Submittals:
  - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
  - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

B. Section 01 7704 – Closeout Procedures and Training: Procedures for closeout submittals.

- 1. Submit written special warranty with forms completed in Owner name and registered with manufacturer as specified in this section.

### 1.4 QUALITY ASSURANCE

- A. Identification: Each unit of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched, or ceramic fired on the glass and be visible when the unit is glazed.
- B. Perform Work in accordance with FGMA Glazing Manual.
- C. Installer Qualifications: Company specializing in performing the Work of this Section with minimum 5 years documented experience.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 6000 – Product Requirements: Transport, handle, store, and protect Products.

### 1.6 PROJECT CONDITIONS OR SITE CONDITIONS

- A. Environmental Requirements:
  - 1. Do not install glazing when ambient temperature is less than 40 degrees F.
  - 2. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

## **SECTION 08 8000 GLAZING**

### **1.7 WARRANTY**

- A. Section 01 7704 - Closeout Procedures and Training: Procedures for closeout submittals.
- B. Special Warranty:
  - 1. Include coverage for cracking, breakage, and replacement of same.
    - a. Warranty Period: 1 year.
  - 2. Include coverage for sealed glass units from seal failure interpane dusting or misting, and replacement of same.
    - a. Warranty Period: 10 years

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
  - 1. Pilkington Libbey-Owens-Ford, Toledo, OH (800)221-0444.
  - 2. PPG Industries, Pittsburgh, PA (412) 434-2858 (800) 377-5267.
  - 3. Viracon, Owatonna, MN (800) 533-2080.
  - 4. OR Equal
- B. Section 01 6000 – Product Requirements: Product options and substitutions. Substitutions: Permitted.

### **2.2 GLASS MATERIALS**

- A. Tempered Glass: Condition A (uncoated surfaces), Type II, Class 1, Quality q3 (glazing select), Kind FT (fully tempered glass), match color of clear or tinted glass as applicable; fully thermal tempered, heat strengthening or chemical tempering is not permitted. Perform tempering by horizontal oscillating roller hearth or high speed roller hearth process. Do not permit fabrication processes leaving gripper or tong marks. Handle and size glass according to manufacturer's written instructions.
- B. Low Emissivity Glass (Low E Glass): Provide units with thin metallic high-transmittance coating applied to the number 3 surface of the unit, unless otherwise indicated. The U-value for the IGU shall be no greater than 0.34, unless otherwise indicated.

### **2.3 GLASS SETTING MATERIALS**

- A. Glazing materials and accessories shall be fully compatible with the materials and finishes with which they are in contact.

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- B. Setting Blocks: ASTM C864, channel shape; having ¼ inch internal depth, Shore A hardness of 80 to 90 Durometer. Blocks shall be a minimum 2 inch long. Block width shall be approximately 1/16 inch less than the full width of the rabbet. Block thickness shall be at least 3/16 inch, sized for rabbet depth as required.
- C. Spacers: ASTM C864, channel shape, with ¼ inch internal depth, 3/32 inch flanges, eb, 1/8 inch thick, one to 3 inches long. Spacers shall provide Shore A hardness of 40 to 50 Durometer.
- D. Vinyl Glazing Channels: Profile compatible with framing system and designed to accommodate glass of specified thickness, light gray in color. Provide for dry glazing aluminum frames where indicated or permitted.
- E. Glazing Tape: Poly-isobutylene based sealant tape, conforming to AAMA 804.1, with adhesive one side protected by temporary paper cover, Extrusion-Seal manufactured by Pecora Corp., No. 303 by Protective Treatments, Inc., or equal.
- F. Spring Steel Spacers: Galvanized steel wire or strip designed to position glazing in channel or rabbet sash with stops.
- G. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbet sash without stops.
- H. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular, or diamond-shaped pieces, 1/4 inch minimum size.
- I. Glazing Sealants for Metal Sash: GE Silicones Silglaze II 2800, GE Silicones Silpruf, GE Silicones 1200 Silicone, and Dow Corning 999A. Polybutylene, oleoresinous, asphalt, and oil base sealants are not permitted. Provide sealant of same color as structural silicone sealant unless otherwise required.
- J. Glazing Compound for Wood Sash: Provide acrylic latex glazing compound for bedding and sealing glass in wood frames
- K. Glazing Compounds and Sealants for Thermoplastic: Provide silicone, butyl, or polysulfide glazing compound.
- L. Mirror Setting Materials: Manufactured by Palmer Products Corporation, or equal, for installation of mirrors, and as follows:
  - 1. Mirror backing paint: Mirro-Bac Paint, or equal, formulated to protect mirror silvering.
  - 2. Mirror bond coat: Mirro-Mastic Bond, or equal, formulated to isolate deleterious backing materials from mastic and mirror.
  - 3. Mirror mastic: Palmers Super Set Mirro-Mastic PM290.

## SECTION 08 8000 GLAZING

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  - 1. Verify that openings for glazing are correctly sized and within tolerance.
  - 2. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
- B. Report in writing to Project Manager prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

#### 3.2 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.

#### 3.3 GLAZING

- A. Locate setting blocks at quarter points of sill; set in sealant if heel or toe bead is required.
- B. Install spacers inside and out except where pre-shimmed tape or glazing gaskets are to be used.
- C. Set each piece in a series to other pieces in pattern draw, bow, or other visually perceptible characteristics.
- D. Provide glazing sealants and gaskets as required for glazing application. Coordinate with other Sections for material compatibility.
- E. Gaskets:
  - 1. Provide adequate anchorage, particularly for driven-in wedge gaskets.
  - 2. Miter and weld end of channel gaskets at corners to provide continuous gaskets.
  - 3. Seal face gaskets at corners with sealant to close opening and prevent withdrawal of gaskets from corners.

## **SECTION 08 8000 GLAZING**

- F. Do not leave voids in glazing channels except as specifically indicated or recommended by glass manufacturer. Force sealant into channel to eliminate voids. Tool exposed surfaces to slight wash away from joint. Trim and clean promptly.
- G. Do not allow sealant to close weeps of aluminum framing.
- H. Provide filler rod where sealants are used in the following locations:
  - 1. Head and jamb channels.
  - 2. Colored glass over 75 united inches in size.
  - 3. Clear glass over 125 united inches in size.

### **3.4 CONSTRUCTION**

- A. Interface with Other Work: Coordinate glazing with installation of entrances specified in Section 08 11 13 Hollow Metal Doors and Frames and 08 41 13 Aluminum Entrances and Storefronts.

### **3.5 FIELD QUALITY CONTROL**

- A. Section 01 4000 - Quality Requirements: Field testing and inspection.
- B. Inspect preparation and installation of glass.

### **3.6 CLEANING**

- A. Section 01 7300 – Execution: Cleaning.
- B. Remove glazing materials from finish surfaces.
- C. Remove labels after Work is complete.
- D. Clean glass and adjacent surfaces.

### **3.7 PROTECTION**

- A. Section 01 4000 – Quality Requirements: Completion and Inspection.
- B. After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark reflective or Spandrel glass units.

## **END OF SECTION**



**SECTION 09 0565**  
**MOISTURE TESTING FOR FLOORING INSTALLATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Moisture, alkali, and bond testing of existing and new concrete slabs on grade and elevated slabs scheduled to receive adhered flooring.

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Division 09 Finishes: Flooring Sections.

**1.2 REFERENCES**

**A. ASTM International (ASTM):**

1. ASTM D7234 – Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
2. ASTM F710 – Practice for Preparing Concrete Floors to Receive Resilient Flooring.
3. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
4. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

**1.3 TESTING REQUIREMENTS**

**A. Perform the following tests:**

1. At new and existing concrete slabs on grade and below grade:
  - a. Moisture Vapor Emission Rate testing per ASTM F1869.
  - b. Relative Humidity testing per ASTM F2170.
  - c. pH testing per ASTM F710.
  - d. Bond testing per D7234 or manufacturer recommendations.
2. At new and existing lightweight concrete elevated slabs:
  - a. Relative Humidity testing per ASTM F2170.
  - b. pH testing per ASTM F710.
  - c. Bond testing per D7234 or manufacturer recommendations.
3. At new normal weight concrete elevated slabs:
  - a. Moisture Vapor Emission testing per ASTM F1869.
  - b. Relative Humidity testing per ASTM F2170.
  - c. pH testing per ASTM F710.

**SECTION 09 0565**  
**MOISTURE TESTING FOR FLOORING INSTALLATION**

- d. Bond testing per D7234 or manufacturer recommendations.

**1.4 SUBMITTALS**

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; indicating:
  - 1. Moisture, humidity, and pH limits.
  - 2. Manufacturer's bond/compatibility test procedure.
- B. Test Report: Submit chart form with small scale floor plans showing the location of each test performed.
  - 1. Submit report for relative humidity test in accordance to ASTM F2170. Include pH, moisture vapor emission, and adhesion test results.
  - 2. Indicate areas where the test results exceed the floor covering manufacturer's limits and indicate proposed remediation procedures.

**1.5 QUALITY ASSURANCE**

- A. Tests indicated in this Section shall be performed by CONTRACTOR or a qualified independent testing agency retained and paid for by CONTRACTOR. OWNER may perform testing at its own expense to compare to CONTRACTOR's test results.
- B. Testing kits:
  - 1. Moisture-Vapor Emission: Prepackaged anhydrous calcium chloride test kits conforming to requirements of ASTM F-1869.
  - 2. Alkalinity: Calibrated digital pH meter in accordance with ASTM F-710.
  - 3. Relative Humidity: Relative humidity concrete moisture testing equipment conforming to ASTM F-2170.
- C. Chemically based products such as sealers, primers, fillers, and adhesives, shall be approved by the OWNER's Office of Environmental Health and Safety (OEHS).

**1.6 ENVIRONMENTAL CONDITIONS**

- A. Project areas to be tested shall be at the same temperature and humidity expected during normal use. These temperature and humidity levels shall be maintained for 48 hours prior to, and during the testing. If this is not possible, temperature and relative humidity ranges shall be within ranges indicated in the applicable ASTM test method.

**PART 2 – PRODUCTS – NOT USED**

**PART 3 - EXECUTION**

**3.1 PREPARATION**

**SECTION 09 0565**  
**MOISTURE TESTING FOR FLOORING INSTALLATION**

- A. Testing shall take place after allowing concrete to dry for a minimum of 90 days.
- B. Prior to test placement, CONTRACTOR shall clean concrete slabs and have them free of foreign substances, such as residual adhesives, curing or hardening compounds, adhesive removers, sealers, paints, and other foreign materials that might prevent adhesive bond. These materials shall be removed not less than 24 hours prior to the placement of the test kits. Testing when floor coverings have never been installed may waive the 24-hour wait period.
- C. The test site temperature and humidity shall be in conformance to Article "Environmental Conditions."
- D. Minimum number of tests: For Moisture Vapor Emission Rate, Relative Humidity, and pH testing, provide three for the first 1,000 square feet of floor area, and at least one for each additional 1,000 square feet or fraction thereof.

**3.2 MOISTURE VAPOR EMISSION TESTING (MVEP)**

- A. MVEP testing shall be performed in accordance to ASTM F1869.
- B. Unless more stringent requirements are recommended by flooring manufacturer, the maximum allowable moisture release at time of flooring installation shall be three pounds per 24 hours per 1,000 square feet.
- C. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time. Expose Calcium Chloride and set dish on concrete surface. Install test containment dome and allow test to proceed for 60 – 72 hours.
- D. Retrieve the test dish by carefully cutting through containment dome. Close and reseal test dish. Weigh test dish on site recording weight and stop time. Calculate and report results as "pounds of emission per 1,000 sq. ft. per 24 hours".
- E. In the event the MVEP value exceeds the value specified in this Article and the flooring manufacturer recommended limits, CONTRACTOR shall propose remediation to OWNER. In new concrete slab construction, remediation shall be at no cost to OWNER.

**3.3 RELATIVE HUMMIDITY TESTING**

- A. Relative humidity testing shall be performed in conformance to ASTM F2170.
- B. Choose test areas where high moisture levels are suspected. Holes in new concrete slabs may be cast or drilled. Depth of holes shall be 40% of slab thickness for slabs drying only from the top, and 20% when drying from top and bottom, as indicated on ASTM F2170. Determine the concrete thickness of each type of slab to be tested and calculate depth of holes.
  - 1. Hole shall be drilled dry; do not use water for cooling or lubrication. Drill holes in the concrete and insert test liners. Hole shall not be more than 0.04 inches, or one millimeter, larger than the test liner.
  - 2. Before placing concrete, secure liner tube to formwork or steel reinforcing to avoid displacement during concrete placement, consolidation, and finishing.

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**MOISTURE TESTING FOR FLOORING INSTALLATION**

Secure a solid rod into the liner and protrude slightly above the top of the liner to exclude fresh concrete from entering the liner.

- C. Clean the area around the hole with a vacuum cleaner and vacuum the dust out of the hole. Immediately, set the sleeve by tapping the sleeve into the hole with a hammer or mallet.
- D. Remove the sleeve plug and place probe into the sleeve assuring that it reaches the bottom of the test hole. Connect the probe lead wire to the meter and turn meter on. Allow time for the probe to sit in the test sleeve to achieve moisture equilibrium before taking relative humidity readings. Probe shall be at the same temperature as the concrete before the reading. Check for drift and follow meter manufacturer recommendations.
- E. Record the relative humidity to the nearest percent and temperature to the nearest degree. Record location of hole within the structure and depth of probe. Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the test location. Remove the liner and fill the hole with a cementitious patching compound.
- F. In the event the relative humidity exceeds 75% and the flooring manufacturer recommended limits, CONTRACTOR shall propose remediation to OWNER. In new concrete slab construction, remediation shall be at no cost to OWNER.

**3.4 PH LEVEL TESTING**

- A. Perform testing in accordance to ASTM F710, and at the same time as the vapor emission and relative humidity tests.
- B. Place several drops of water onto the concrete surface to form a puddle approximately 1" in diameter. Allow the water to set for 60 +/- 5 seconds. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading. Record and report results.
- C. When using pH Pencil and pH Meters, follow the instrument manufacturer's instructions.
- D. The surface of the concrete should have a pH of 9 or less. In the event the pH exceeds this value, and the flooring manufacturer recommended pH limits, CONTRACTOR shall propose remediation to OWNER. In new concrete slab construction, remediation shall be at no cost to OWNER.

**3.5 BOND TEST**

- A. Perform bond testing in accordance to ASTM D4541 or per manufacturer's recommendations.
- B. Select appropriate locations for the bond tests such as near walls or in light traffic areas. Spaced test samples approximately 50 feet apart throughout the designated installation area. Number of tests will be determined by the recommended spacing of 50 feet.
- C. Use the flooring material and recommended adhesives. Install 3' x 3' panels using the exact techniques that will be used for the flooring installation. It is recommended that tests be spaced approximately 50 feet apart throughout the designated

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**MOISTURE TESTING FOR FLOORING INSTALLATION**

installation area. Tape edges of panels to prevent edge drying of adhesive. Protect test panel from traffic.

- D. After 72 hours of placing the flooring, remove tape and observe whether it is bonded tightly to the floor, by trying to lift the edges with a scraper or other means, or pull flooring from the subfloor by hand. Determine if bonding is suitable for flooring installation.
- E. At locations where membrane, primer, leveler, or patch are applied, perform applicable bond testing recommended by flooring manufacturer to assure adequate bondage of flooring to substrate.
- F. Success or failure shall be determined by visual interpretation and the amount of physical effort required to remove the floor covering. If the flooring material can be removed, it will indicate failure of the bond test. If the flooring requires a great deal of effort to pull it up, the bond test can be considered successful, providing no sign of moisture is found. If bond failure occurs in new concrete slab construction, remediation shall be at no cost to OWNER.

**3.6 CLEAN UP**

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**3.7 PROTECTION**

- A. Protect the Work of this section until installation of finish flooring.

**END OF SECTION**

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Non-structural metal framing.
2. Slotted system for positive attachment of metal studs to fluted steel decks for head of wall expansion joint movement (cyclic).

**B. Related Requirements:**

1. Division 01 - General Requirements.
2. Section 07 9200 – Joint Sealants.
3. Section 09 2900 - Gypsum Board.

**1.2 PROJECT REQUIREMENTS**

**A. Regulatory Requirements: Comply with CBC requirements.**

**B. Design Requirements:**

1. Metal Studs: Studs for interior partitions shall be roll-formed channel or C-shapes.
2. Track: Stud track for floor and ceiling anchorage shall be channel configuration, sized to fit studs. Galvanized steel as manufactured for installation with specified metal studs.
3. Design: Design is based on minimum 5 pounds per square foot load applied perpendicular to walls. Deflection shall not exceed 1/240 under design load.

**C. Performance Requirements: The top track fire-rated assembly, when incorporated into stud systems and tested in conjunction with products specified in Sections 07 8116 and/or 07 8413, shall exhibit the following performance characteristics:**

1. Cyclic System: When tested for cyclical movement, in accordance with UL 2079.
2. When subsequently tested for one- and two-hour fire-resistive rated construction, in accordance with ASTM E119 and ASTM E814, assembly shall conform to requirements for hose stream resistance.

**1.3 SUBMITTALS**

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

- A. Shop Drawings: Submit drawings showing framing, connection details, accessories, and anchorage. Indicate location of assemblies and size and spacing of framing components.
- B. Product Data: Submit manufacturer's catalog data for each item proposed for installation.
- C. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

**1.4 DEFINITIONS**

- A. Cyclic Anchoring Method: A system which provides for positive attachment (as described in ASTM C754) of studs to upper track, and of track to overhead fluted deck, while permitting up to 1-inch of vertical movement.
- B. System: The application of the above products in their entirety as tested. There can be no intermixing of components unless specifically outlined in the appropriate test reports.

**1.5 QUALITY ASSURANCE**

- A. Coordinate with related Work to provide blocking for items mounted on finished surfaces and to provide allowances for pipes and other items inside partitions and walls.
- B. Comply with following as a minimum requirement:
  - 1. American Welding Society (AWS): Structural Welding Code Steel (D1.1); and Structural Welding Code Sheet Steel (D1.3).
  - 2. ASTM Standards:
    - a. ASTM A641 – Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire.
    - b. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
    - c. ASTM A1003 –Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.
    - d. ASTM C645 – Standard Specification for Non-Structural Steel Framing Members.
    - e. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

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**NON-STRUCTURAL METAL FRAMING**

- f. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- g. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.
- h. ASTM E814 - Standard Test Methods for Fire Tests of Penetration Firestop Systems.
- 3. Underwriter Laboratories (UL):
  - a. UL 94 – Classification and Flame-Retardant Thermoplastics.
  - b. UL 2079 - Standard for Safety Tests for Fire Resistance of Building Joint Systems.
- 4. American Iron and Steel Institute:
  - a. North American Standard for Cold Formed Steel Framing – Nonstructural Members.
- 5. Military Specifications (MIL-P):
  - a. Paint High Zinc Dust Content, Galvanizing Repair.
- C. Tolerances: Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting a 10-foot straightedge for its entire length at any location within a 1/8 inch tolerance. Install horizontal framing level within a tolerance of 1/8 inch in 12 feet in any direction.
- D. Manufacturers shall be members of the Steel Framing Industry Association (SFIA) or the Steel Stud Manufacturers Association (SSMA).

**1.6 DELIVERY, STORAGE AND HANDLING**

- A. Materials shall be delivered in their original unopened packages and stored protected from damage. Do not store material directly on grade. Provide adequate support to prevent bowing of material prior to installation.
- B. Store welding electrodes in accordance with AWS D12.1.

**PART 2 – PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Non-structural metal framing:
  - 1. ClarkDietrich.



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**NON-STRUCTURAL METAL FRAMING**

2. Marino/Ware.
  3. Cemco.
  4. Equal.
- B. Top Track Systems:
1. BlazeFrame DSL or MaxTrak by ClarkDietrich, or equal. Down-standing legs shall be nominally 2 1/2-inch and shall be provided with 1 1/2-inch slots at 1 inch on center.
  2. VertiTrack or VertiClip System by The Steel Network, Inc. or equal. Pre-assembled track with clips installed to match stud spacing. Clips with attached bushing and screws to allow stud movement.
  3. System must provide for minimum tested overall movement of 3/4" up and 3/4" down.
  4. Track shall be provided in standard widths of 4 and 6 inches and in 16, 18, and 20 gage (54, 43, and 33 mil) sheet steel thickness, as required by Project conditions and detailed.

**2.2 MATERIALS**

- A. Light Gage Metal Framing:
1. Metal framing shall be formed from corrosion resistant-steel conforming to requirements of ASTM A653, 33 ksi minimum.
  2. Metal framing shall be manufactured in conformance to AISI S220 and zinc coated to G60 per ASTM C645/AISI S220.
  3. Install metal framing according to ASTM C754.
- B. Studs: SFIA , Intertek CCRR - 0204SSMA, ICC-ES ER-3064, minimum yield 33 ksi, hot-dipped galvanized sheet steel, G-60, C Stud type, punched web (except tracks and joists), C-shaped, sizes required to conform to details and scheduled wall thicknesses. Studs shall be rolled from new steel sheet and shall not be produced from re-rolled steel. Stud flanges shall not be less than 1 1/4-inch wide; track legs, not less than 1 1/4-inch wide.
1. Wall Framing and Furring for Gypsum Wallboard: Studs and tracks shall be 20 gage (30 mils) 33 ksi unless otherwise indicated.
  2. Load-Bearing Studs: Studs and members 18 gage (43 mil) and thicker shall conform to requirements of Section 05 4100 - Structural Metal Stud Framing.
  3. Stud gages indicated on Drawings or specified are the minimum. Where required stud height and/or loads exceed code requirements or

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**NON-STRUCTURAL METAL FRAMING**

manufacturer's recommendations, provide heavier gage studs and/or decrease stud spacing as necessary to conform to code requirements.

- C. Shaft Wall Framing Members: CH or CT studs and J runners, 20 gage (30 mil) minimum for 2-1/2, 4 or 6 inch studs, conforming to AISI S220, fabricated of steel conforming to ASTM A653, hot-dip galvanized.
- D. Framing Accessories: Provide standard related accessories including floor and ceiling tracks, clips, web stiffeners, anchors, and similar items, of same manufacture as each type of stud specified, and as required for a complete installation.
- E. Wires: Soft-annealed galvanized steel wire per ASTM A641, 8 gage for hanger wires and 16 gage for framing unless otherwise specified.
- F. Fasteners: Wafer-head screws, self-drilling type for 20 gage (30 mil) metal and heavier. ASTM C954 self-drilling, self-tapping screws, Type S-12 pan head, 1/2 inch long.
- G. Acoustical Sealant: Permanently resilient type, non-hardening, as specified in Section 07 9200.
- H. Zinc-Rich Paint: Conform to MIL-P-21035. "Cold Galvanizing Compound", manufactured by ZRC Products Company, or equal. Provide for touch-up of galvanized surfaces.
- I. Steel Backing Plates: Provide a minimum 4 inch wide by 16 gage (54 mil) steel, or sections of studs and stud track welded or fastened to web of studs, except as otherwise indicated. Apply galvanizing coat.
- J. Anchorage Devices Powder Actuated: Minimum 0.177 inch diameter by 1-7/16 inch long fasteners in regular concrete and 0.145 inch diameter by 1 1/8-inch long fasteners in lightweight concrete. Allowable shear and tension values as permitted in ICC ES reports shall be reduced to 80 percent.
- K. Anchorage Devices, Drilled Expansion Anchors: Minimum 3/8 inch diameter with 2-1/4 inch embedment. Allowable shear and tension values as permitted in ICC ES reports shall be reduced to 80 percent.
- L. Top Track System Materials:
  - 1. Forming steel shall be mill certified prime steel:
    - a. For 0.0538 inch sections, conform to ASTM A1003, Grade 50 with a minimum yield point of 50,000 psi.
    - b. For 0.0428 and 0.0329 inch sections, conform to ASTM A1003, Grade 33, with a minimum yield point of 33,000 psi.
    - c. Formed steel shall be provided with galvanizing in accordance with ASTM A653 for a G60 zinc coating.

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2. Fasteners:
  - a. For attachment of steel studs to slotted track or deflection clip, minimum No.8 corrosion resistant by ½ inch waferhead screws.
  - b. For attachment of track system to overhead structural element or metal decking, as provided for by the structural details affecting the Work.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify that overhead or concealed Work is completed, tested, inspected, and finished as required before starting Work of this section.

**3.2 INSTALLATION**

- A. Walls and Partitions:
  1. Fasten floor runners for exterior walls and interior partitions to concrete slab with required power driven fasteners. Spacing of fasteners not to exceed 24 inches on center. Fasten ceiling runners to structure as by top track system manufacturer.
  2. Sound insulated walls and partitions: Embed floor runner tracks in two beads of acoustical sealant or two runs of compressible tape seal. Install top track nested into slotted track system, in same manner for full height of walls. Where wall ends abutting concrete, masonry, or steel set end studs in two beads of acoustical sealant or two tape seals and secure at 4-foot centers vertically.
  3. Space studs not over 16 inch on center unless indicated otherwise. Studs shall be located approximately 2 inches from door frame jambs, abutting partitions and partition corners, except those providing support for door and window openings.
  4. Furnish and install manufacturer's standard floor track. Fasten track to floor by means of 1/4 inch by 1 1/4-inch Star "Dryvin" hammer drive anchors or 3/16 inch by 1 inch round head, "Rawl-Drives" one-piece expansion bolts spaced not to exceed 3 feet, and installed in drilled holes in slab, or to wood joist with nails as indicated. Track may be fastened to concrete floor slabs with, power-driven fasteners.
  5. Studs shall be seated squarely in track with stud web and flanges abutting track web, plumbed and securely fastened with sheet metal screws, to flanges or web of both floor and top tracks. Provide 4 screws per stud.

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6. Where there is no suspended ceiling, tops of stud walls shall be provided with track and shoes and be fastened as specified for floors. Welding of studs to ceiling track will not be permitted except where bearing studs are installed.
  7. Over metal doorframes, install a cut-to-length section of runner track, with flanges slit and web-bent to allow flanges to overlap adjacent vertical studs, and securely fasten to studs. At doorjambs, extend studs continuous to structure above.
  8. Bridging, or horizontal bracing of 1 1/2-inch, cold-rolled channels shall be fastened in a manner to prevent stud rotation. Bridging shall be furnished as follows: walls up to 10 feet high, one row at mid-height; walls exceeding 10 feet high, bridging, or bracing rows spaced not to exceed 5 feet on center.
  9. Wind bracing shall be fastened where indicated on Drawings. Minimum size of strap shall be as indicated on Drawings. Track where strap terminates shall be anchored as indicated on Drawings.
- B. Suspension Under Ducts: For hangers spaced at 4 to 5 1/2-foot centers, provide 6 gage (0.192 inch diameter) hanger wires with minimum 2 inch runner channels spaced at maximum 48 inch centers. For greater spans, design system for live load of 10 pounds per square foot of area plus dead load and provide a detail in Shop Drawings.

**3.3 CONNECTIONS TO METAL DECKING**

- A. Provide pre-molded neoprene filler strips matching flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.
- B. The top runner track of fire-rated partitions shall be a minimum of 20 gage (33 mils) and fastened to metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Neither wallboard nor metal studs shall be fastened to top runner to allow for slab deflection. Areas above runner shall be friction fit with a minimum depth of 2 1/2-inch of 4 pounds per cubic foot mineral wool insulation. A minimum of 1/2 inch of firestopping compound shall be installed to each side of mineral wool insulation for 1-hour system, and 1 inch of firestopping for a 2-hour system. Install required special tracks, angles, fasteners, and strips of gypsum wallboard as required to achieve required fire resistance rating.
- C. Proprietary fire-rated top tracks are installed in accordance with manufacturer's recommendations and fire rating approval requirements.

**3.4 CLEANING**

- A. Remove debris, rubbish, and waste material and legally dispose of off Project site.

**3.3 PROTECTION**

**SECTION 09 22 16**  
**NON-STRUCTURAL METAL FRAMING**

- A. Protect Work of this section until Substantial Completion.

**END OF SECTION**

## **SECTION 09 2800 CEMENT BOARD**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Cement board and accessories.
- B. Related Sections
  - 1. Section 07 9200 – Joint Sealants.
  - 2. Section 09 2216 – Non-Structural Metal Framing
  - 3. Section 09 2900 – Gypsum Board.
  - 4. Section 09 3000 – Porcelain Tile.

#### **1.2 REFERENCES**

- A. American National Standards Institute (ANSI):
  - 1. A108.11, American National Standard for Interior Installation of Cementitious Backer Units.
  - 2. A118.1, American National Standard Specifications for Dry-Set Portland Cement Mortar.
  - 3. A118.4, American National Standard Specifications for Latex-Portland Cement Mortar.
  - 4. A118.9, Test Methods, and Specifications for Cementitious Backer Units.
  - 5. A136.1, American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile.
- B. American Society for Testing and Materials (ASTM):
  - 1. C 473, Test Methods for Physical Testing of Gypsum Panel Products.
  - 2. C 1325, Specification for Fiber-Mat Reinforced Non-Asbestos Cement Interior Substrate Sheets.
  - 3. C 1002, Specification for Steel Drill screws for the Application of Gypsum Panel Products or Metal Plaster Bases.
  - 4. D 2394, Methods for Simulated Service Testing of Wood and Wood-Based Finish Flooring.

#### **1.3 SUBMITTALS**

- A. Product Data: Manufacturers' specifications and installation instructions for each product specified.

## **SECTION 09 2800 CEMENT BOARD**

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

- A. Packaging and Shipping: Have materials shipped in manufacturer's original packages showing manufacturer's name and product brand name.
- B. Storage and Protection: Store materials inside and protected from damage by the elements. Protect ends, edges, and faces of cement boards from damage.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. National Gypsum Company.
  - 1. Cement Board:
    - a. Tile Backer: PermaBase® BRAND Cement Board OR Equal.
    - b. Underlayment: PermaBase BRAND Underlayment OR Equal.

### **2.2 MATERIALS**

- A. Cement Board:
  - 1. Backer Board: Cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; and complying with ANSI A118.9 and ASTM C 1325 (PermaBase BRAND Cement Board).
    - a. Thickness: 5/8 in.
    - b. Width: 4 ft.
    - c. Length: 8 ft.
    - d. Edges: Tapered.
    - e. Compressive Strength: Not less than 2250 lbs. per sq. in. when tested in accordance with ASTM D 2394.
    - f. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C 473.
  - 2. Underlayment: Cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; and complying with ANSI A118.9 and ASTM C.
    - a. Thickness: 1/4 in.
    - b. Width: 3 ft. or 4 ft.
    - c. Length: 4 ft. or 5 ft.
    - d. Edges: Tapered.
    - e. Compressive Strength: Not less than 2250 lbs. per sq. in. when tested in accordance with ASTM D 2394.
    - f. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C 473.

**SECTION 09 2800  
CEMENT BOARD**

4. Fasteners:
- a. Nails: 1-1/2-in. long, hot dipped galvanized, and in accordance with FS FF-N-105B, Type 2, Style 20.
  - b. Screws: Hi-Lo thread screws (No. 8) wafer head, corrosion-resistant, 1-1/4 in. or 1-5/8 in. long, and complying with ASTM C 1002.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. General: In accordance with the following reference standards and manufacturer's recommendations: ANSI A108.11.

Payment for items of work covered under Division 9 of the plans and these specifications shall be based on the lump sum bid pricing identified in the Bid Schedule. No additional compensation will be allowed.

**END OF SECTION**



## **SECTION 09 2900 GYPSUM BOARD**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Walls and Ceilings.
  - 2. Accessories.

#### **1.2 RELATED SECTIONS**

- A. Related Sections:
  - 1. Section 07 9200 – Joint Sealants.
  - 2. Section 09 2216 – Non-Structural Metal Framing
  - 3. Section 09 9123 – Interior Painting.

#### **1.3 REFERENCES**

- A. ASTM C1396 – 11 Standard Specifications for Gypsum Board.
- B. ASTM C473 – 12 Standard Test Methods for Physical Testing of Gypsum Panel Products.
- C. ASTM C1629 – Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Level 3 (highest) for hard- and soft-body impact when tested in accordance with ASTM C1629.
- B. Average water absorption for panels is not greater than (5) percent by weight after a two-hour immersion when tested in accordance with ASTM C473.

#### **1.5 SUBMITTALS**

- A. Submit under provisions of Section 01 3300 – Submittal Procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.

#### **1.6 QUALITY ASSURANCE**

- A. Quality Standards: GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Board.

## **SECTION 09 2900 GYPSUM BOARD**

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.

### **1.8 PROJECT CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturers offering items which may be incorporated in the Work include the following:
  - 1. United States Gypsum Company.
  - 2. National Gypsum Properties, LLC.
  - 3. American Gypsum.
  - 3. Or approved equal.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 6000 – Product Requirements.

### **2.2 GYPSUM BOARD**

- A. Gypsum Board Type X (fire-resistant) or Type C or Type ULIX as required by fire rated design and acoustic requirements: 5/8 inch thick, 4-foot wide and up to 16-foot-long conforming to ASTM C1396 with long edges tapered. Typically provide Type X fire resistant at rated walls per plan.
- B. Hi-impact XP Gypsum Board: 5/8" thick moisture and mold resistant with tapered edges; paper faced gypsum board with superior impact resistance & face paper folded around long edges to reinforce and protect core, ends cut square and finished smooth, typical at all locations. See plans for more info. Typical at all other locations not being fire rated or being wet locations.
- C. Water-Resistant Gypsum Backing Board: ASTM C630; 5/8 inch thick, ends cut square and finished smooth. 48-inch width, maximum permissible length; ends and edges straight and solid, edges tapered. Board consisting of a noncombustible water-resistant gypsum core, surfaced on face and back with water-repellent paper bonded to the core & face paper folded around long edges to reinforce and protect core, to be used at wet locations, see plans.

### **2.3 ACCESSORIES**

## **SECTION 09 2900 GYPSUM BOARD**

- A. Corner Beads and Edge Trim: GA 201 and GA 216.
- B. Joint Materials: Reinforcing tape and joint compound.
- C. Fasteners: Type S12 screws.

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. Section 01 7300 – Execution: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- C. Report in writing to the Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected and approved by Engineer.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and as indicated on the Drawings.
- B. Fasten gypsum board to furring or framing with screws.
- C. Tape, fill, and sand joints.

#### **3.3 FINISH LEVEL SCHEDULE**

- A. Level 4: Walls and ceilings are scheduled to receive paint finish.
  - 1. Level 1, plus three (3) separate coats of compound at joints, angles, fasteners, and accessories. Compound shall be smooth and free of tool marks and ridges.

#### **3.4 PROTECTION**

- A. Protect installed products until Substantial Completion.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

Payment for items of work covered under Division 9 of the plans and these specifications shall be based on the lump sum bid pricing identified in the Bid Schedule. No additional compensation will be allowed.

## **END OF SECTION**

## SECTION 09 3000 TILE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Tile and Accessories: Floor Unglazed and Wall Glazed.
- B. Related Sections:
  - 1. Section 07 9200 - Joint Sealant.

#### 1.2 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A108.5, 1999 - Specifications for Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
  - 2. ANSI A108.10, 1999 - Specifications for Installation of Grout in Tilework.
  - 3. ANSI A118.1, 1999 - Standard Specification for Dry-Set Portland Cement Mortar.
  - 4. ANSI A118.4, 1999 - Latex-Portland Cement Mortar.
  - 5. ANSI A118.9, 1999 - Test Methods and Specifications for Cementitious Backer Units
  - 6. ANSI A137.1, 1988 - Specifications for Ceramic Tile.
- B. ASTM International (ASTM):
  - 1. ASTM C 50 - Standard Specification for Portland Cement.
  - 2. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.
  - 3. ASTM C 847 - Standard Specification for Metal Lath.
- C. Tile Council of North America (TCNA): TCA Handbook for Ceramic Tile Installation, 2007.

#### 1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Procedures for submittals.
  - 1. Manufacturer's data sheets on each product to be used, including:
    - a. Preparation instructions and recommendations.
    - b. Storage and handling requirements and recommendations.
    - c. Installation methods.
  - 2. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
  - 3. Manufacturer's Certificate:
    - a. Certify that products meet or exceed specified requirements.
    - b. For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
  - 4. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

## SECTION 09 3000 TILE

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Company experienced in performing the Work of this Section.
- B. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing, or overheating.

### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install adhesives in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during tiling and for a minimum of 7 days after completion.

### 1.7 EXTRA MATERIALS

- A. Provide for Owner's use a minimum of 2 percent of the primary sizes and colors of tile specified, boxed, and clearly labeled.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with project requirements, manufacturers offering items which may be incorporated in the Work include the following:
  - 1. Dal-Tile Corporation.
  - 2. American Marazzi Tile, Inc.
  - 3. Roca Tile Group.
  - 4. Or approved equal as provided in Section 01 6000 – Product Requirements.

### 2.2 TILE

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types of colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
  - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other

## SECTION 09 3000 TILE

- packages.
  - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
  - 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
- B. Floor Unglazed Porcelain Tile or approved non-skid materials shall be used for the floor.:
- 1. Colors: As scheduled.
  - 2. Trim Units: Matching cove base, cove base corner, bullnose, cove/inside finger cove, radius cap, sink rail in corner/outcorner, outside cove corner shapes in sizes coordinated with field tile.
  - 3. Tile grout color as specified in drawings.
  - 4. Material samples shall be provided for approval by appropriate City Staff.
- C. Wall Porcelain Tile shall be used for the wall surface as scheduled.:
- 1. Colors: As scheduled.
  - 2. Trim Units: Matching cove base, cove base corner, bullnose, cove/inside finger cove, radius cap, sink rail in corner/outcorner, outside cove corner shapes in sizes coordinated with field tile.
  - 3. Tile grout color as specified in drawings.
  - 4. Material samples shall be provided for approval by appropriate City Staff.
- D. See Color / Material Schedule on Drawings for size and color.

### 2.3 SETTING MATERIALS

- A. Mortar Bed Materials:
- 1. Portland cement: ASTM C150, type 1, gray or white.
  - 2. Hydrated Lime: ASTM C207, Type S.
  - 3. Sand: ASTM C144, fine.
  - 4. Latex additive: As approved.
  - 5. Water: Clean and potable.
- B. Grout:
- 1. Standard Grout: Cement grout, sanded or unsanded, as specified in ANSI A118.6; color as selected.
  - 2. Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7; color as selected.
- C. Membrane at Walls:
- 1. 4 mil (0.1 mm) thick polyethylene film, ASTM D4397, ANSI A 118.10.
  - 2. Reinforced asphalt paper.
- D. Reinforcing Mesh: 2-inch by 2-inch (50 by 50 mm) size weave of 16/16 wire size;

**SECTION 09 3000**  
**TILE**

welded fabric, galvanized.

- E. Cementitious Backing Units
  - 1. ANSI A 118.9 or ASTM C 1325 (Type B).
  - 2. 2" alkali – resistant glass fiber mesh type.

**PART 2 EXECUTION**

**3.1 EXAMINATION**

- A. Division 1 - Execution: Verification of existing conditions before starting work.
  - 1. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1 and are ready to receive tile.

**3.2 PREPARATION**

- A. Protect surrounding work from damage.
- B. Remove any curing compounds or other contaminants.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

**3.3 INSTALLATION - GENERAL**

- A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Form internal angles square and external angles bullnosed.

**SECTION 09 3000  
TILE**

**3.4      INSTALLATION - WALL TILE**

- A.    Wall Tile: Install over cementitious backer units on studs, in accordance with TCA Handbook Method W244C-07, using membrane at toilet rooms.
- B.    Floor Tile: on cement mortar bed, install in accordance with TCA Handbook method F121-07 OR if existing slab is not depressed for a mortar bed install tile floor using the dry-set mortar, Later-Portland Cement Mortar, Epoxy of Furan Grout TSA method F115-07.

**3.5      CLEANING**

- A.    Clean tile and grout surfaces.

**3.6      PROTECTION OF FINISHED WORK**

- A.    Do not permit traffic over finished floor surface for 72 hours after installation.
- B.    Cover floors with kraft paper and protect them from dirt and residue from other trades.
- C.    Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways

**END OF SECTION**



**SECTION 09 5113**  
**ACOUSTICAL PANEL CEILING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

**1.2 SUMMARY**

- A. Section Includes:
1. Acoustical Ceiling Panels.
  2. Exposed grid suspension system.
  3. Suspended metal grid ceiling system (wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
  4. Perimeter trim.
- B. Related Sections:
1. Section 02 4149 – Selective Structure Demolition
  2. Section 09 2900 - Gypsum Board
  3. Section 09 9123 – Interior Painting
  4. Division 23 – Heating, Ventilation, and Air Conditioning
  5. Division 26 - Electrical

**1.3 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
1. ASTM C 635 - Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  2. ASTM C 636 - Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
  3. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
  4. ASTM E 580 - Specification for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.

**1.4 SYSTEM DESCRIPTION**

- A. Design Requirements: Rigidly secure acoustical ceiling system including integral mechanical and electrical components with maximum deflection of 1/360.
- B. Continuous/Wall-to-Wall

**SECTION 09 5113**  
**ACOUSTICAL PANEL CEILING**

**1.5 SUBMITTALS**

- A. Section 01 3300 - Submittal Procedures: Procedures for Submittals.
  - 1. Product Data: Metal grid suspension system components and acoustical panel units.
  - 2. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.

**1.6 QUALITY ASSURANCE**

- A. Regulatory Requirements: Surface Burning Characteristics in Accordance with ASTM E 84 for Class III or C finish:
  - 1. Flame Spread: Less than 200.
  - 2. Smoke Density: Less than 450.

**1.7 DELIVERY, STORAGE AND HANDLING**

- A. Deliver acoustical units in manufacturer's original unopened containers with brand name and type clearly marked.
- B. Store under cover in dry, watertight conditions.
- C. Prior to installation, store acoustical units for 24 hours minimum at same temperature and relative humidity as space where Work will be installed.

**1.8 PROJECT CONDITIONS**

- A. Jobsite Requirements: Maintain uniform temperature range of 60-85 degrees F, and humidity of no more than 70 percent relative humidity prior to, during, and after installation.

**1.9 ENVIRONMENTAL REQUIREMENTS**

- A. Resource Management:
  - 1. Recycled Content:
    - a. Acoustical panels type ACT-1: Manufactured from minimum 20 percent recycled newsprint.
    - b. Suspension system: Manufactured from minimum 20 percent recycled steel.

**SECTION 09 5113**  
**ACOUSTICAL PANEL CEILING**

**1.10 MAINTENANCE**

- A. Extra Materials: Provide 1 box of extra acoustical panels for each panel type, pattern, and color to State Representative.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Armstrong World Industries, Incorporated, Lancaster, PA (800) 448-1405.
- B. USG Interiors, Chicago, IL (800) 950-3839.
- C. CertainTeed Ceilings Corp. (800) 346-7978
- D. Or equal.

**2.2 SUSPENSION SYSTEM**

- A. Existing system to remain; protect in place.
- B. New system to match existing system.
  - 1. Color: White, see the finish material schedule on sheet A0.2, unless noted otherwise.
- C. Accessories

**2.3 ACOUSTICAL CEILING PANELS**

- A. Acoustical ceiling panels shall be class A in accordance to ASTM E1264.
- B. Acoustical panels shall meet the following surface-burning characteristics when tested in accordance to ASTM E84 for Class A materials:
  - 1. Maximum Flame Spread: 25.
  - 2. Maximum Smoke Developed: 50.
- C. Mold and Mildew Resistance: Panels and faces shall be treated with a biocide paint additive or an antimicrobial solution to inhibit mold and mildew.

**2.4 CEILING TYPES**

- A. ACT-1:

**SECTION 09 5113**  
**ACOUSTICAL PANEL CEILING**

1. Acoustical Ceiling Panels Type ACP:
  - a. Panel Name: Armstrong Calla & Ultima 1912, USG Mars ClimaPlus 88785, CertainTeed Symphony M #1220BB-75-1, or equal.
  - b. Panel Size: **24 in x 48 in** where needed to be replaced (**Match existing type**).
  - c. Panel Thickness: 3/4 inch.
  - d. Edge Detail: Angled Tegral.
  - e. Light Reflectance: 0.85 minimum, in accordance with ASTM E1477.
  - f. CAC: Minimum 45, UL Classified, complying with ASTM E1414.
  - g. NRC: Minimum 0.70, UL Classified, complying with ASTM C423.
  - h. Color: White per Finish Material Schedule.
  - i. Recycled Content: up to 56% total recycled content.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  1. Verify that layout of hangers will not interfere with other Work.
- B. Report in writing to State Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the United States Postal Service.

**3.2 INSTALLATION - SUSPENSION SYSTEM**

- A. Install system in accordance with ASTM C 636 and manufacturer's published instructions.
- B. Provide metal hanger tabs and clips attached to metal deck where required for attachment of suspension wires.
- C. Hang system independent of walls, columns, ducts, pipes, and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

## SECTION 09 5113 ACOUSTICAL PANEL CEILING

Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest affected hangers and related carrying channels to span extra distance.

- D. Locate system to match the demoed existing to Reflected Ceiling Plan.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Do not eccentrically load system or produce rotation of runners.
- F. Install edge molding at intersection of ceiling and vertical surfaces using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions. Secure at 16 inches (41 cm) on center.
- G. Install hold-down clips within five feet of doors.
- H. Rivet cross tees at 4 feet on center to edge molding.
- I. Install compression struts and secure system with tie wires as required to tie into existing.
  - 1. Provide hanger wires, splayed 45 degrees, within 3 inches of intersection between main runner and cross runner as required to tie into existing system.
  - 2. Provide compression strut and splayed hanger wires as follows:
    - a. One assembly for each light fixture.
    - b. Located within 6 feet of wall.
    - c. Located at maximum 12 feet on center or as indicated on Drawings.

### 3.3 INSTALLATION - ACOUSTICAL PANELS

- A. Fit acoustic units in place free from damaged edges or other defects. Install acoustic units' level, in uniform plane, and free from twist, warp, and dents.

### 3.4 CONSTRUCTION

- A. Interface with Other Work:
  - 1. Schedule installation of acoustic units after interior wet work is completed.
  - 2. Install after major above ceiling work is complete.
  - 3. Coordinate location of hangers with other Work.
- B. Site Tolerances:
  - 1. Variation from Flat and Level Surface: 1/8 inch in 12 feet.

### 3.5 FIELD QUALITY CONTROL

**SECTION 09 5113**  
**ACOUSTICAL PANEL CEILING**

- A. Inspect acoustical panel placement, ceiling grid suspension system installation and connection to structure.

**3.6 CLEANING**

- A. Clean exposed surfaces of acoustical ceilings including trim, edge moldings, and suspension system members.

**END OF SECTION**

## **SECTION 09 6513 RUBBER BASE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Topset coved rubber base for installation with surface flooring.
- B. Related Requirements:
  - 1. Division 01 - General Requirements.
  - 2. Section 09 6813 – Tile Carpeting.

#### **1.2 SUBMITTALS**

- A. Product Data: Submit manufacturer's published technical data describing materials, construction, and recommended installation instructions. Submit technical data and installation instructions for each adhesive material.
- B. Maintenance Instructions: Submit manufacturer's recommendations for maintenance, care, and cleaning of base.
- C. Samples: Submit Samples of top set base in each available color. Following color selections, submit Samples, not less than 12 inches long of each selected color and type. Submit pint cans of each type of adhesive.
- D. Maintenance Materials: Before Substantial Completion, deliver at least 50 lineal feet and five outside corner units of each color of rubber base installed. Deliver the materials in unopened factory containers or in sealed cartons with labels identifying the contents, matching installed materials. Include unopened cans of adhesives adequate to install the maintenance materials.

#### **1.3 QUALITY ASSURANCE**

- A. Qualifications of Installer: Minimum five years' experience in successfully installing the same or similar flooring materials.
- B. Comply with the following as a minimum requirement:
  - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 2. ASTM F1861: Standard Specification for Resilient Wall Base.
  - 3. Comply with current CHPS requirements, [www.chps.net](http://www.chps.net).
  - 4. Chemically based products such as sealers, primers, fillers, adhesives, etc. must be approved by Owner's Office of Environmental Health and Safety (OEHS).
  - 5. Each selected color and configuration shall be from same dye lot and color.

## **SECTION 09 6513 RUBBER BASE**

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

- A. Materials shall be delivered to the Project site in original unopened manufacturer's packaging clearly labeled with manufacturer's name. Store materials at room temperature, but not less than 70 degrees F, for a minimum of 48 hours before installation, unless otherwise indicated in manufacturer's printed instructions.

### **1.5 PROJECT CONDITIONS**

- A. Ventilation and Temperature: Verify areas that are to receive rubber base are ventilated to remove fumes from installation materials, and areas are within temperature range recommended by the various material manufactures for site installation conditions.

### **1.6 WARRANTY**

- A. Manufacturer shall provide a five-year material warranty.
- B. Installer shall provide a two-year fabrication and installation warranty.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Burke/Mercer Wall Base.
- B. Roppe, Pinnacle Rubber Base.
- C. Flexco Company, Wallflower Premium Rubber Wall Base.
- D. Johnsonite.
- E. Equal.

### **2.2 MATERIALS**

- A. Rubber base: Conform to ASTM F 861; Group 2, solid (homogeneous); Type 1, TS, (thermoset) vulcanized rubber, Style A, 4-inch high unless otherwise indicated, integral colors as selected, non-shrinking, 1/8-inch-thick, with matching molded outside corners.
- B. Base Adhesive: Water based, low odor type, as recommended by manufacturer of rubber base.

## **PART 3 - EXECUTION**

### **3.1 COORDINATION**



## **SECTION 09 6513 RUBBER BASE**

- A. Coordinate the Work of this section with other sections to provide a level, smooth and clean finish surfaces to receive rubber base.

### **3.2 EXAMINATION**

- A. Field verify dimensions and other conditions affecting the Work of this section before commencing the Work of this section.
- B. Before Work is started, examine surfaces that are to receive rubber base. Deficiencies shall be corrected before starting the Work of this section.

### **3.3 PREPARATION**

- A. Do not start preparation until adjacent concrete floor slabs are at least 90 days old and finished flooring is installed.
- B. Install rubber base when ambient temperature is 70 degrees °F or higher.

### **3.4 INSTALLATION**

- A. Install top set base at hard floors, including resilient flooring, concrete and wood, carpet, and other soft floors.
- B. Securely fasten cement base to backing in long lengths in accordance with manufacturer's recommendations. Lay out lengths so that not less than 18 inches long filler pieces are provided. Assure that top and toe continuously contact the wall and floor, and that all joints are tight. Install matching factory formed external corners at all offsets. Inside corners shall be coped; wrapped corners are not acceptable.
- C. Use of adhesive gun is prohibited. Apply adhesive directly to substrate using the appropriate notched trowel or spreader according to manufacturer's instructions. Maintain 1/8-inch gap from top of base to prevent adhesive oozing onto adjacent surfaces.
- D. Base and outside corners shall be rolled with a seam roller before adhesive sets.

### **3.5 CLEANING**

- A. Maintain surfaces of base clean as installation progresses. Clean rubber base when sufficiently seated and remove foreign substances.
- B. Clean adjacent surfaces of adhesive or other defacement. Replace damaged and/or defective Work to the specified condition.

### **3.6 CLEAN UP**

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**SECTION 09 6513**  
**RUBBER BASE**

3.7 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

END OF SECTION

**SECTION 09 6813  
TILE CARPETING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Tile carpeting.
- B. Related Requirements:
  - 1. Division 01 - General Requirements.
  - 2. Section 03 3000 - Cast-In-Place Concrete.
  - 3. Section 09 0565 - Moisture Testing for Flooring Installation.

**1.2 SUBMITTALS**

- A. Shop Drawings: Submit dimensioned layout of carpet tile and details for binder bars.
- B. Samples:
  - 1. Submit a minimum of three labeled carpet tile actual size with proper backing. Carpet style and color as selected by the Owner.
  - 2. Trim and accessories: Submit 12-inch (min.) long Samples of each type of trim proposed for the Work.
- C. Product Data: Submit the following:
  - 1. Carpet tile manufacturer's published technical data fully describing carpet materials, construction, and recommended installation directions.
  - 2. Technical data and installation instructions for each adhesive and sealer material.
  - 3. Carpet tile manufacturer's published instructions for maintenance, care, cleaning, and repair of carpet.
  - 4. Manufacturers recommended adhesives and primers.
- D. Certificate:
  - 1. Submit a certificate from carpet tile manufacturer that materials supplied comply with fire hazard resistance standards specified.
  - 2. Submit a manufacturer certification that the installer is approved by the manufacture to install the specified product.
- E. Installer's Experience Qualifications: Submit list of not less than five projects with similar scope of work, extending over period of not less than five years, indicating installer's experience record.

**1.3 QUALITY ASSURANCE**

- A. Comply with the following as a minimum requirement:
  - 1. Manufacturer's installation instructions

**SECTION 09 6813  
TILE CARPETING**

2. Materials shall comply with CBC Chapter 11B and ADAAG requirements.
  3. Carpet tile must be free of Anti-Microbial Protection.
  4. Comply with ASTM F1869 for moisture testing.
- B. Requirements of Regulatory Agencies: Carpet tile shall meet requirements of federal, state, and local regulatory agencies for flammability, static control, or other properties as specified with testing documentation from the manufacturer by a third-party laboratory.
- C. Carpet Tile Installation: Comply with CRI 104 - Standard for Installation of Textile Floor Covering Materials.
- D. Each color of carpet tile shall be of the same dye lot.
- E. Qualifications of Installer: Minimum five years' experience in successfully installing the same or similar flooring materials.
- F. Pre-Installation and Progress meetings: Prior to start of work of this section and after approval of submittals, schedule an on-site Pre-Installation and progress meetings between Contractor, Supervising Installer, CPM, and Project Manager to review construction, drawings, and installation procedures in accordance with the requirements of this specification.

**1.4 DELIVERY, STORAGE AND HANDLING**

- A. Full cartons of carpet tile shall be packaged and identified by the flooring manufacturer. Distributor, dealer, or vendor cutting, re-packaging, and re-labeling is not permitted.
- B. Store material at least 48 hours at room temperature prior to installation and in accordance with manufacturer's instructions.
- C. Deliver fire-rated materials with testing agency labels and required fire classification numbers attached and legible.

**1.5 JOB CONDITIONS**

- A. Ventilation and Temperature: Verify areas to be carpeted are ventilated to remove any off gassing from installation materials, and areas are within temperature range recommended by the various material manufacturers for Project site installation conditions. The temperature of a concrete slab must be stabilized above 65 degrees both 12 hours prior to and after the installation. The following environmental conditions inside the building are critical for proper installation. Temperature must be between 65 degrees F and 95 degrees F and the humidity between 10 percent and 65 percent for at least 72 hours before and 72 hours after installation. In addition, any adhesives and primers should be stored under these conditions for a minimum of 24 hours prior to installation.
- B. Protection: Prohibit traffic on carpet for at least 12 hours after installation. Cover carpet with heavy non-staining Kraft paper in areas where the Work of other trades is to be performed and traffic and passage areas. Protect carpet from damage or soiling. Maintain protection in place until Substantial Completion.

**1.6 WARRANTY**

**SECTION 09 6813  
TILE CARPETING**

- A. Contractor shall provide a two-year installation warranty. The warranty period will begin after the City accepts substantial completion of contract work.
- B. Manufacturer shall provide a 30-year material warranty as described below:
  - 1. Delamination Warranty: Carpet tile will not delaminate for a minimum of 30 years from the date of installation.
  - 2. Zippering Warranty: Carpet tile will not zipper or develop continuous pile yarn runners in the body of the carpet for a minimum of 30 years from the date of Substantial Completion.
  - 3. Edge Ravel: Carpet tile will not have continuous pile yarn coming out at seams for a minimum of 30 years from the date of Substantial Completion.
  - 4. Cup, Dish or Dome Warranty: The manufacturer warrants that the carpet tile will not cup, dish, or dome for 30 years from the date of Substantial Completion.
  - 5. Dimensional Stability Warranty: The manufacturer warrants that the carpet tile will not lose its dimensional stability (namely: growth or shrinkage with glue-down installations) for 30 years due to normal variations in atmosphere, temperature, or humidity
  - 6. Wear Warranty: The manufacturer warrants that the carpet tile will lose no more than 10 percent by weight of the pile fiber during the life of the carpet from the date of Substantial Completion.
- C. Manufacturer shall provide a 10-year material warranty for colorfastness and texture retention.
  - 1. Stain and Soil Protection: 10-year stain removal written guaranty.
  - 2. Texture Retention Warranty: The manufacturer warrants that the carpet tile will maintain its physical surface texture against crushing, matting, and walking out for 10 years from the date of Substantial Completion.
  - 3. Colorfastness to light: Carpet tile will not fade for 10 years due to exposure to sunlight.
  - 4. Colorfastness to atmospheric contaminants: Carpet tile will not fade for 10 years due to atmospheric contaminants.

**1.7 MAINTENANCE**

- A. Extra Materials - Carpet Tile: Provide to the city full-size units equal to 10 percent of amount installed for each type, color, pattern, and dye lot of carpet indicated.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS AND PRODUCTS**

- A. Modular Carpet Tile, Heavy Commercial Traffic: Subject to compliance with requirements, provide Shaw Carpet Sky Tile, or comparable product by one of the followings:

**SECTION 09 6813  
TILE CARPETING**

1. Mohawk Industries.
2. Patcraft.
3. Mannington Commercial, Inc.
4. Tarkett
5. Or approved equal that meet or exceed the products and systems listed below.

B. Adhesives and Primers: As recommended by tile carpeting manufacturer.

**2.2 MATERIALS**

A. Carpet tile shall meet the following minimum standards:

1. Provide glue-down or firm cushion installation that complies with CBC section 11B-302.2.
2. Carpet shall have level loop, textured loop, level cut or level-cut/uncut pile texture and maximum pile height of ½" per CBC Section 11B-302.2.
3. Color: As indicated on Finish Schedule.
4. Fiber Content: 100 percent nylon 6,6.
5. Fiber Type: ECO solution dyed cf nylon.
6. Pile Characteristic: Multi-level pattern loop.
7. Pile Thickness: 0.116 inches for finished carpet tile according to ASTM D 6859.
8. Stitches: 9.0 stitches per inch.
9. Surface Pile Weight: 17 oz./sq. yd.
10. Primary Backing/Backcoating: Manufacturer's standard composite materials.
11. Secondary Backing: Manufacturer's standard material.
12. Size: 24 by 24 inches OR as indicated on Finish Schedule.
13. Applied Soil-Resistance Treatment: Manufacturer's standard material.
14. Antimicrobial Treatment: Manufacturer's standard material.

B. Performance Characteristics as follows:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.

## **SECTION 09 6813 TILE CARPETING**

3. Smoke Density: NO greater than 450 when tested in accordance with0 ASTM E662.
4. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
5. Tuft Bind: Not less than 10 lbf according to ASTM D 1335.
6. Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.
7. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
8. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
9. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
- C. Adhesive: Water-resistant latex-based adhesive recommended by carpet tile manufacturer for re-leasable adhesive carpet tile installation. When primers or sealers are furnished, verify their compatibility with adhesive.
- D. Crack Filler and Leveling Compound: 100 percent cementitious binder type (as defined by ASTM C150).
  1. Webcrete #95 as manufactured by Durabond
  2. Ardex SD-F as manufactured by Ardex
  3. Or as recommended by the flooring manufacturer and approved by the Architect.
  4. Leveling Compound shall meet or exceed 200 pounds when tested in accordance with ASTM 1583.

### **PART 3 – EXECUTION**

#### **3.1 EXAMINATION**

- A. Before installation is started, examine surfaces to receive carpet tile. Deficiencies shall be corrected before starting Work of this section.
- B. Field verify dimensions and other conditions affecting this Work before commencing carpet tile installation.

#### **3.2 PREPARATION**

- A. Provide concrete moisture vapor emission and pH testing to concrete per Section 09 0561 - Moisture Testing for Flooring Installation for areas specified to be covered with carpet tile. Includes concrete placed below, on and above grade. For replacement projects, concrete slabs not in direct contact with ground may be excluded from this requirement. Comply with requirements of ASTM F1869.

## SECTION 09 6813 TILE CARPETING

- B. Preparation of Subfloors: Any leveling compound used over a vapor or moisture barrier will be warranted to be installed in a wet or moist environment without moisture limitations.
  - 1. Delay application of flooring until sub-floors are sufficiently dry according to flooring manufacturer's recommendations, or perform remedial measures as recommended by flooring materials manufacturer.
- C. Cleaning and Drying: Clean concrete floor slabs of oil, grease, waxes, curing compounds, dust, dirt, debris, paint, and other deleterious substances. Failure to remove or seal old adhesives or other floor coatings may result in installation failure. Provide a commercial vacuum cleaner to remove dust and dirt. Do not furnish oiled or chemical treated sawdust or any similar product for dust removal.
- D. Leveling: Verify floor slabs true to level and plane within a tolerance of 3/16 inch in 10-feet. Test floor areas both ways with a 10-foot straightedge and repair high and low areas exceeding allowable tolerance. Pop ups shall be hammered out and the floor filled with an approved cementitious leveling compound. Remove high areas by power sanding, stone rubbing or grinding, chipping off and filling with an approved cementitious leveling compound, or equivalent method. Fill low areas with an approved cementitious leveling compound. Repair and level the surfaces having abrupt changes in plane, such as trowel marks or ridges, whether within the allowable tolerance. Again, clean areas where repairs are performed and prime floor using recommended primer by manufacture. Do not sand, stone rub grind or power chip floor adhesives that contain asbestos.
- E. Conditioning of Materials: Carpet tile and adhesives shall be conditioned at the Project site at not less than 65 degrees F and relative humidity between 10 percent and 65 percent for 48 hours prior to installation and in accordance with manufacturer's instructions.
- F. Floors should be level and sound. Any trowel marks from old adhesives must be sanded smoothly, creating a level surface prior to the application of adhesives and primers.

### 3.3 CARPET TILE INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Install carpet tiles in each dye lot in the number sequence as furnished by manufacturer. Measure the area to find the best starting point that will utilize a maximum size perimeter tile. After selecting the starting point, snap a chalk line that bisects this point by at right angles. To achieve a perfect angle, form a triangle by measuring 6-inch up from the center point. Then measure 8-inches out from the center point. Then, find a 10-inch angle between these two points. (See manufacturers written instructions for complete details).
- C. Color Control: Install dye lot in the number sequence at locations indicated to prevent shading variations. Install only one dye lot for each area of building unless otherwise reviewed. If more than one dye lot is required, obtain prior review of color match between dye lots by Owner and its representative's written approval.



## **SECTION 09 6813 TILE CARPETING**

- D. Carpet Tile Fit: Refer to the layout Shop Drawings. The corners of the carpet tiles should be flat to assure a proper fit. Install the carpet tiles snugly. Be careful to not to over tighten the installation.
- E. Laying and Seaming: Cut carpet tiles for seams between rows and prevent damage to loops, prevent edge ravel, and preserve uniform row alignment and spacing on both sides and across seams. Install carpet tiles with loop rows in straight lines both ways, free of offsets, waviness, distortion, or misalignment. Cut seam edges straight and square with backing. Trim carpet tiles at walls, columns, and penetrations for a compressed fit.
- F. Doorways: Extend carpet tiles into doorways without piecing in and seam to the carpet on other side of door under door centerline except where metal thresholds occur; no small filler pieces of carpet tiles will be permitted at doorways.
- G. Adhesive Installation: Provide proper equipment as required by manufacturer. Evenly spread adhesive free of excess or thin areas. Place and lay carpet tile within open time of adhesive.
- H. Binder Bars: Provide bars at edges of carpet tiles not abutting walls or other construction, securely fastened in place by using aluminum drive nails. Precisely align splices and tightly miter angles.

### **3.4 PROTECTION**

- A. Protect the Work of this section until Substantial Completion. Limit rolling traffic on carpet tiles for at least 12 hours after installation. Cover carpet tiles with heavy non-staining Kraft paper in areas where the Work of other trades is to be performed and/or traffic and passage areas. Protect carpet from damage or soiling. Maintain protection in place until Substantial Completion.

### **3.5 CLEANING**

- A. As each carpeted area is completed, clean up dirt and debris, remove spots and soiling with proper cleaner, trim off loose threads with sharp scissors, and vacuum entire area clean.

### **3.6 CLEAN-UP**

- A. Remove rubbish, debris, and waste materials and legally dispose of them off the Project site.

### **3.7 INSTRUCTION**

- A. Before Substantial Completion of the Work, should the Owner request and at the Owner discretion, provide a four-hour Owner instruction period for proper maintenance of carpeting. Technical representative of manufacturer shall provide instructions.

**END OF SECTION**

**SECTION 09 9113  
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 listed in part, 3.6 Exterior Painting Schedule.
- B. Related Requirements:
  - 1. Section 05 5000 "Metal Fabrication" for shop priming of metal substrates with primers specified in this Section.
  - 2. Section 09 9123 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.

**1.3 DEFINITIONS**

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 35 units at 85 degrees, according to ASTM D 523
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.
- H. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the U.S. EPA.
- I. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.

**SECTION 09 9113  
EXTERIOR PAINTING**

- J. RAVOC: Reactivity adjusted VOC 'Reactivity' means the ability of a VOC to promote ozone formation.
- K. PDCA: Painting & Decorating Contractors of America [www.pdca.org](http://www.pdca.org)
- L. SSPC: Scopes of SSPC Surface Preparation Standards and Specifications. [www.sspc.org](http://www.sspc.org).
- M. Green Wise: Green Wise products are tested in an ISO accredited laboratory to meet environmentally determined performance standards established by Coatings Research Group, Inc.
- N. Dunn-Edwards Conformance Chart: [DE CONFORMANCE TABLE](#)

**1.4 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, no smaller than 7 inches by 10 inches (177.8 mm by 254 mm) or larger than 8.5 inches by 11 inches (215.9 mm by 279.4 mm).
  - 2. Label each Sample for project, architect, general contractor, painting contractor, paint color name and number, paint brand name, "P" number if applicable, 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.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: Provide not less than 1 gal. (3.8 L) of each material and color applied.

**1.6 QUALITY ASSURANCE**

**SECTION 09 9113  
EXTERIOR PAINTING**

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

**1.7 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 degrees F (7 degrees C) or more than 120 degrees F (49 degrees C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

**1.8 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50- and 90-degrees F (10 and 32 degrees C).
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- C. A painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.

**SECTION 09 9113  
EXTERIOR PAINTING**

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Basis-of-Design Product: Provide products listed from Dunn-Edwards Corporation

**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. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.

- D. Colors: As selected by the Architect.

1. Indicate a percentage of the surface area that will be painted with deep tones.

**2.3 SOURCE QUALITY CONTROL**

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. The owner may engage the services of a qualified testing agency to sample paint materials. The contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to the Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by a testing agency.
2. The testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. The contractor shall remove noncomplying paint materials from the Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will comply with requirements to use compatible products and systems as described in Paragraph 2.2.A. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

**SECTION 09 9113  
EXTERIOR PAINTING**

**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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. 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.
- B. Remove hardware, covers, plates, and comparable 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 the bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and re-prime 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 to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

**SECTION 09 9113  
EXTERIOR PAINTING**

**3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied at no additional cost to the Owner, to completely hide base material, provide uniform color, and to produce satisfactory finish results.
  - 3. Apply coatings without thinning except as specifically required by label directions or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
  - 4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  - 5. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  - 6. Paint the entire exposed surface of window frames and sashes.
  - 7. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 8. Priming may not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required ensuring an even primed surface before applying finish coat.
- B. Tint each undercoat to a lighter shade of the finish coat (not to exceed 2 ounces of colorant) to facilitate identification of each coat if multiple coats of same material are to be applied.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Block Fillers: Provide block fill as scheduled to conform to the following: PDCA Standard P12-05.
  - 1. Level 3 - Premium fill: One or multiple coats of high-performance block filler manufactured to be applied at a high dry film build. The block filler shall be back rolled to eliminate voids and to reduce most of the masonry profile depth.
- F. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

## SECTION 09 9113 EXTERIOR PAINTING

1. Paint the following work where exposed to view:
  - a. Equipment, including panelboards and switch gear.
  - b. Uninsulated metal piping.
  - c. Uninsulated plastic piping.
  - d. Pipe hangers and supports.
  - e. Metal conduit.
  - f. Plastic conduit.
  - g. Tanks that do not have factory-applied final finishes.
  - h. Other items as directed by the Architect.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  1. The contractor shall touch up and restore painted surfaces damaged by testing.
  2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the 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.

### 3.6 EXTERIOR PAINTING SCHEDULE

- A. Ferrous Metal Substrates:
  1. Premium Latex over a Waterborne Alkyd Primer System:
    - a. Prime Coat: Primer, rust inhibitive, waterborne alkyd, interior/exterior, Dunn-Edwards, Bloc-Rust Premium [BRPR00](#) Series or Enduraprime rust preventative primer [ENPR00](#).



**SECTION 09 9113  
EXTERIOR PAINTING**

- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, semi-gloss, Dunn-Edwards, Spartashield [SSHL50](#) 100% acrylic, (Gloss Level 5).

**END OF SECTION**

**SECTION 09 9123  
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 the following interior substrates listed in 3.6 Interior Painting Schedule.
- B. Related Requirements:
  - 1. Section 06 2000 "Finish Carpentry" for surface preparation and the application of paint systems on substrates.
  - 2. Section 09 2900 Gypsum Board.

**1.3 DEFINITIONS**

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 1 to 2 units at 85 degrees.
- B. Gloss Level 2: 5 to 9 units at 60 degrees and 10 to 15 units at 85 degrees.
- C. Gloss Level 3: 10 to 15 units at 60 degrees and 15 to 30 units at 85 degrees.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and 35 to 50 units at 85 degrees.
- E. Gloss Level 5: 40 to 50 units at 60 degrees.
- F. Blocking: Two painted surfaces sticking together such as a painted door sticking to a painted jamb.
- G. Mildew Resistant: Certified products are specially formulated with microbicidal additives that resist mold, mildew, and algae growth on the paint film and inhibit growth of bacterial odors.
- H. CHPS: Collaborative for High Performance Schools. A national movement to improve student performance and the entire educational experience by building the best possible schools. [www.chps.net](http://www.chps.net).
- I. EG: Ethylene Glycol. Ethylene glycol is listed as a hazardous air pollutant (HAP) by the U.S. EPA.
- J. PDCA: Painting & Decorating Contractors of America [www.pdca.org](http://www.pdca.org).

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**INTERIOR PAINTING**

- K. RAVOC: Reactivity adjusted VOC. "Reactivity" means the ability of a VOC to promote ozone formation
- L. SSPC: The Society for Protective Coatings publishes Scopes of SSPC Surface Preparation Standards and Specifications [www.sspc.org](http://www.sspc.org) .
- M. Dunn-Edwards Conformance Chart: [D-E CONFORMANCE TABLE](#)

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. LEED v.4 Requirements: Interior paints and coatings must pass CDPH Standard Method V1.1 (also called section 01350) emissions testing; and they must comply with the VOC content limits of the California ARB 2007 Suggested Control Measure for Architectural Coatings.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, no smaller than 7 inches X 10 inches (177 mm X 254 mm) or larger than 8.5 inches X 11 inches (216 mm X 280 mm).
  - 2. Label each Sample for project, architect, general contractor, painting contractor, paint color name and number, paint brand name, "P" number if applicable, and application area.
- E. 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.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: Provide not less than 1 gal. (3.8L) of each material and color applied.

**1.6 QUALITY ASSURANCE**

## **SECTION 09 9123 INTERIOR PAINTING**

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
    - b. Other Items: Architect will designate items or areas required.
  - 2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### **1.7 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 (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

### **1.8 FIELD CONDITIONS**

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50- and 90-degrees F (10 and 32 degrees C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F (3 degrees C) above the dew point; or to damp or wet surfaces.
- C. A painting contractor should follow proper painting practices and exercise judgment based on his or her experience and project specific conditions as to when to proceed.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

**SECTION 09 9123  
INTERIOR PAINTING**

- A. Basis-of-Design Product: Provide products listed from the Dunn-Edwards Corporation.
- B. OR Equal.

**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 material that complies with VOC limits of authorities having jurisdiction.
- C. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited and zero VOC colorants should be used whenever possible.
- D. Colors: As selected by the Architect.
  - 1. Indicate a percentage of surface area which will be painted with deep tones.

**2.3 SOURCE QUALITY CONTROL**

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  - 1. The owner may engage the services of a qualified testing agency to sample paint materials. The contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project the Project samples may be taken at Project site. Samples will be identified, sealed, and certified by a testing agency.
  - 2. The 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. Contractors will comply with requirements to use compatible products and systems as described in Article 2.2. The 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**

**SECTION 09 9123**  
**INTERIOR PAINTING**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  - 1. Wood: 15 percent.
  - 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that the finishing compound is sanded smoothly.
- 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.
- B. Remove hardware, covers, plates, and comparable 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 the bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and re-prime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Aluminum Substrates: Remove loose surface oxidation.
- E. 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.

## **SECTION 09 9123 INTERIOR PAINTING**

### **3.3 APPLICATION**

- A. Apply paints according to manufacturer's written instructions.
  - 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 the 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. Tint each undercoat to a lighter shade of the finish coat (not to exceed 2 ounces of colorant) to facilitate identification of each coat if multiple coats of same material are to be applied.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Block Fillers: Provide block fill as scheduled to conform to the following PDCA Standard P12-05:
  - 1. Level 3 - Premium Fill: One or multiple coats of high-performance block filler manufactured to be applied to a high dry film build. The block filler shall be back rolled to eliminate voids and to reduce most of the masonry profile depth.

### **3.4 FIELD QUALITY CONTROL**

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. The contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### **3.5 CLEANING AND PROTECTION**

## SECTION 09 9123 INTERIOR PAINTING

- A. At the end of each workday, remove rubbish, empty cans, rags, and other discarded materials from the 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.

### 3.6 INTERIOR PAINTING SCHEDULE

#### A. Gypsum Board Substrates:

- 1. Premium Low Odor / Zero VOC Latex System:
  - a. Prime Coat: Primer sealer, latex, interior, Dunn-Edwards, Vinylastic Select [VNSL00](#).
  - b. Intermediate Coat: Latex, interior, matching topcoat
  - c. Topcoat: Latex, interior, semi-gloss, Dunn-Edwards, Spartawall [SWLL50](#), (Gloss Level 5).

#### B. Ferrous Metal Substrates:

- 1. Premium Low Odor / Zero VOC Latex over a Waterborne Alkyd Primer System:
  - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, Dunn-Edwards, Bloc-Rust Premium [BRPR00](#) Series or Enduraprime rust preventative primer [ENPR00](#).
  - b. Intermediate Coat: Latex, interior, matching topcoat.
  - c. Topcoat: Latex, interior, semi-gloss, Dunn-Edwards, Spartawall [SWLL50](#), (Gloss Level 5).

END OF SECTION



## SECTION 10 1400 SIGNAGE

### PART 1 - GENERAL

#### 1.1 REALTED DOCUMENTS

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

#### 1.2 REFERENCES

- A. California Building Code; 2022 CBC Section 11B-703
  1. Tactile character type: Tactile characters on signs shall be raised 1/32-inch (0.794 mm) minimum and shall be sans serif uppercase characters accompanied by Contracted Grade 2 Braille (see note below).
  2. Tactile character size: Raised characters shall be a minimum of 5/8 inch (15.9 mm ) and a maximum of 2 inches (51 mm) high. .
  3. Finish and contrast: Contrast between character, symbols and their background must be 70% minimum and have a non-glare finish.
  4. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10. All letters measured must be uppercase. After choosing a typestyle to test, begin by printing the letters I, X, O at 1 inch high. Place the template's 1:1 square over the X or O, whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the "I" is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the typestyle is compliant with proportion requirement.
  5. Braille: California (Contracted) Grade 2 Braille shall be used wherever Braille is required in other portions of these standards. Dots shall be 1/10-inch (2.54 mm) on center in each cell with 2/10-inch (5.08 mm) space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background. Braille dots shall be domed or rounded.
  6. Mounting location shall be determined so that a person may approach within 3 inches (76 mm) of signage without encountering protruding objects or standing within the swing of the door.

#### 1.3 DEFINITIONS

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

## SECTION 10 1400 SIGNAGE

- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
  - 1. Acrylic sheet.
  - 2. Polycarbonate sheet.
  - 3. Die-cut characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.
- D. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
  - 1. Acrylic Sheet: 8 by 10 inches for each color required.
  - 2. Polycarbonate Sheet: 8 by 10 inches for each color required.
  - 3. Accessories: Manufacturer's full-size unit.
- E. Sign Schedule: Use same designations indicated on Drawings.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products like those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADAAG Accessibility Guidelines and California Building Code.

### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metal and polymer finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image colors and sign lamination.

## SECTION 10 1400 SIGNAGE

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products of following manufacturers are acceptable and are the basis for intended design and quality.
1. H. Toji and Company.
  2. Vomar Products Inc.
  3. Mohawk Sign Systems, Inc.
  4. Accent Signage Systems.
  5. The Gruenke Company.
  6. Ada Sign Products.
  7. Rowmark.
  8. Equal.

#### 2.2 MATERIALS AND FABRICATION

- A. Interior Sign Materials:
1. Substrate Panel: 1/8 inch minimum thick, integrally colored, or clear acrylic plastic, or laminated acrylic. Conforming to ASTM D4802; non-glare (matte), UV stable, suitable for interior and exterior use.
    - a. Corners shall be radius.
    - b. Edges shall be square and eased.
    - c. Colors as selected by ARCHITECT from manufacturer's custom color range.
  2. Fasteners:
    - a. Stainless steel tamper-proof screws and plastic anchors.
    - b. Signs mounted on fire-rated doors shall be secured with adhesive.
    - c. Adhesives and sealants shall comply with the limits for VOC content and shall be approved by OWNER's Office of Environmental Health Services (OEHS).

#### 2.3 COMMUNICATION ELEMENTS AND FEATURES

- A. Raised Characters Raised characters shall comply with CBC 11B-703.2.

## SECTION 10 1400 SIGNAGE

1. Character Type: Characters on signs shall be raised 1/32 inch minimum above their background and shall be sans serif uppercase characters duplicated in Braille. Characters and Braille shall be in a horizontal format.
  2. Character Height: Character height measured vertically from the baseline of the character shall be 5/8 inch minimum and 2 inch maximum based on the height of the uppercase letter "I".
  3. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the letter "I".
  4. Stroke Thickness: Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.
  5. Character and Line Spacing shall be in conformance to CBC 11B-703.2.7 and 11B-703.2.8.
  6. Character Placement: Shall be placed in accordance to Paragraph 2.03, C below.
- B. Visual Characters: Visual characters shall comply with CBC Section 11B-703.5. Characters shall be conventional in form and shall be uppercase or lowercase or a combination of both, as indicated on the drawings. Characters shall not be italic, oblique, highly decorative, or of other unusual forms.
1. Finish and Contrast: Characters and their backgrounds shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.
  2. Character Proportions: Characters shall be selected from fonts where the width of the uppercase letter "O" is 60 percent minimum and 110 percent maximum of the height of the uppercase of the letter "I".
  3. Character Height: Minimum character height shall comply with CBC Table 11B-703.5.5.
  4. Height from Finish Floor or Ground: Visual characters shall be a 40 inches minimum above the finish floor or ground
  5. Stroke Thickness: Uppercase letter "I" shall be 10 percent minimum and 20 percent maximum of the height of the character.
  6. Character and Line Spacing: Shall be in accordance to CBC 11B-703.5.8 and 11B-703.5.9.
- C. Braille: Contracted Grade 2 Braille, conforming to CBC 11B-703.3. Braille characters shall be inlaid optically correct acrylic Raster beads into computer drilled holes in the panel surface.
1. Dimensions and Capitalization: Braille dots shall have a domed or rounded shape and shall comply with CBC Table 11B-703.3.1. The indication of an

## SECTION 10 1400 SIGNAGE

uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials, and acronyms.

2. Position: Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multi-lined, Braille shall be placed below the entire line of text. Braille shall be separated 3/8 inch minimum and 1/2 maximum from any other tactile characters and 3/8 inch minimum from raised borders and decorative elements.
- D. Pictograms: In conformance to CBC 11B-703.6. Pictograms shall have a field height of 6 inches minimum. Characters and Braille shall not be in the pictogram field.
1. Finish and Contrast: Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.
  2. Text Descriptors: Pictograms shall have text descriptors located directly below the pictogram field, and shall comply with CBC 11B-703.2, 11B-703.3 and 11B-703.4.
- E. International Symbol of Accessibility (ISA): Shall comply with CBC 11B-703.7 and CBC Figure 11B-703.7.2.1. The ISA shall consist of a white figure on a blue background. The blue color shall be approximate to FS. 15090 in Federal Standard 595C.
- F. Mounting Locations and Height: Signs with tactile characters shall be as indicated on the drawings and in conformance to CBC 11B-703.4.
1. Mounting Locations:
    - a. Identification signs for rooms and spaces shall be located on the wall adjacent to the latch side of the door, as one enters the room or space.
    - b. Signs that identify exits shall be located at the exit door when approached in the direction of egress travel.
    - c. Signs containing tactile characters shall be located so that a clear floor space 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45-degree open position.
    - d. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.
    - e. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located at the inactive leaf.
    - f. Where a tactile sign is provided at double doors with two active leaf's, the sign shall be located to the right of the right-hand door.

## SECTION 10 1400 SIGNAGE

- g. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.
2. Mounting height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters.

### 2.4 RESTROOM SIGNAGE

- A. Multiple-Occupancy restrooms shall be provided with geometric symbols and wall mounted pictograms with text descriptors accompanied by Braille.
- B. Geometric Symbols:
  1. Doorways leading to toilet rooms shall be identified by a geometric symbol complying with CBC Section 11B-703.7.2.6.
  2. Male Restroom Door Symbol: 1/4-inch-thick equilateral triangle with edges 12 inches long, with vertex pointing upward, the triangle symbol shall contrast with the door, either light on a dark background or dark on a light background. A male silhouette shall appear within the equilateral triangle in contrasting color to it.
  3. Female Restroom Door Sign: 1/4-inch-thick circle 12-inch diameter, the circle symbol shall contrast with the door, either light on a dark background or dark on a light background. A female silhouette shall appear within the circle in contrasting color to it.
  4. "All Gender" Restroom Door Sign (Single occupancy restrooms): 1/4 inch thick circle, 12-inch diameter with a 1/4 inch thick equilateral triangle with the vertex pointing upward superimposed on the circle and within the 12-inch diameter. Triangle and circle shall be of contrasting colors; the circle symbol shall contrast with the door. A female and male silhouettes shall appear within the equilateral triangle in contrasting color to it, and the word "restroom" shall appear on the bottom part of the circle in contrasting color to it.
  5. Edges and Vertices on Geometric Symbols: Shall be eased or rounded at 1/16 inch minimum or chamfered at 1/8 inch maximum. Vertices shall be radiused between 1/8 inch minimum and 1/4 inch maximum.
  6. Location and Mounting Height: Symbols shall be mounted at 58 inches minimum and 60 inches maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within one inch of the vertical centerline of the door.
- C. Room Identification for Multiple-Occupancy Restrooms: Provide a 16 inch long by 6-inch-tall room identification sign, including a pictogram of the International Symbol of

## SECTION 10 1400 SIGNAGE

Accessibility on the side. Restroom names shall be “Girls” or “Boys,” for students, and “Women” and “Men” for staff. Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.

- D. Room Identification for Single-Occupancy Restrooms: Provide a 16 inch long by 6 inch tall room identification sign, including a pictogram of the International Symbol of Accessibility on the side. Text descriptor shall be “All Gender Restroom.” Characters, Braille, pictograms and mounting locations and height shall be in conformance to Article 2.03.

### 2.6 RAISED CHARACTER AND BRAILLE EXIT SIGNS

#### A. Tactile Exit Sign Types:

- 1. “EXIT.”

#### B. Sign Requirements:

- 1. Finish and Contrast: Refer to paragraph 2.03.B.
- 2. Raised Characters and Proportions: Refer to paragraph 2.03.A.
- 3. Braille: Refer to paragraph 2.03.C.
- 4. Mounting Location and Height: Refer to paragraph 2.03.F.

## 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 work.
- B. Verify that items, including anchor inserts, are sized, and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Mounting Location: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without

## **SECTION 10 1400 SIGNAGE**

encountering protruding objects or standing within swing of door. CBC Section 1117B.5.7.

- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
  - 1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
  - 2. Shim Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
  - 3. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.
- C. Geometric Signs: Geometric toilet room signs shall be fastened to doors with three tamper-proof oval-head counter-sunk screws.

### **3.3 CLEANING AND PROTECTION**

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

**END OF SECTION**



**SECTION 10 2813  
TOILET ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Toilet Accessories.
  - 2. Attachment hardware.
- B. Related Sections:
  - 1. Section 06 1000 - Rough Carpentry: Placement of backing and blocking for attachment of accessories.

**1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 2. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - 3. ASTM A 366 - Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

**1.3 SUBMITTALS**

- A. Division 1 - Submittal Procedures: Procedures for submittals.
  - 1. Product Data: Data for each accessory describing size, finish, details of function, and attachment methods.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Conform to California Building Code, 2010 Edition and Federal ADA for mounting heights and locations of accessories.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Section 01 6000 - Product Requirements: Transport, handle, store, and protect products.
- B. Deliver accessories in original labeled packaging, bearing manufacturer's name and type of accessory.

**SECTION 10 2813  
TOILET ACCESSORIES**

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
  - 1. Bobrick Washroom Equipment,
  - 2. Or approval equal as permitted in Section 01 60 00 - Product Requirements: Product options and substitutions.
- B. Product numbers listed on the drawings are those of Bobrick. If one of the other manufacturers is to be supplied the quality and design shall equal or exceed that of Bobrick.

**2.2 MATERIALS**

- A. Sheet Steel: ASTM A 366.
- B. Galvanized Sheet Steel: ASTM A 366, ASTM A 123 to 1.25 ounces per square yard.
- C. Stainless Steel Sheet: ASTM A167, Type 304.
- D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
- E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

**2.3 MANUFACTURED UNITS – See Drawings**

**2.4 FABRICATION**

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- C. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.
- D. Shop assemble components and package complete with anchors and fittings.
- E. Provide steel anchor plates, adapters, and anchor components for installation.

**SECTION 10 2813  
TOILET ACCESSORIES**

- F. Back paint components where contact is made with building finishes to prevent electrolysis.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Section 01 7000 – Execution and Closeout Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  - 1. Verify correct location of opening in wall for recessed accessories.
  - 2. Verify that attachment blocking and backing plates are in place in the correct location for accessory connections.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**3.2 PREPARATION**

- A. Deliver inserts and rough-in frames to site for scheduled installation.
- B. Provide and use templates and rough-in measurements as required.

**3.3 INSTALLATION**

- A. Install fixtures, accessories, and items in accordance with manufacturer's instructions, and as indicated on Drawings. Use tamper-proof fasteners.
- B. Install plumb and level, securely and rigidly anchored to substrate.

**3.4 ADJUSTING AND CLEANING**

- A. Adjust accessories for proper operation.
- B. Remove temporary labels and protective coatings. Clean and polish exposed surfaces.

**END OF SECTION**

## **SECTION 10 5113 METAL LOCKERS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Metal lockers and accessories.
- B. Related Requirements:
  - 1. Division 01 - General Requirements.
  - 2. Section 03 3000 - Cast-In-Place Concrete.
  - 3. Section 09 2216 – Non-Structural Metal Framing.

#### **1.2 SUBMITTALS**

- A. Shop Drawings: Submit Shop Drawings indicating locker sizes, locations, construction details, and locker numbering layout. Indicate size and location of accessories, mounting heights of hardware and details of anchorage.
- B. Material Samples: Submit color chips of manufacturer's standard colors for selection by ARCHITECT.

#### **1.3 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturer: Regularly engaged in manufacturing metal lockers for at least 5 years and must be ISO 9001:2015 certified.

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

- A. Deliver materials to the Project site with manufacturer's labels intact and legible.
- B. Protect metal lockers before, during and after installation. In case of damage, provide necessary repairs and replacements immediately.

#### **1.5 WARRANTY**

- A. Manufacturer's standard warranty to repair or replace components of locker products that fail in materials or workmanship within 3 years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Spacesaver
- B. Republic Storage Products PDQ Lockers.
- C. List Industries Inc., Superior, Heavy-Duty Corridor.

## SECTION 10 5113 METAL LOCKERS

- D. Salsbury Industries ([www.lockers.com](http://www.lockers.com))
- E. Or Approved Equal.

### 2.2 FABRICATION

- A. Frames: Constructed from 16 gage steel formed to a channel to include a continuous door stop on each side of frame, with at least 16 gage steel formed channel cross lapped members located at top and bottom and welded at corners. Bodies shall be at least 16 gage cold-rolled steel for tops, intermediate bottoms, and sides. Backs shall be minimum of 18 gage cold rolled steel with bottoms and intermediate bottoms totally enclosed and bolted or riveted. The bottoms and intermediate bottoms shall fit tight along the sides and backs. A gap minimally greater than 1/16" is allowable at the tabs locating the part inside the door frame and at the back corners where legs can be fitted. The bottom of lowest opening in the locker shall be constructed from 16 gage cold rolled steel, reinforced each one with a 16 gage cold rolled steel hat section to prevent distortion when anchored. Lockers bodies assembled of all welded construction are not acceptable.
- B. Doors:
  - 1. Lockers shall be furnished with right-hand hinged doors, unless otherwise indicated. Doors shall be at least 14 gage cold-rolled steel.
  - 2. Door stiffeners – Minimum 18 gage steel, 2 inches wide, formed in a hat channel shape and located top to bottom along the hinge side of each door. Weld a minimum of 6 inches on center and tack welded to the top and bottom door flange. Door stiffeners shall not have openings.
  - 3. Doors shall be provided with non-corrosive number plates, 22 gage aluminum minimum, having figures approximately 3/8 inch high etched into metal, finished in black enamel and fastened with binder-head bolts, or rivets. Split rivets are not permitted. Holes in number plates and doors shall be the same size and shall not exceed 0.125 inch.
    - a. Provide numbering for lockers.
    - b. Locker numbering shall start with number 1, and increase consecutively throughout the room, running first from top to bottom on multi-tiered lockers and then from left to right consecutively.
    - c. Accessible lockers shall also be numbered following this sequence.
- C. Door Handles: Recessed handles shall be constructed 22 gages, drawn plated steel, stainless steel, or die cast zinc alloy, nickel plated, with a minimum tensile strength of 40,000 PSI, and shall be furnished with a 3/8-inch eye for a 3/16-inch standard padlock and padlock strike. Doors 72 inches or more in height shall be furnished with three locking points. The two locking points shall be no more than 8 inches from top and bottom. The third locking point shall be at the center. Doors shall be automatic latching when pushed shut. All other locker doors shall be single point latching.

## SECTION 10 5113 METAL LOCKERS

- D. Hinges: 16 gage continuous piano hinge for the full height of the door. Weld the hinge to the door and rivet to the door frame using 3/16-inch diameter rivets.
- E. Shelves, Hooks, and Coat Rods: Lockers shall be furnished with at least two single-prong hooks with ballpoints, located on opposite sides. Hooks shall be smooth and rustproof and shall be fastened with two dome head 10-14 bolt with Kep nuts (nut with built on external tooth lock washer) each or 2 each 3/16" diameter pop rivets. Lockers that are 72 inches, and are 18 inches or deeper, shall be furnished with coat rod and 2 coat hooks. Single-tier 72-inch-high lockers shall be furnished with one shelf, 9 inches from top of locker.
- F. Accessible lockers
  - 1. Comply with CBC Chapter 11B requirements.
  - 2. Handle: One handed operation and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds maximum. Operable handle shall be located no lower than 15" and no higher than 48" above finish floor.
  - 3. Locker bottom: The locker bottom shall be no lower than 15" above finish floor. If the bottom of the opening designated as ADA accessible is located below this minimum, an additional shelf shall be installed no less than 15" above finish floor.
  - 4. Assigned Lockers: minimum one locker and not less than 5 percent of total lockers shall be accessible.
  - 5. Provide manufacturer's 4 by 4-inch ISA symbol decal.
  - 6. Accessible lockers shall include an accessible lock with a metal dial, 1695MK ADA Master Lock Company, Zephyr 1992A or equal. 72-inch locker doors shall include 1636MKADA Master Lock, Zephyr 1930A or equal. Mounting height for locks must be 48 inches maximum above floor.
- G. Kep nuts and/or 3/16" diameter pop rivets shall be used for assemblies, including those to attach wardrobe hooks. Bolts shall not protrude more than 1/8-inch past dome head 10-14 bolt with Kep nut.
- H. Exposed ends, backs and tops ends, backs tops and hoods, shall be 16 gage cold-rolled steel.
- I. Parts shall be finished before assembly; fasteners shall be cadmium-plated.
- J. Accessories: Lockers shall be furnished with 16 gage sloping tops unless recessed. Lockers shall be furnished with metal legs and skirts unless they are installed on a raised concrete curb and/or platform. Provide 16 gage cold-rolled steel trim, cap strips, filler strips, corner fillers, and other items required for a complete assembly.

### 2.3 FINISH

- A. Steel shall be galvalume coated per ASTM A792. Surfaces shall be finished with powder coating. Dry film thickness shall be a minimum of 2 mil for all surfaces. The

## SECTION 10 5113 METAL LOCKERS

manufacturer shall supply a Certificate of Conformance stating that the lockers satisfy finish requirements of these specifications.

- B. Finished surfaces shall be lead free. The manufacturer shall supply a Certificate of Conformance stating that finished surfaces are lead free and that they satisfy finish requirements of these specifications.
- C. Manufacturer shall provide a minimum of five standard colors. Standard color to be selected by ARCHITECT. The selected color applied at exterior exposed areas including side panels, tops, frame, hinges, and doors with a light shade common color applied on all internal areas.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Locker banks shall be fabricated with independent backs.
- B. Installation of lockers shall be in accordance with manufacturer's written recommendations and Shop Drawings reviewed. Installation shall meet requirements of Department of Health Services codes. Installed lockers shall comply with CBC Chapter 11B requirements.
- C. Provide and install trim, sloped, hoods, tops, cap strips, ends and back panels, filler strips, corner fillers, and any other items required to complete installation in accordance with manufacturer's written recommendations and this specification. Exposed ends, tops, and backs shall be 16 gage cold-rolled steel and powder coated to match new lockers.
- D. Lockers shall be completely assembled and ready for installation prior to delivery to the Project site. The lockers shall be set plumb and securely fastened in place. Bottom of lockers shall be reinforced to prevent distortion from anchoring devices.
- E. Anchor lockers to back wall, not to exceed 4 feet. Anchor back-to-back lockers to floor, not to exceed 4 feet.
- F. The back shall be secured with a minimum thickness of 5/16 inch zinc plated steel or stainless-steel anchor as indicated on drawings.

#### LOCKER SCHEDULE

| Room Area | Size: W by D by H | Legs & Apron | Concrete Base | # Tiers |
|-----------|-------------------|--------------|---------------|---------|
| Corridor  | 18" by 24" by 78" | yes          | no            | 2       |

#### 3.2 CLEANUP

- A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

#### 3.3 PROTECTION

- A. Protect the Work of this section until Substantial Completion.

### END OF SECTION

**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT AND FIXTURES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work of this section, as shown or specified, shall be provided by the Contractor and shall be in accordance with the requirements of the Contract Documents.
- B. Work includes all labor, materials, equipment, accessories, and appliances required to Furnish and install food service equipment as indicated on the drawings and herein specified.
- C. Related work in other Sections:
  - 1. Section 09 2216 - Non-Structural Metal Framing.
  - 2. Division 22 - Plumbing.
  - 3. Division 26 - Electrical.
- D. Contractor shall provide cutting of holes in equipment or fixtures for pipes and drains as required for their installation.
- E. Contractor shall provide adequate raceways and accesses in fixtures for the plumbing lines and for Electrical Contractor to install his work. Where there is neglect by the Contractor to provide for such space, he shall make the necessary revisions/repairs to the work without expense to the City. Cutting and patching required by such work shall be reworked to its original finish.
- F. Contractor shall provide and locate outlet boxes, receptacles, device plates, switches, junction boxes, where they are a part of the fixture and indicated on equipment electrical layout sheets. All other electrical work shall be furnished and installed by the Electrical Contractor, including installation of conduits in fixtures, connection to boxes, and the wiring of electrical outlets and equipment.
- G. The drawings indicate the desired basic arrangement and dimensions of the equipment; minor deviations therefore may be substituted for approval according to Section 01 2513, and provided basic requirements are met and no major rearrangements of services to the equipment are required to affect the proposed alteration, such deviations shall be made without expense to City.
- H. The Contractor shall be responsible for the satisfactory operation of the assembled equipment. Tests of the installed equipment shall be required. Defects or deficiencies noted as a result of tests shall be corrected to the entire satisfaction of the City and/or its agent at the expense of the Contractor. The Contractor shall consult the mechanical and electrical drawings and their accompanying specifications to determine additional requirements of the work and shall cooperate with all trades to ensure a completely satisfactory installation.



**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT AND FIXTURES**

- I. Required voltages, cycles and phase and electrical requirements shall be checked before ordering equipment.

**1.2 SUBMITTALS**

- A. All submittals shall be made according to Section 01 33 00 and as described herein.
- B. Submit the following for each item:
  1. The Contractor shall submit for approval two (2) copies of 1/4" scale plans showing location of all plumbing, and electrical with elevations and sections of all special equipment for use of the respective trades. The Contractor shall be responsible for the accuracy of the outlets in the building in connection with his work. One copy with approved corrections shall be returned to the Contractor who shall revise such drawings and re-submit two (2) additional copies for final approval.
  2. The Contractor shall submit two (2) copies for approval of 3/4" (20mm) scale shop drawings covering all items of work included; detail drawings shall show all dimensions and all details of construction installation and the relation to adjoining and related work; all reinforcements, anchorages and other work required for complete installation. One copy with approval or corrections shall be returned to the Contractor who shall revise such drawings and resubmit two (2) additional copies for final approval. (Scale: 3/4" (20mm) and larger, as required.) Shop drawing blueprints shall not be larger than 30" x 42" (760 x 1060mm).
- C. After final approval Contractor shall print and distribute four (4) copies of shop drawings to other interested parties, or as directed by the City.
- D. Approval of such drawings shall not relieve the Contractor from responsibility for any deviations from the drawings and specifications unless such deviations are approved in writing by the City or his agent.

**1.3 WORK NOT INCLUDED**

- A. Plumbing and electrical trims, including stainless steel cover plates for outlets and pull boxes, and connections shall be furnished by the respective trades involved, unless otherwise specified.
- B. Connections to the mechanical and electrical services are specified under the General Contractor specifications and shall not be considered as part of the work of this section, unless specifically indicated otherwise on drawings or specifications.

**1.4 QUALITY ASSURANCE**

**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT AND FIXTURES**

- A. All Food Service Equipment and Fixtures shall be provided and installed using experienced, skilled workmen to the highest standard of workmanship and shall be free of any defects due to faulty workmanship.
- B. All work and materials shall conform to the drawings and specifications; any changes or deviations in materials or methods must be approved by the Architect.
- C. Food Service Equipment and Fixtures shall meet requirements of local and state codes where applicable. Comply with all laws, ordinances, rules and regulations and orders of any public authority having jurisdiction over this part of the Work.
- D. The Contractor shall be responsible for taking accurate job-site measurements for all dimensions related to the Work.
- E. The Contractor shall examine all conditions pertaining to the installation of Food Service Equipment and Fixtures and shall provide all coordination as required to achieve the proper and timely completion of the installation.
- F. The Contractor will not change brands of materials during the course of the work unless approved by the Architect.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT**

- A. All equipment and fixtures shall be provided as indicated on drawings and specifications and as described herein.
- B. All electrically operated or heated equipment shall be in full accordance with and will conform to the latest standard of the National Board of Fire Underwriters, National Electrical Manufacturer's Association and Underwriters Laboratories, Inc. Where applicable standards have been set up by that agency and are acceptable to authorities having jurisdiction.
- C. All steam-heated equipment shall be manufactured in accordance with A.S.M.E. code requirements and shall carry the A.S.M.E. stamp.
- D. Food service equipment, electric commercial cooking and warming equipment and soda fountain equipment shall conform to standards of the National Sanitation Foundation standards.

**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT AND FIXTURES**

- E. "Cord and plug" shall mean a sufficient length (from item to receptacle) of grease resistant insulated cord with cap of sufficient size and capacity to carry the connected load. Plug shall match receptacles.
- F. Contractor to verify all pertinent data with City before ordering all items listed in the construction documents Food Service Specialty Equipment Schedule.
- G. Contractor to verify the exact voltage and phase to be used prior to ordering any equipment.

**PART 3 - EXECUTION**

**3.1 DELIVERIES AND STORAGE**

- A. The equipment and fixtures shall be delivered and installed as noted on the Specialty Equipment schedule on sheet A0.2.
- B. The Contractor shall submit to the City within five (5) days of execution of contract, a Progress Schedule, showing the order of expected progress of the job with the expected starting and completion dates of the various parts of the job.
- C. Insofar as possible, work shall be fabricated and finished in the shop and delivered completely to the job site ready to set in place.
- D. Follow manufacturers' recommendations for all handling and storage of equipment.

**3.2 INSTALLATION**

- A. Manufacturer's directions shall be followed in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on the drawings or specifications.
- B. Installation of equipment shall be in strict accordance with manufacturer's approved shop and installation drawings.
- C. State and local health regulations and ordinances and minimum standards of the National Sanitation Foundation Standards Nos. 1, 2, 3, and 4 shall be fully adhered to and other additional requirements which might develop shall be included to insure a complete sanitary installation.
- D. All equipment and fixtures installed against walls shall be sealed off with mastic approved by the Health department to prevent vermin harborage.

**SECTION 11 4000**  
**FOOD SERVICE EQUIPMENT AND FIXTURES**

- E. Contractor shall provide a competent representative to be present when installation is complete and ready to put into operation, and to instruct City's employees in the proper use and maintenance of items and to set up a maintenance schedule.
- F. Repair damage done to the premises as a result of installation of equipment and fixtures.
- G. During and upon completion of work, remove excess materials, rubbish, and debris from site. Fixtures and equipment shall be wiped clean, and floors swept broom clean.

END OF SECTION

## **SECTION 22 05 00 PLUMBING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Waterproofing.
  - 2. Electrical Connections and Protection.
  - 3. Supports and anchors.
  - 4. Cleaning, Protection and Adjustment.
  - 5. Dielectric Fittings.
  - 6. Piping connections.
  - 7. Sleeves and Seals.
- B. Related Documents: The Contract Documents, as defined in Section 01 10 00 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
  - 1. 079200 - Joint Sealants: Sealants.
  - 2. 099100 - Painting: Field painting.

#### **1.2 WATERPROOFING**

- A. Where work penetrates waterproofing, including waterproof concrete, the Engineer shall approve the method of installation prior to performing the work. Furnish necessary sleeves, caulking and flashing required to make openings watertight.

#### **1.3 PAINTING**

- A. Painting requirements of this section shall conform to Division 9 – Finishes: Painting.
- B. Provide surface preparation, priming, and final coat application in strict accordance with manufacturer's recommendations.
- C. Provide painting of plumbing piping and equipment exposed in mechanical equipment room and in occupied spaces. Plumbing items to be painted are as follows:
  - 1. Piping, pipe hangers, pipe insulation, and supports
  - 2. Equipment and support.
  - 3. Accessory items.

**SECTION 22 05 00**  
**PLUMBING**

**1.4 CLEANING, PROTECTION AND ADJUSTMENT**

**A. Cleaning**

1. General cleaning requirements are specified in Division 1 – General Requirements.
2. Upon completion of the work, clean the exterior surface of equipment, accessories, and trim installed. Clean, polish, and leave equipment, accessories, and trim in first-class condition.

**B. Protection of Surfaces**

1. Protect surfaces from damage during the construction period.
2. Provide plywood or similar material under equipment or materials stored on floors or roofs. Provide protection in areas where construction may damage surfaces.
3. Surfaces damaged during the construction shall be repaired or replaced at no additional cost to the City. The Engineer shall approved the method of repairing or replacing the surface.

**C. Protection of Services**

1. Protect services from damage during the construction period.
2. Repair, replace and maintain utilities, facilities, or services (underground, above ground, interior or exterior) damaged, broken or otherwise rendered inoperative during construction.
3. Services damaged during the construction shall be replaced at the cost of the Contractor at fault. The Engineer shall approve the method used in repairing, replacing, or maintaining the services.

**D. Protection of Equipment and Materials**

1. Equipment and materials shall be stored in a manner that shall maintain an orderly, clean appearance. If stored on-site in open or unprotected areas, equipment and material shall be kept off the ground and out of standing water by means of pallets or racks and covered with tarpaulins.
2. Equipment and material, if left unprotected and damaged, shall be repainted, or otherwise refurbished at the discretion of the Owner. Equipment and material are subject to rejection and replacement if, in the opinion of the Engineer or manufacturer the equipment has deteriorated or been damaged to the extent that its immediate use or performance is questionable, or that its normal life expectancy has been curtailed.
3. During the construction period, protect piping, fittings, valves, equipment, and associated appurtenances from damage and dirt. Each system of piping shall be flushed to remove grit, dirt, sand, and other foreign matter for as long a time as required to thoroughly clean the systems.

**E. Adjustment**

1. After the entire installation has been completed, make required adjustments to balancing valves, circulating systems, pressure reducing valves and similar devices until performance requirements are met.

## SECTION 22 05 00 PLUMBING

2. Provide factory-lubricated bearings for equipment. Before initial startup of equipment, inspect and verify bearings for proper amounts of lubricant. If required, provide proper amounts of lubricant in accordance with manufacturer's recommendations.

### 1.5 DIELECTRIC FITTINGS

- A. Ferrous to non-ferrous pipe connections shall be made with threaded, soldered, plain, or welded end connections that match piping system material. Dielectric fittings shall prevent any electrolytic action between dissimilar materials.

### 1.6 PIPING CONNECTIONS

- A. Make pipe connections according to the following
  1. Provide unions in supply piping systems 4 inches and smaller:
    - a. Adjacent to each side of valve
    - b. At final connection to equipment
  2. Provide flanged connections for supply piping systems 4 ½ inches and larger:
    - a. Adjacent to each side of valve
    - b. At final connection to equipment
  3. Provide sewer lateral cleanout:
    - a. As indicated on Plans.

### 1.7 SLEEVES AND SEALS

- A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage (1.2 mm thick) galvanized steel.
- B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage (1.2 mm thick) galvanized steel.
- C. Sealant: refer to Section 07 92 00 – Joint Sealants.

## PART 2 - PRODUCTS

### 2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
  1. Unistrut.
  2. Superstrut.
  3. B-Line.
  4. Or approved equal.

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**PLUMBING**

**B. Plumbing Piping – Drain, Waste, Vent:**

1. Conform to ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

**C. Plumbing Piping - Water:**

1. Conform to ASTM F708.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.



**SECTION 22 05 00  
PLUMBING**

15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

**2.2 PIPE HANGER AND SUPPORT SCHEDULE**

| PIPE SIZE<br>Inches (mm)                             | MAX. HANGER SPACING<br>Feet (m) | HANGAR ROD DIAMETER<br>Inches (mm) |
|------------------------------------------------------|---------------------------------|------------------------------------|
| 1/2 to 1-1/4<br>(12 to 32)                           | 6.5 (2)                         | 3/8 (9)                            |
| 1-1/2 to 2<br>(38 to 50)                             | 10 (3)                          | 3/8 (9)                            |
| 2-1/2 to 3<br>(62 to 75)                             | 10 (3)                          | 1/2 (13)                           |
| 4 to 6<br>(100 to 150)                               | 10 (3)                          | 5/8 (15)                           |
| 8 to 12<br>(200 to 300)                              | 14 (4.25)                       | 7/8 (22)                           |
| PVC (All Sizes)                                      | 6 (1.8)                         | 3/8 (9)                            |
| C.I. Bell and<br>Spigot (or No-Hub)<br>and at Joints | 5 (1.5)                         | 1/2 (13)                           |

**2.3 PROTECTION OF ELECTRICAL EQUIPMENT**

- A. Plan and arrange overhead piping to avoid dedicated electrical space that may include motors, controllers, switchboards, panel boards, or similar equipment.
1. Dedicated electrical space is equal to the width and depth of the electrical components and extends from the floor to a height of 6 feet above the electrical components or to the structural ceiling, whichever is lower. No piping, leak detection apparatus, equipment, components, or associated appurtenances foreign to the electrical installation shall be in the dedicated electrical space.
  2. Dropped, suspended, or any other type of ceiling that does not add strength to the building structure cannot be provided as a separation between dedicated electrical spaces for the installation of foreign components within the dedicated electrical space.
- B. Where the installation of foreign components occur above the dedicated electrical space (6 feet above the electrical systems), contractor shall provide a means of secondary containment to prevent damage to the electrical systems.

**SECTION 22 05 00  
PLUMBING**

**2.4 DIELECTRIC FITTINGS**

- A. Dielectric unions shall be factory – fabricated assemblies with a minimum working pressure as required to suit system pressures.
- B. Dielectric flanges shall be factory – fabricated, companion flange assemblies with a minimum working pressure as required to suit system pressures.
- C. Dielectric flange kits shall be field – fabricated with a minimum working pressure as required to suit system pressures. Kit shall include flanges, full face type phenolic gasket, phenolic bolt sleeves, phenolic washers, and steel backing washers.
- D. Dielectric couplings shall be galvanized steel with inert and noncorrosive, thermoplastic lining, threaded ends and a minimum working pressure as required to suit system pressures.
- E. Dielectric nipples shall be electroplated steel nipple with inert and noncorrosive, thermoplastic lining, plain, threaded, or grooved ends and a minimum working pressure as required to suit system pressures.
- F. Acceptable Manufacturers:
  - 1. Watts Industries
  - 2. Zurn Industries
  - 3. Sioux Chief Industries
  - 4. Or approved equal.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Execution and Closeout Requirements: Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- C. Report in writing to the Engineer prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected and approved by the Engineer.
- D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the City.

**SECTION 22 05 00  
PLUMBING**

**3.2 PREPARATION - MECHANICAL IDENTIFICATION**

- A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.3 INSTALLATION - GENERAL**

- A. Install in accordance with manufacturer's instructions.
- B. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

**3.4 INSTALLATION - PIPE HANGER AND SUPPORTS**

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- G. Support riser piping independently of connected horizontal piping.
- H. Provide copper plated hangers and support for copper piping. In lieu of copper plated hardware, provide non-conductive inserts.
- I. Design hangers for pipe movement without disengagement of supported pipe.
- J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

**END OF SECTION**

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Plumbing demolition.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Supports and anchorages.

**1.2 DEFINITIONS**

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

**PART 2 - PRODUCTS**

**2.1 PIPE, TUBE, AND FITTINGS**

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

- A. ASME B1.20.1 for factory-threaded pipe and pipe fittings.

**2.2 JOINING MATERIALS**

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAgl, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.

**2.3 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 (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) 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 (107 deg C).

**2.4 MECHANICAL SLEEVE SEALS**

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel Include two for each sealing element.
- D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

**2.5 SLEEVES**

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- 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 set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

**2.6 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

**PART 3 - EXECUTION**

**3.1 PLUMBING DEMOLITION**

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

**3.2 PIPING SYSTEMS – COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- O. Verify final equipment locations for roughing-in.
- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.



**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

**3.3 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. 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 unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 5. PVC Non pressure Piping: Join according to ASTM D 2855.
  - 6. PVC to ABS Non pressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Non pressure Piping Gasketed Joints: Join according to ASTM D 3212.

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

**3.4 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

**3.5 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

**3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES:**

- A. Provide fabricated steel supports as necessary.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

**3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES**

**SECTION 22 05 22**  
**COMMON WORK RESULTS FOR PLUMBING**

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach substrates as required to support applied loads.

**END OF SECTION**

## **SECTION 22 11 16 DOMESTIC WATER PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Aboveground domestic water pipes, tubes, fittings, and valve above grade and inside the building.
2. Valves.
3. Dielectric Fittings.
4. Escutcheons.

#### **1.2 SUBMITTALS**

- A. Product Data:** For each type of product indicated.
- B. Field quality-control reports.**

#### **1.3 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.**
- B. Comply with NSF 61 for potable domestic water piping and components.**

### **PART 2 - PRODUCTS**

#### **2.1 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube:** ASTM B 88, Type L water tube, drawn temper.
1. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint ends.

#### **2.2 PIPING JOINING MATERIALS**

- A. Metal, Pipe-Flange Bolts and Nuts:** ASME B18.2.1, carbon steel unless otherwise indicated.

## **SECTION 22 11 16 DOMESTIC WATER PIPING**

- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

### **2.3 BALL VALVES**

- A. Manufacturers:
  - 1. Grinnell Corporation.
  - 2. Other acceptable manufacturers offering equivalent products.
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. Red-White Valve Corporation.
    - d. NIBCO.
    - e. Apollo.
    - f. Or equal.
- B. Up to 2 Inches: Bronze two-piece body, stainless or chrome plated steel ball, Teflon seats and stuffing box ring, lever handle solder or threaded ends. Note: Three-piece full port ball valves are recommended up to 3". Also recommended to add option for extended handle stem for insulated pipes.
- C. Over 2 Inches: Cast steel body, chrome plated steel ball, Teflon seat and stuffing box seals, lever handle, flanged.

### **2.4 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Description:
    - a. Pressure Rating: 150 psig at 180 deg F.
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.

### **2.5 ESCUTCHEONS**

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

## **SECTION 22 11 16 DOMESTIC WATER PIPING**

### **PART 3 - EXECUTION**

#### **3.1 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 domestic water piping level and plumb.
- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated.
- E. 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.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.

#### **3.2 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. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

#### **3.3 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 unions.

## **SECTION 22 11 16**

### **DOMESTIC WATER PIPING**

- C. Dielectric Fittings for NPS 2-1/2 to NPS 64: Use dielectric flanges or flange kits.

#### **3.4 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.

#### **3.5 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.

## **SECTION 22 11 16 DOMESTIC WATER PIPING**

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.

### **3.6 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 the valves and allow them to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

**END OF SECTION**



**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:
1. Cleanouts.
  2. Floor drains.
  3. Roof flashing assemblies.
  4. Miscellaneous sanitary drainage piping specialties.
  5. Flashing materials.

**1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.3 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 CLEANOUTS**

- A. Cast-Iron Floor Cleanouts:
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. Josam Company; Josam Div.
    - b. Oatey.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Light Commercial Operation.
    - h. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.36.2M for adjustable housing cleanout.
  3. Size: Same as connected branch.
  4. Closure: Brass plug with straight threads and gasket OR cast-iron plug.
  5. Top Loading Classification: Light Duty.
  6. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to clean out.

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**SANITARY WASTE PIPING SPECIALTIES**

**B. Cast-Iron Wall Cleanouts:**

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. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass, or stainless-steel cover plate with screw.

**2.2 FLOOR DRAINS**

**A. Cast-Iron Floor Drains:**

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. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products Inc.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3 with backwater valve, if specified.
3. Body Material: Gray iron.
4. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel, where required or specified.
5. Sediment Bucket: as specified
6. Top or Strainer Material: Nickel bronze.
7. Top of Body and Strainer Finish: Rough bronze
8. Top Shape: Round.
9. Top Loading Classification: Light Duty.
10. Trap Primer Connection

**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**2.3 ROOF FLASHING ASSEMBLIES**

- A. Roof Flashing Assemblies:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Acorn Engineering Company; Elmdor/Stoneman Div.
    - b. Thaler Metal Industries Ltd.
- B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
  - 1. Open-Top Vent Cap: Without cap.
  - 2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
  - 3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

**2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES**

- A. Air-Gap Fittings:
  - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  - 2. Body: Bronze or cast iron.
  - 3. Inlet: Opening in top of body.
  - 4. Outlet: Larger than inlet.
  - 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- B. Vent Caps:
  - 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  - 2. Size: Same as connected stack vent or vent stack.

**2.5 FLASHING MATERIALS**

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Use: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Refer to Division 22 Section 220522 "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Provide water hammer arrestor at end of each main / submain serving flush valve services
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

## **SECTION 22 13 19 SANITARY WASTE PIPING SPECIALTIES**

- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining indirect-waste piping discharge into sanitary drainage system.
- K. Install vent caps on each vent pipe passing through roof.
- L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### **3.3 FLASHING INSTALLATION**

- A. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
- B. Set flashing on floors and roofs in solid coating of bituminous cement.
- C. Secure flashing into sleeve and specialty clamping ring or device.
- D. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### **3.4 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**SECTION 22 13 19**  
**SANITARY WASTE PIPING SPECIALTIES**

**END OF SECTION**

**SECTION 23 05 00**  
**COMMON WORK RESULTS FOR HVAC**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Basic mechanical methods.
  - 2. Supports and anchors.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

**1.2 SUBMITTALS**

- A. Procedures for closeout submittals.
  - 1. Fabrication submittals: Contractor shall submit shop drawings for location of equipment and fabrication of hardware, for review by owner's representative prior to fabrication and installation.
  - 2. Project Record Documents: Accurately record the following:
    - a. Record drawings (as-builts)
    - b. Start-up reports
    - c. Provide test and balance report.

**1.3 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - 1. Conform to applicable local code for support of ductwork.

**1.4 BASIC MECHANICAL METHODS**

- A. Comply with manufacturer's published instructions for delivery, storage, protection, installation, and materials.
- B. When equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so if he properly supervises the operation and retains full responsibility for the equipment operated. Regardless of whether the equipment has or has not been operated, the Contractor shall professionally clean the equipment, install new filter media, make all required adjustments, and complete all punch list items before final acceptance by the Representatives of the Owner

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- C. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- D. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- E. Items exposed (in areas without ceilings) shall be installed in a neat, orderly manner. Elements shall be perpendicular and parallel to building lines.
- F. In those conditions where ductwork is exposed in finished areas, careful craftsmanship and only the highest standards of installation will be acceptable. All routing of exposed ducts, pipes, conduits, shall be approved in advance by the Owner's Representative prior to installation.
- G. Drawings and Specifications:
  - 1. The Drawings indicate the general arrangement of systems and are to be followed as far as possible. If deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Owner's Representative, for approval before proceeding with the work.
  - 2. This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. Contractor shall coordinate this work with all other branches in such a manner as to cause a minimum of conflict or delay.
  - 3. Where any work is so placed as to cause or contribute to a conflict it shall be readjusted at the expense of the Contractor causing the conflict. The decision shall be final about the arrangement of ducts, piping, etc., where conflict arises.
  - 4. Where offsets in systems are required to complete the installation, or for the proper operation of the system, these shall be deemed to be included in the Contract.
  - 5. Significant deviations from Drawings must be approved by the Engineer of Record.
- H. Locations:
  - 1. Mechanical layouts indicated on drawings are diagrammatic. Exact locations of ducts, pipes, and equipment may vary because of conflicts with work of other trades. Work out conflicts where relocations will not affect operation or appearance of systems.
  - 2. Locate equipment requiring periodic servicing so that it is readily accessible. Do not back up service sides to walls, nor place it too close to other equipment to make service impractical.



**SECTION 23 05 00**  
**COMMON WORK RESULTS FOR HVAC**

**PART 2 - PRODUCTS**

**2.1 SLEEVES AND SEALS**

- A. Sleeves for Round Ductwork: Galvanized steel.
- B. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- C. Sealant: Refer to Section 079200.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- B. Report in writing to Owner's Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the State.

**3.2 INSTALLATION - GENERAL**

- A. Install in accordance with manufacturer's instructions.
- B. The use of lead-containing solder for plumbing and plumbing fixtures is prohibited in the construction of this project.

**END OF SECTION**

**SECTION 23 05 93**  
**TESTING, ADJUSTING AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Testing, adjustment, and balancing of air systems.
  - 2. Measurement of final operating condition of HVAC systems.
  - 3. Sound measurement of equipment operating conditions.
  - 4. Vibration measurement of equipment operating conditions.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

**1.2 REFERENCES**

- A. Associated Air Balance Council (AABC):
  - 1. AABC - National Standards for Total System Balance.
- B. National Environmental Balancing Bureau (NEBB).
  - 1. Deemed acceptable in lieu of AABC on all accounts.

**1.3 SUBMITTALS**

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
  - 1. Assurance/Control Submittals:
    - a. Test Reports: Submit the following reports directly to State Representative from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Section 014000 - Quality Requirements:
      - 1) Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
      - 2) Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for inclusion in operating and maintenance manuals.
      - 3) Provide reports in binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

**SECTION 23 05 93**  
**TESTING, ADJUSTING AND BALANCING FOR HVAC**

- 4) Indicate data on AABC National Standards for Total System Balance forms.
- b. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
- c. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.

**1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Company specializing in testing, adjusting, and balancing of specified with minimum 5 years documented experience. Company to be certified by one of the following.
    - a. AABC Certified Independent Testing and Balancing Agency.
    - b. National Environmental Balancing Bureau Certified Independent Agency (NEBB).
- B. Certification: Certify the testing, adjusting, and balancing field data reports.
- C. Testing, Adjusting, and Balancing Reports: Use testing, adjusting, and balancing Agent's standard forms.
- D. Contractor shall demonstrate operation of all equipment and hardware, to include economizer and CO2 monitoring with supplemental signal generators to effect performance outboard of design conditions.

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

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Systems with associated terminal devices, outside air services to include:
  - 1. AC-A
  - 2. AC-B
  - 3. CU/FC-1
  - 4. EF-1
  - 5. EF-2
  - 6. EF-3
  - 7. EF-4
- B. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.

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**TESTING, ADJUSTING AND BALANCING FOR HVAC**

2. Temperature control systems are installed completely and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Duct systems are clean of debris.
5. Air outlets are installed and connected.
6. Duct system leakage is minimized.

**3.2 PREPARATION**

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to State Representative to facilitate spot checks during testing.
- B. Provide additional balancing instruments as required.

**3.3 INSTALLATION TOLERANCES**

- A. Fan Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

**3.4 ADJUSTING**

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by State Representative.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

**SECTION 23 05 93**  
**TESTING, ADJUSTING AND BALANCING FOR HVAC**

**3.5 AIR SYSTEM PROCEDURE**

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities. Perform this work with cooling system energized where applicable to obtain the extra resistance of wet coils.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross-sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Open volume control devices to 100%.
- F. Vary total system air quantities by duct static pressure set point. Provide adjustment to set point as necessary to achieve air flows.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

**END OF SECTION**

## **SECTION 23 07 13 DUCT INSULATION**

### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Ductwork insulation.
  - 2. Duct liner.
  - 3. Insulation jackets.
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

### **1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
  - 3. ASTM C335 - Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
  - 4. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 5. ASTM C534 - Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
  - 6. ASTM C547 - Mineral Fiber Pipe Insulation.
  - 7. ASTM C553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - 8. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
  - 9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
  - 10. ASTM E84 2007 Edition - Surface Burning Characteristics of Building Materials.
  - 11. ASTM E96 - Water Vapor Transmission of Materials.
- B. National Fire Protection Association (NFPA):
  - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
  - 1. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- D. Underwriters Laboratories, Inc. (UL):
  - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
- E. California Energy Code (for materials and installation)

## **SECTION 23 07 13 DUCT INSULATION**

### **1.3 SUBMITTALS**

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
  - 1. Product Data:
    - a. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

### **1.4 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
  - 2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.
- B. Materials:
  - 1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.

### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Section 016000 - Product Requirements: Transport, handle, store, and protect Products.
- B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Store insulation in original wrapping and protect from weather and construction traffic.
- D. Protect insulation against dirt, water, chemical, and mechanical damage.

### **1.6 PROJECT CONDITIONS OR SITE CONDITIONS**

- A. Jobsite Requirements
  - 1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
  - 2. Maintain temperature during and after installation for minimum period of 24 hours.

## **SECTION 23 07 13 DUCT INSULATION**

### **1.7 ENVIRONMENTAL REQUIREMENTS**

#### **A. Energy efficiency:**

1. Insulation: Minimum thickness in accordance with ASHRAE 90.1. Provide additional thickness to ensure surface temperatures are below 100 degrees and to prevent condensation on cold surfaces.

## **PART 2 - PRODUCTS**

### **2.1 DUCTWORK INSULATION**

#### **A. Glass Fiber, Flexible Duct Wrap**

1. Manufacturers:
  - a. Owens/Corning, Toledo, OH (800) 438-7465.
  - b. Other acceptable manufacturers offering equivalent products.
    - 1) CertainTeed.
    - 2) Schuller (Manville).
    - 3) Knauf.
    - 4) Or equal.
2. Insulation: ASTM C553 flexible, noncombustible blanket.
  - a. 'K' ('Ksi') value: ASTM C518, 0.30 at 75 degrees F.
  - b. Maximum service temperature: 250 degrees F.
  - c. Maximum moisture absorption: 0.20 percent by volume.
  - d. Density: 0.75 lb./cu ft.
3. Vapor Barrier Jacket
  - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
  - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - c. Secure with pressure sensitive tape.
4. Vapor Barrier Tape
  - a. Manufacturers:
    - 1) Owens/Corning.
    - 2) CertainTeed.
    - 3) Schuller (Manville).
    - 4) Or equal.
  - b. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
5. Tie Wire: Annealed steel, 16 gage.

#### **B. Glass Fiber Duct Liner, Flexible**

1. Manufacturers:
  - a. CertainTeed.
  - b. Other acceptable manufacturers offering equivalent products.
    - 1) Knauf.
    - 2) Schuller (Manville).



## SECTION 23 07 13 DUCT INSULATION

- 3) Owens Corning.
    - 4) Or equal.
  2. Insulation: ASTM C553; flexible, noncombustible blanket.
    - a. 'K' ('Ksi') value: ASTM C518, 0.28 at 75 degrees F.
    - b. Maximum service temperature: 250 degrees F.
    - c. Density: 1.5 lb./cu ft.
    - d. Maximum Velocity on Coated Air Side: 4,000 ft./min.
  3. Adhesive
    - a. Waterproof fire-retardant type.
  4. Liner Fasteners: Galvanized steel, impact applied with integral head.
- C. Glass Fiber, Rigid Board
  1. Manufacturers:
    - a. CertainTeed.
    - b. Other acceptable manufacturers offering equivalent products.
      - 1) Knauf.
      - 2) Schuller (Manville).
      - 3) Owens Corning.
      - 4) Or equal.
  2. Insulation: Glass fibers bonded with a thermosetting resin for rigidity. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
    - a. 'K' ('Ksi') value: ASTM C518, 0.28 at 75 degrees F.
    - b. Maximum service temperature: 250 degrees F.
    - c. Density: 1.5 lb./cu ft.
  3. Vapor Barrier Jacket
    - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
    - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
    - c. Overlap seams with pressure sensitive tape.
  4. Vapor Barrier Tape
    - a. Manufacturers:
      - 1) Owens/Corning.
      - 2) CertainTeed.
      - 3) Schuller (Manville).
      - 4) Or equal.
    - b. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber-based adhesive.
  5. Pin to ductwork below 8 feet and seal all perforations hardcast mastic.

## **SECTION 23 07 13 DUCT INSULATION**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
  - 1. Verify that piping has been tested before applying insulation materials.
  - 2. Verify that ductwork has been tested before applying insulation materials.
  - 3. Verify that surfaces are clean, foreign material removed, and dry.
- B. Report in writing to Owner's Representative prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the State.

#### **3.2 INSTALLATION - DUCTWORK INSULATION**

- A. Install materials in accordance with manufacturer's instructions and ASHRAE 90.1.
- B. Insulated ductwork conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
  - 1. Provide with or without standard vapor barrier jacket.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal end of insulation.
- D. For ductwork exposed in finished spaces below 10 feet above finished floor, finish with aluminum jacket.
- E. External Duct Insulation Application:
  - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  - 2. Secure insulation without vapor barrier with staples, tape, or wires.

## **SECTION 23 07 13 DUCT INSULATION**

3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

**F. Duct and Plenum Liner Application:**

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.
3. Seal and smooth joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

### **3.3 CONSTRUCTION**

- A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated.

### **3.4 DUCTWORK INSULATION SCHEDULE**

**A. Flexible Glass Fiber Duct Wrap Insulation Schedule:**

| <b>DUCTWORK</b>          | <b>THICKNESS</b> | <b>FINISH</b>   |
|--------------------------|------------------|-----------------|
| Supply Ducts             | 1-1/2 INCH       | Aluminized Film |
| Return Ducts             | 1-1/2 INCH       | Aluminized Film |
| Outdoor Air Intake Ducts | 1-1/2 INCH       | Aluminized Film |

**B. Flexible Glass Fiber Duct Liner Insulation Schedule:**

| <b>DUCTWORK</b>           | <b>THICKNESS</b> | <b>FINISH</b>       |
|---------------------------|------------------|---------------------|
| Plenums (Cooling System)  | 1 INCH           | Black Pigmented, UL |
| Supply Ducts              | 1 INCH           | Black Pigmented, UL |
| Return Ducts              | 1 INCH           | Black Pigmented, UL |
| Outdoor Air Intake Ducts  | 1 INCH           | Black Pigmented, UL |
| Ducts Exposed to Outdoors | 2 INCH           | Black Pigmented, UL |

**END OF SECTION**

**SECTION 23 32 00**  
**AIR DUCT CLEANING**

**PART 1 - GENERAL**

**1.1 QUALIFICATION OF THE HVAC SYSTEM CLEANING CONTRACTOR**

- A. Membership: The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA) or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- B. Certification: The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full-time basis or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- C. Supervisor Qualifications: A person certified as an ASCS by NADCA or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- D. Experience: The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the Owner.
- E. Equipment, Materials and Labor: The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials, and labor to adequately perform the specified services.
  - 1. The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A, contractors should comply with applicable national safety codes and standards.
  - 2. The contractor shall always maintain a copy of all current MSDS documentation and safety certifications at the site, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
  - 3. Contractor shall submit to the Owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.
- F. Licensing: The HVAC system cleaning contractor shall provide proof of maintaining the proper license(s), if any, as required to do work in this state.

## **SECTION 23 32 00 AIR DUCT CLEANING**

Contractor shall comply with all Federal, state, and local rules, regulations, and licensing requirements.

### **1.2 STANDARDS**

- A. NADCA Standards: The HVAC system cleaning contractor shall perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association (NADCA).
  - 1. All terms in this specification shall have their meaning defined as stated in the NADCA Standards.
  - 2. NADCA Standards must be followed with no modifications or deviations being allowed.
  
- B. Applicable Standards and Publications: The following current standards and publications of the issues currently in effect form a part of this specification to the extent indicated by any reference thereto:
  - 1. National Air Duct Cleaners Association (NADCA): Assessment, Cleaning & Restoration of HVAC Systems (ACR 2005), 2004.
  - 2. National Air Duct Cleaners Association (NADCA): Understanding Microbial Contamination in HVAC Systems, 1996.
  - 3. National Air Duct Cleaners Association (NADCA): Introduction to HVAC System Cleaning Services, 2004.
  - 4. National Air Duct Cleaners Association (NADCA): Standard 05 Requirements for the Installation of Service Openings in HVAC Systems, 2004.
  - 5. Underwriters' Laboratories (UL): UL Standard 181.
  - 6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, Ventilation for Acceptable Indoor Air Quality.
  - 7. Environmental Protection Agency (EPA): Building Air Quality, December 1991.
  - 8. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): HVAC Duct Construction Standards - Metal and Flexible, 1985.
  - 9. North American Insulation Manufacturers Association (NAIMA): Cleaning Fibrous Glass Insulated Air Duct Systems, 1993.

## **PART 2 - HVAC SYSTEM CLEANING SPECIFICATIONS AND REQUIREMENTS**

### **2.1 SCOPE OF WORK**

**SECTION 23 32 00**  
**AIR DUCT CLEANING**

- A. Scope: This section defines the minimum requirements necessary to render existing HVAC components clean for re-use, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.
- B. The Contractor shall be responsible for the removal of visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.
- C. The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning, and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts to the air conditioning unit (AHU), the interior surfaces of the AC, mixing box, coil compartment, condensate drain pans, supply air ducts, fans, fan housing, fan blades, turning vanes, filters, filter housings, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

**2.2 HVAC SYSTEM COMPONENT INSPECTIONS AND SITE PREPARATIONS**

- A. HVAC System Component Inspections: Prior to the commencement of any cleaning work, the HVAC system cleaning contractor shall perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project. The cleanliness inspection should include air handling units and representative areas of the HVAC system components and ductwork. In HVAC systems that include multiple air handling units, a representative sample of the units should be inspected. The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification, or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented.
  - 1. Damaged system components found during the inspection shall be documented and brought to the attention of the Owner.
- C. Site Evaluation and Preparations: Contractor shall conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- C. Inspector Qualifications: Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning, at minimum, such personnel should have an understanding of HVAC system design, and

**SECTION 23 32 00**  
**AIR DUCT CLEANING**

experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

**2.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS**

- A. Containment: Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- B. Particulate Collection: Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- C. Controlling Odors: Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- D. Component Cleaning: Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- E. Air-Volume Control Devices: Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- F. Service Openings: The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
  - 1. Contractor shall utilize the existing service openings already installed in the HVAC system where possible.
  - 2. Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
  - 3. Closures must not significantly hinder, restrict, or alter the airflow within the system.
  - 4. Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
  - 5. Openings must not compromise the structural integrity of the system.
  - 6. Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

**SECTION 23 32 00**  
**AIR DUCT CLEANING**

7. Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
  8. Rigid fiber glass duct systems shall be resealed in accordance with NAIMA recommended practices. Only closure techniques that comply with UL Standard 181 or UL Standard 181a are suitable for fiber glass duct system closures.
  9. All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the Owner in project report documents.
- G. Ceiling sections (tile): The contractor may remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- H. Air distribution devices (registers, grilles & diffusers): The contractor shall clean all air distribution devices.
- I. Air conditioning units, terminal units (VAV, Dual duct boxes, etc.), blowers and exhaust fans: The contractor shall insure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers, and drive assemblies. All visible surface contamination deposits shall be removed in accordance with NADCA Standards. Contractor shall:
1. Clean all air conditioning units (AC) internal surfaces, components and condensate collectors and drains.
  2. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
  3. Clean all coils and related components, including evaporator fins.
- J. Duct Systems. Contractor shall:
1. Create service openings in the system as necessary to accommodate cleaning of otherwise inaccessible areas.
  2. Mechanically clean all duct systems to remove all visible contaminants, such that the systems can pass Cleaning Verification Tests (see NADCA Standards).
- 2.4 HEALTH AND SAFETY
- A. Safety Standards: Cleaning contractors shall comply with applicable federal, state, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment. All applicable standards of the Occupational Safety and Health Administration (OSHA) shall be followed when working in accordance with this specification.



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- B. Occupant Safety: No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- C. Disposal of Debris: All Debris removed from the HVAC System shall be disposed of in accordance with applicable federal, state, and local requirements.

**2.5 MECHANICAL CLEANING METHODOLOGY**

- A. Source Removal Cleaning Methods: The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. It is the contractor's responsibility to select Source Removal methods that will render the HVAC system Visible Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified test, in accordance with all general requirements. No cleaning method, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
  - 1. All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
  - 2. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.
  - 3. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes, or regulations.
  - 4. All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- B. Methods of Cleaning Fibrous Glass Insulated Components
  - 1. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure,

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and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

2. Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).

**C. Damaged Fibrous Glass Material**

1. Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
2. Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air conditioner and/or ductwork requiring replacement.
3. Replacement material: In the event fiber glass materials must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA. Replacement of damaged insulation is not covered by this specification.

**D. Cleaning of coils**

1. Any cleaning method may be used which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drains pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

**E. Antimicrobial Agents and Coatings**

1. Antimicrobial agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
2. Application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
3. When used, antimicrobial treatments and coatings shall be applied in strict accordance with the manufacturer's written recommendations and EPA registration listing.
4. Antimicrobial coatings shall be applied according to the manufacturer's written instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than fogged downstream onto surfaces.

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**PART 3 - EXECUTION**

**3.1 CLEANLINESS VERIFICATION**

- A. General: Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- B. Visual Inspection: The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
  - 1. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the Owner reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standards.
  - 2. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
  - 3. NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature.
- C. Verification of Coil Cleaning
  - 1. Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

**3.2 PRE-EXISTING SYSTEM DAMAGE**

- A. Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

**3.3 POST INSTALLATION / PRE-ACCEPTANCE REQUIREMENTS**

- A. Measure as identified herein shall be provided for portions of installation showing deterioration for time and damage therein after installation.

**3.4 POST-PROJECT REPORT**

- B. At the conclusion of the project, the Contractor shall provide a report to the Owner indicating the following:

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1. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
2. Areas of the system found to be damaged and/or in need of repair.

**END OF SECTION**

## **SECTION 23 57 32 HVAC EQUIPMENT**

### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Split System Heat Pump Ductless (FC/CU-1)
  - 2. Rooftop Exhaust Fan (EF-1, 2).
  - 3. Cabinet Exhaust Fan (EF-3, 4).
- B. Related Documents: The Contract Documents, as defined in Section 011000 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- C. Related Sections:
  - 1. Section 233000 – HVAC Ductwork
  - 2. Division 26 - Electrical

### **1.2 REFERENCES**

- A. ARI 210 - Unitary Air Conditioning Equipment
- B. NFPA 70 - National Electrical Code
- C. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- D. UL 465 - Central Cooling Air Conditioners

### **1.3 DEFINITIONS**

- A. Ductless Split System Heat Pump (FC / CU): Multi-component packaged, self-contained, factory-assembled, pre-wired unit for field assembly consisting of cabinets and frames, evaporator fan, evaporator-coil, heat-pump, condenser coil, condenser fan, compressor, controls, and filters in draw-through air flow configuration.
- B. Roof Ventilator Exhaust Fan (EF): Spun aluminum shroud, curb-mounted unit, consisting of motor and fan on mounts, wiring and terminations, for rooftop installation.
- C. Ceiling Cabinet Exhaust Fan (EF): Ceiling-mounted cabinet fan, consisting of motor and fan on mounts, wiring and terminations, in-line installation.

## **SECTION 23 57 32 HVAC EQUIPMENT**

### **1.4 SUBMITTALS**

- A. Section 016000 – Product Requirements, Product Data, and Samples: Procedures for submittals.
  - 1. Product Data: Provide product data for manufactured Units. Indicate performance capacities, energy-efficiency ratings, and electrical characteristics.
  - 2. Shop Drawings: Provide shop drawings for manufactured Units. Indicate pipe connections, ductwork connections, filter and media size and quantity, condensate drain connection, thermostatic valves, temperature controls connections and electrical rough-in connections with electrical characteristics and connection requirements.
  - 3. Assurance/Control Submittals:
    - a. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
    - b. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
- B. Section 017700 – Closeout Procedures and Training: Procedures for closeout submittals.
  - 1. Project Record Documents: Accurately record the following:
    - a. Plan view of installed location of Units
    - b. Elevation or section view of installed Units.
  - 2. Warranty: Submit a written minimum five (5) years warranty to include coverage for refrigeration compressors condenser and evaporator with forms completed in Owner name and registered with manufacturer as specified in this Section.
  - 3. Extra Products: Submit extra products as specified in this Section.
  - 4. Operating instruction: Document training by furnishing a sign-in sheet with a description of the training provided instructors' name and organization, and those who received training. Refer to 01780 1.3, 1.4, and 1.5 for more specific training

### **1.5 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Manufacturer: Company specializing in manufacturing Products specified with minimum five (5) years' documented experience.
  - 2. Installer: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.

## SECTION 23 57 32 HVAC EQUIPMENT

- B. Regulatory Requirements:
  - 1. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 – Product Requirements: Transport, handle, store, and protect Products.

## PART 2 - PRODUCTS

- A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
  - 1. Split System Heat Pump-Ductless (FC/CU)
    - a. Carrier.
    - b. Trane.
    - c. Approved Equal.
  - 2. Exhaust Fan (EF)
    - a. Greenheck.
    - b. Loren Cook.
    - c. Approved Equal.
- B. Section 016000 – Product Requirements: Product options and substitutions. Substitutions: Permitted providing equal quality and performance, and as agreed to by Engineer.

### 2.2 MATERIALS

- A. Grade of equipment as manufactured by respective manufacturers, for products as identified herein and on drawings, and for performances, capacities, and efficiencies as scheduled, and with accessories, options, ancillaries, and trim as noted.
- B. Provide additional hardware as required for complete operating system as identified on plan.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

## **SECTION 23 57 32 HVAC EQUIPMENT**

- B. Verify that proper power supply is available.
- C. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
- D. Report in writing to Owner prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### **3.2 INSTALLATION**

- A. Mount equipment and hardware with exterior components to provide water-tight installations.
- B. Install equipment level and square and plumb and in accordance with manufacturer's instructions.
- C. Provide ancillaries and trim as required for complete system operation, to include refrigerant piping, control wiring and cable, et al.
- D. HVAC Controls
  - 1. Provide ductless split system heat pump with microprocessor based thermostat with programmatic scheduling. Microprocessor thermostat shall be well mounted with finish work, mounting beauty rings, et al. as necessary for finished presentation.
  - 2. Refit rooftop exhaust fan controls commensurate to existing switching.
  - 3. Interlock ceiling cabinet fan operation with local restroom light switching.

### **3.3 FIELD QUALITY CONTROL**

- A. Section 014000 - Quality Requirements: Field testing and inspection.
- B. Operating Instruction
  - 1. Provide on-site instruction to review the operation of the system and detail any common troubleshooting or maintenance that is required to ensure normal operation.
  - 2. Provide one complete set of equipment operating, installation, and programming manuals that will remain at the installed location.

## **END OF SECTION**



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**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.
  - 1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.
- B. Related Work Specified Elsewhere:
  - 1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.
- C. Work Installed but Furnished by Others:
  - 1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

**1.02 GENERAL REQUIREMENTS**

- A. Guarantee See General Conditions:
  - 1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure,

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correct deficiency immediately and without additional cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.
- B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom-made equipment must have complete test data submitted by the manufacturer attesting to its safety.
- C. Codes and Regulations:
1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:
    - a. Institute of Electrical and Electronic Engineers - IEEE
    - b. National Electrical Manufacturers' Association - NEMA
    - c. Underwriters' Laboratories, Inc. - UL
    - d. National Fire Protection Association - NFPA
    - e. American Society for Testing and Materials - ASTM
    - f. American National Standards Institute - ANSI
    - g. California Electrical Code - CEC, Title 24, Part 3
    - h. California Code of Regulations, Title 8, Subchapter 5
    - i. California Building Code-CBC, Title 24 Parts 1 & 2
    - j. State & Municipal Codes in Force in the Specific Project Area
    - k. Occupational Safety & Health Administration - OSHA

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- I. California State Fire Marshal
    - m. California Fire Code- CFC, Title 24 Part 9
    - n. National Electrical Testing Association - NETA
  - 2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above.  
In the case where the codes have different levels of requirements, the most stringent rules shall apply.
- D. Requirements of Regulatory Agencies:
- 1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.
    - a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.
    - b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.
- E. Shop Drawings:
- 1. See Division 01 for additional requirements.
  - 2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
  - 3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
  - 4. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.

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5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.
  - a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.
  - b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.
  - c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.
  - d. Include complete catalog information such as construction, ratings, insulation systems, as applicable.
  - e. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.
  - f. Reference listings to the specifications' Sections and Article to which each is applicable.
  - g. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and communication equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.
6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.

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- F. Interpretations: The Contractor through the Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.
- G. Standard of Quality
1. The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.
  2. Items for similar application shall be of the same manufacturer.
  3. The label of listing by UL shall appear on all materials and equipment for which standards have been established by the agency.
  4. Where codes as listed in Section General Requirement Section of the Specifications that establish label or approved requirements, furnish all materials and equipment with either the required labels affixed or the necessary written approval.
  5. Provide the type and quantity of electrical materials and equipment necessary to complete Work and all systems in operation, tested and ready for use.
  6. Provide and install all incidental items that belong to the Work described and which are required for complete systems.
  7. All switchboards, distribution boards, panel boards and circuit breakers shall be of the same manufacturer.
  8. All wiring devices such as switches and receptacles shall be of the same manufacturer.
- H. Substitutions: Refer to Division 01
- I. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:
1. General Requirements:

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- a. Panelboards.
  - b. Conduits.
  - c. Conductors, include all selected insulation types.
  - d. Fuses.
  - e. Disconnect switches.
  - f. Pullboxes.
  - g. Control devices, standard and special receptacles, switches, outlets and finish device plates.
- J. Utility Service:
- 1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to building service from locations which are acceptable to the Owner.
  - 2. Verify electrical, architectural and structural, dimensional and other requirements with the Owner.
  - 3. Should any major modifications to the work indicated be necessary to comply with the Owner requirements, notify the Architect.
  - 4. Contractor shall contact the utility company representatives to establish pre-construction coordination, obtain all necessary meters and/or approvals, and schedule utility work to coordinate with the construction schedule.
  - 5. All utility services shall be installed per the utility company requirements. Verify final construction requirements with utility company service planners prior to construction.
- K. Record Drawings: Refer to Division 01, Contract Closeout.
- L. Work Responsibilities:
- 1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work. Where conflicts occur in plans

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and/or specifications, the most stringent application shall apply and shall be part of the base bid.

2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.
  3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
  4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
  5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
  6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.
  7. Contractor shall be responsible for coordination of coordinated drawings when required by the Architect.
  8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.
- M. Installation General: For special requirements, refer to specific equipment under these requirements.
1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
  2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without

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approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.

3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
4. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
5. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
6. Protect work, materials and equipment and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.
7. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.
8. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
9. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
10. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.
11. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance



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with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

N. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 2.
2. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.
2. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.

O. Tests

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.
3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.
4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.
5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an

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authorized representative of the Owner's Representative.

Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
  7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.
- P. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.
- Q. Cleaning Up:
1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
  2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
  3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
  4. Leave the entire installation in a clean condition.
- R. Completion:
1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly

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posted or installed and final cleaning of equipment and premises has been completed.

2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.
- S. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01.
- T. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.
- U. Final Completion of Electrical Systems:
1. Prior to Final Completion of operating electrical systems, the Contractor shall:
    - a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
    - b. Furnish the required Operating and Maintenance Data/Manuals.
    - c. Clean up of the project pertaining to this Division of the work.
    - d. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.
    - e. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
    - f. Submission of warranties and guarantees.
  2. Final Completion of Work Shall be Contingent On:

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- a. Contractor replacing defective materials and workmanship.
  - b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
  - c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
  - d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.
- V. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.
- W. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

**1.03 PROJECT RECORD DOCUMENTS**

- A. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2012 compatible DWG or DXF format. Owner's consultant will furnish CAD

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backgrounds for use by the Contractor after construction is 85% complete except where prohibited by Contract.

- B. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Architect and Owner.
- C. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.
- D. Final Record Drawings: Conform to Division 01 requirements.
- E. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.
- F. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.
- G. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required and to the extent required under other Sections.
- H. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.
- I. Quantity:
  - 1. Review sets: As for Shop and Field Drawings.
  - 2. Record set: Refer to Division 01.

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- J. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.
- K. Warranty Certificates: Comply with Division 01.

**END OF SECTION**

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**PART 1 - GENERAL**

**1.1 SCOPE OF WORK**

- A. The work covered by this section consists of furnishing and installing all materials, equipment, fixtures and performing all labor and operations for complete and operable systems.
- B. Provide all new materials, unless noted otherwise, of the best quality, and in perfect condition, and materials of the same make and quality throughout the work and as hereinafter specified. Comply with the requirements of ASTM, NEMA, U.L., and NBFM for materials and equipment.
- C. The intent of these specifications is to establish a standard of quality of materials installed. Include materials as specified without exception in the Base Bid. Submit for approval any proposed substitution, complete descriptive, technical, and cost comparison data, and test reports. Do not furnish or install any substitute items without written approval at the time of contract signing. Reimburse the Owner for any additional engineering charges and for any changes in the work of other trades resulting from substitutions. List proposed substitutions on the Bid Form, stating the reasons for substitution. When requested by the Architect or Electrical Engineer, samples, electrically wired at 120V. with plug, or system demonstrations of both specified and proposed items will be submitted for inspection at the Electrical Engineer's office and at a time convenient to all concerned parties.
- D. Where a substitution alters the design or space requirements indicated on the plans, Contractor is responsible for all additional cost for Engineering to revise plans.
- E. Verifying Drawings and Job Conditions:
  - 1. Examine all drawings and specifications in a manner to be fully familiar of all work required.
  - 2. Visit the site and verify existing conditions. Where existing conditions differ from drawings, make adjustments and allowances for all necessary equipment to complete all parts of the drawings and specifications.
- F. Shop Drawings:
  - 1. Submit drawings in one set accompanied by letter of transmittal listing the number and dates of the drawings submitted.
  - 2. Mark the drawings submitted with the name of the project, numbered consecutively, and bearing approval as evidence that the

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drawings have been checked. Any drawings submitted without this approval will be returned for resubmission.

3. Submit Shop drawings on, but not limited to, the following:

- |                      |                  |
|----------------------|------------------|
| a. Panels            | c. Product List  |
| b. Lighting Fixtures | d. Time Switches |

G. Drawings of Record:

1. Provide and keep up-to-date, a complete record set of blue line prints. Show every change from the original drawings. Keep this set of prints on the job site and use it only as a record set. Do not make changes in the layout without definite instruction in each case. Obtain a set of Contract Drawings from Architect and incorporate all changes as noted on the record set of prints. Deliver this set to the Architect upon completion and acceptance of work.

H. Accuracy of Plans and Specifications:

1. Plans and /or specifications showing deviation from standard practice methods or from compliance with codes, and/or any omissions, does not relieve the responsibility of furnishing, making or installing all items required by code and / or intended for the function of the system.

I. Permits, Fees, and Insurance:

1. Obtain and pay for all insurance, permits, etc. necessary for this Contract.

J. Codes and Regulations:

1. All work performed under this Section of the Specifications complies with the rules and regulations of the Division of Industrial Safety, State of California, as set forth in the latest edition of the Electrical Safety Orders, the National Electrical Code, NFPA, and all rules and regulations of local codes having jurisdiction, including the presently adopted edition Title 21 and 24 California Administrative Code.

K. Testing and Adjustment:

1. Test all circuits, outlets, switches, lights, motors, circuit breakers and any other electrical equipment, upon completion of all electrical work.

L. Guarantees of Materials and Workmanship:

1. Furnish and install all materials under this Contract, new and free from all defects, and guaranteed for a period of two years from the date of acceptance of the work. Should any trouble develop during this period due to defective material or faulty workmanship, furnish all necessary labor and materials to correct the trouble without



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additional cost to the Contract. Correct any defective material or inferior workmanship noticed at the time of installation immediately, to the satisfaction of the Architect.

- M. Removal of Rubbish:
  - 1. Remove rubbish, excess materials, tools, or equipment related to this portion of the work, frequently during construction and upon completion of the work.
  
- N. Drawings and Specifications:
  - 1. The electrical drawings are considered as part of these specifications, and any work or materials shown on the drawings and not mentioned in the specifications, or vice versa, shall be as if specifically mentioned in both.
  - 2. The data herein specified and shown on the drawings is as exact as could be prepared, but their extreme accuracy is not guaranteed. The drawings and specifications are for assistance and guidance. The installation is essentially as shown and specified. The exact location of the equipment, material, apparatus and devices as well as the distances and levels, are more or less governed by the physical conditions and arrangements of the building. Accept this Contract with this understanding.
  - 3. Make minor changes, when ordered by the Architect, accommodating the installation of the work with other sections of the Contract without additional cost to the Contract.
  
- O. Safety Conditions:
  - 1. It is the Contractor's responsibility to prevent any damages to personnel and/or property resulting from contact with new or existing energized circuits, switches, circuit breakers, or other electrical apparatus. All electrical work to be constructed with electrical systems de-energized in the area of work.
  
- P. Final Inspection and Acceptance:
  - 1. After all requirements of the specifications and drawings have been completed, a representative of the Owner will inspect the work. Provide competent personnel to demonstrate the operation of any item or system involved to the complete satisfaction of each representative.

### **PART 2 - PRODUCTS**

#### **2.1 PANELBOARDS:**

- A. Provide the automatic circuit breaker type, quick-make, and quick-break panelboards. Provide wiring gutter sides, top and bottom.

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- B. Provide panelboards from the same manufacturers as the main switchboard; type, mounting, and size as noted on the drawings with silver-plated copper bussing.
- C. Where space is called for on the panelboard schedules, provide space and mounting for future circuit breaker installation as indicated.
- D. Use trims having doors equipped with flush type combination lock and catch, two milled type keys supplied with each panel, all locks are keyed alike. Provide a clear covered directory frame with a typed identification card, indicating type of circuit and location, in accordance with final circuitry and panel designation on each door. Completely fill in all panel directories, using actual connections, Owner's designations, or other factual information. Key all doors to Yale LL803, or as directed by Owner.
- E. Where called for on the drawings, provide a separate compartment within the panelboards for contactors and/or time switches.

**2.2 CIRCUIT BREAKERS:**

- A. Provide circuit breakers with inverse time characteristic thermal and magnetic tripping elements, with an interrupting capacity of not less than ratings identified per plans, UL labeled, NEMA rated, molded case type. Use common trip single handle multi-pole breakers. Handle extensions are not permitted. All circuit breakers will have covers sealed on non-interchangeable trip breakers and trip unit covers sealed in interchangeable trip breakers to prevent tampering. Be sure the circuit breaker current rating markings clearly visible after breaker is installed. One manufacturer for all circuit breakers for a given panel. Provide bolt-on circuit breakers unless specifically noted on electrical drawings.

**2.3 POWER DISCONNECT SWITCHES:**

- A. Provide power disconnect switches having product construction requirements as specified and/or indicated. Where not otherwise indicated, the following requirements apply:
  - 1. Enclosure: NEMA 1, surface type in dry locations. Use NEMA 3R for exterior locations.
  - 2. Ratings: Voltage, ampacity, horsepower and inductive ratings complying with power source voltage and characteristics of load controlled.
  - 3. Mechanism: Heavy-duty, quick-make, quick-break, with voidable interlock to prevent opening enclosure in "ON" position. External

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lockable handle operation with provision for not less than two padlocks.

4. Poles and Fusing: Comply with load requirements. Provide unfused switches except where fusing is indicated or required to comply with Code Requirements. Where fuses are installed, use dual-element time delay fuses.

- B. Provide power disconnect switches of the following manufacturers with characteristics complying with load and power source indicated:

1. Westinghouse: Type HF or HU.
2. General Electric: Type TH.
3. Square D: Type HD or HU.

- C. Provide the number of poles necessary to include a pole for each ungrounded conductor. Equip switch with neutral terminal point where neutral is present. Do not switch neutral unless indicated.

### **2.4 PUSHBUTTON STATIONS AND CONTROL DEVICES:**

- A. The type and size of all pushbutton stations, switches, pilot lights and other control devices are as indicated on the drawings.

### **2.5 RELAYS:**

- A. Install control relays for automatic controls or for interlocking as indicated in the drawings. Provide relays with the number and type of poles and with operating coils as indicated. Equip relays with contacts rated not less than 15 amperes for continuous inductive load, unless otherwise shown or specified. Rate operating coils for continuous duty at the operating voltage shown on the drawings.

### **2.6 FUSES:**

- A. Provide (in a location designated by the Owner) a spare fuse cabinet with the following:
  1. Nameplate "spare fuses".
  2. Necessary fuse holders.
  3. Spare set of each size and type of fuses.
- B. Provide dual element fuses for all 600 volt or lower voltage requirements unless otherwise indicated or specified. Where fuses are not made for this application, furnish Bussmann "Limitron" or approved equal fuses.
- C. Provide Bussman Fuses as indicated on plans.

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- D. Replace fuses "blown" or damaged during construction with new fuses of proper rating and type for the particular use, replace spare sets.

**2.7 LIGHTING FIXTURES:**

- A. Furnish, install, and connect lighting fixtures of type designed on the plans.
  - 1. Verify all fixture locations with Architectural drawings prior to rough in.
  - 2. Where there is conflict in fixture quantities on any of the plans the greatest amount will prevail. The description of the lighting fixture supersedes the catalog number and is to be furnished and installed with type to fit description.

**2.8 CONDUIT AND FITTINGS:**

- A. Rigid Conduit (RGS): Hot dipped galvanized or sherardized steel. Republic Steel Co. or approved equal. Intermediate metal conduit may be used, where CEC allows, in lieu of RGS.
- B. Electrical metallic tubing (EMT): Welded, electro-galvanized thin wall steel tubing. All couplings are gland compression type.
- C. Non-metallic conduit (PVC): Polyvinyl chloride Schedule 40 or 80. Install a copper ground wire, sized per National Electrical Code, in all non-metallic conduit power raceways. Use PVC in underground installations only.
- D. Liquid tight Flexible Metal Electrical Conduit: Hot-dipped galvanized steel with exterior, molded polyvinyl jacket. Use for all final connections to all vibrating equipment, transformers, and the like. 18" maximum. Provide a code sized ground wire.
- E. Flexible metallic steel tubing: Liquid tight without a nonmetallic jacket. Use as allowed by code and were permitted by this Specification, section 3.06.C. Provide a code sized ground conductor.
- F. Condulet Type Fittings: As manufactured by Crouse Hinds Company, Appleton Electric Company, or Pyle National or approved equal, smooth inside and out, taper threaded with integral bushings.

**2.9 CONDUCTORS:**

- A. Provide copper conductors, 600-volt A.C. unless noted otherwise. Aluminum conductors are not permitted.

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- B. Use THWN conductors for underground and damp locations, THHN for dry areas.
- C. Deliver conductors to the site in unbroken packages, marked with the manufacturer's name, date of manufacture, voltage, and classification letters. Use only wire recently manufactured (10 months or less).
- D. Provide signal service and low voltage control conductors as specified or noted on the drawings.
- E. No conductor supplying 120 volts or more will be smaller than No. 12 AWG unless otherwise noted on the drawings.
- F. Fixture wire to comply with latest requirements of the National Board of Fire Underwriters. The carrying capacity of the wire as per the latest requirements of the National Electrical Code. No fixture wire may be smaller than #18 gauge. Protect wiring with tape or tubing at all points where abrasion is likely to occur.
- G. Install all conductors of each electrical system in an approved raceway. Factory assemblies, non-metallic/pliable/corrugated raceways, type UF cable or multi-conductor assemblies are not approved.
- H. Use solid conductor, size #10 AWG and smaller, stranded for #8 AWG and larger.

**2.10 JUNCTION AND PULL BOXES:**

- A. Above grade level, provide galvanized junction and pull boxes with removable covers, secured with machine screws. The sizes of all boxes determined by the number and size of conductors entering the box, and by the sizes of conduit terminating in the box. All boxes conform to the applicable Electrical Safety Orders, State of California. Pullboxes flush with grade shall be concrete, with bolt down concrete or steel covers, per plans, with engraved or beadweld identification.

**2.11 OUTLET BOXES:**

- A. Provide galvanized outlet boxes and covers, one piece pressed steel, knockout fixture outlets equipped with 3/8" fixture studs and plaster rings.
- B. Where standard boxes are not suitable, provide boxes of special design to fit space.
- C. Cast aluminum or cast iron for outlet boxes exposed to weather, in damp

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locations, or surface mounted with threaded hubs for conduit connections; cover made watertight with gasket and non-ferrous screws.

- D. Provide outlet boxes in plaster covered walls with raised covers or plaster rings to finish flush with plaster.

**2.12 SWITCHES:**

- A. Local single pole switches: Flush tumbler type A.C. rated quiet type, heavy duty, back or side wired with binding screws, 20A, 120/277V rated switches, Bryant #4901, Hubbell or Leviton #1221, Sierra #5021 or Arrow Hart #1991. Two pole, three-way and lock type of the same manufacturer, white.
- B. Horsepower rated and approved for motor control service on switches controlling or disconnecting single-phase motor loads in excess of 1/3 h.p. Switches complete with overload devices of proper motor nameplate rating.
- C. Local single pole dimmer switches: Flush tumbler type with slide adjustment. 0-10 volt, back or side wired with binding screws, 20A, 120/277V rated

**2.13 RECEPTACLES:**

- A. Convenience outlets consist of a duplex convenience receptacle mounted in an outlet box in the wall, flush with the finish surface and complete with plate.
- B. Receptacles for convenience outlets: Standard duplex, 3-wire grounding type 15 ampere, 125 volt, Hubbell, Bryant, Leviton, or Arrow Hart #5262 white, unless otherwise indicated.
- C. Weatherproof G.F.C.I. receptacles: 15 ampere, 2P 3-wire grounding type, 125 volt with gray fiberglass lift cover plate, Hubbell #GF5262, unless otherwise shown on plans.

**2.14 PLATES:**

- A. Provide stainless steel plates for all switches, convenience outlets, telephone outlets and all other similar outlets, unless otherwise specified or noted.

**2.15 NAMEPLATES:**

- A. Shall be micarta or lamacoid plate, 1/8" thick and have approved size, with

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beveled edges and engraved white letters on black background. Provide nameplates for all items of electrical equipment as well as circuits in the service distribution and power distribution panelboards; lighting distribution panelboards; separately mounted motor starting switches; disconnect switches; motor control pushbutton stations and other similar devices. Each nameplate as approved by the Architect. Use two machine screws for attachment. Cement/adhesive is not approved.

### **PART 3 - EXECUTION**

- 3.1 If construction of building reveals that any part of the Electrical Work would not be readily accessible if installed according to drawings, notify the Architect before proceeding with such installation.
- 3.2 All concrete work such as pull boxes, raised pads, conduit envelopes and other areas where affecting Electrical Work are the responsibility of the Electrical Contractor.
- 3.3 Coordinate layout and installation of electrical work with the overall construction schedule and work schedules of various trades to prevent delay in completion of the project.
  - A. Verify dimensions and information regarding accurate location of equipment, structural limitations, and finish with other affected sections.
  - B. Job Conditions:
    - 1. The drawings do not always show offsets, bends, special fittings, or junctions or pull boxes necessary to meet job conditions. Provide the items as required at no cost to the Owner.
  - C. Weatherproof Equipment:
    - 1. Use weather resistant electrical devices or equipment located in damp, semi-exposed areas. Comply with NEMA Type 3R requirements for enclosures.
  - D. Where devices are shown diagrammatically in the same location, neatly group them together in a reasonable manner. Provide one-piece plate where such is manufactured.
- 3.4 Equipment requiring electrical under other sections is part of the Contract. Work includes all necessary connections.

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**3.5 EXCAVATION AND BACKFILLING:**

1. Excavate and backfill in accordance with section in these documents covering that work.

**3.6 CONDUIT:**

- A. Install all conduit concealed, except where specifically indicated as exposed. Use rigid galvanized steel or I.M.C. for all exposed conduit. Paint with two coats to match adjacent surroundings, if viewed by the public.
- B. Use galvanized rigid steel on all conduit installed in concrete and masonry walls, 3/4 inch trade size minimum, unless otherwise specified and/or noted on the plans. Verify conduit runs in concrete slab, prior to placement. Otherwise, do not run conduits in slabs.
- C. All conduit installed in the dry walls or dry ceilings of the building structures, shall be steel tube (EMT), except that in certain locations and for certain runs where it is impractical to install EMT, and where permission to do so has been given by the Architect, galvanized flexible steel conduit may be used, with a code sized ground conductor.
- D. Run conduit so as not to interfere with or contact other piping, fixtures or equipment. Maintain 6" separation from water piping.
- E. Cut the ends of all conduit square and carefully ream out to full size, and shoulder in fitting.
- F. No running threads will be permitted in locations exposed to the weather, in concrete or underground. Use special watertight union fittings in these locations.
- G. Use PVC Schedule 40 or 80 for all underground conduits. Install all underground conduit at a depth of not less than 24 inches below the final finish grade, unless under concrete slabs or otherwise noted and/or specified. provide metallic high voltage tape buried 12" above conduit, except under floor slab or under concrete walk, in which case, install 6" below bottom of slab. Use IMC for all horizontal and vertical sweeps or risers with factory applied PVC coating. Verify with serving utilities for service conduits, bends, depth below grade, backfill, etc. for specific types. Schedule 80 PVC sweeps are permitted for conduits 4" diameter and greater.
- H. Cut and patch all pavements, curbs, sidewalks, and gutters, whenever



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necessary for laying conduit, or whenever damaged by the operations of this trade. Replace materials with quality and finish equal to that removed or damaged.

- I. Where conduit extends through roof to equipment on roof areas, provide weatherproofing as specified in the appropriate section of these Specifications.
- J. Support all conduit in intervals not less than 10'-0" and within 36 inches from any outlet and at each side of bends and elbows. Use galvanized, concealed conduit supports, heavy stamped, one hole malleable conduit clamps secured with nails. On exposed conduit supports, use two hole clamps with screws, or galvanized steel framed channels secured by screws may be used for conduit supports. Perforated iron for supporting conduit is not permitted.
- K. Use rigid galvanized steel or I.M.C., threaded, for exposed conduit runs. Install parallel or perpendicular to walls, structural members or intersection of vertical plane and ceilings. Avoid field made bends and offsets where possible. Do not install crushed or deformed raceways.
- L. Provide metal sleeves and install where conduit passes through masonry or concrete walls. Use No. 20 gauge galvanized steel sleeves, no more than 1/2 inch greater in diameter than the outside diameter of the conduit. Caulk conduit into sleeves with stone wool, Duseal or Oakum and weatherproof below grade. Where conduit passes through fire resistive walls, partitions, and floors, pack void spaces between conduits with U.S.G. Thermafiber or equal, as approved by the State Fire Marshal.
- M. Provide a heavy nylon cord pull rope in all empty conduits for future use. Leave in place for future use in all runs and tagged with plastic tag at terminating end indicating the location of the opposite end of the conduit.
- N. Use factory-manufactured ells, except where noted otherwise. Field bends are permitted for EMT conduit less than 1" diameter. Conduit radius for signal system is ten times the internal diameter of the conduit.
- O. Cap or seal all conduit ends until wires are pulled.
- P. Use watertight gland compression type connectors and couplings on fittings for thin wall metallic conduit. Screw type or crimp type are not permitted.
- Q. Wire all rotating electrical equipment with flexible, liquid-tight conduit with appropriate slack from disconnect switch to equipment.

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- R. Install expansion coupling at all expansion joint locations, refer to Architectural. Drawings for locations.
- S. Use approved type-bending machines for PVC conduits. Use of blow torch is prohibited.
- T. For grouping, use conduit trapezes made up of suitable Unistrut or Kindorf hangers.
- U. Seal or cap all conduit for a watertight installation.
- V. Use approved conductor pulling machines for all underground conduits. Use of truck is prohibited.

**3.7 OUTLET BOXES:**

- A. Attach outlet boxes on metal studs with TEC screws. Use wood screws for attachment on wood studs. Nails are not acceptable.
- B. Cover all boxes with outlet box protector, Appleton SB-CK or approved equal. Keep plaster and dirt from entering box or panels. If plaster does get in, removed it prior to pulling in wires.
- C. Close all unused openings with plugs.

**3.8 INSTALLATION OF CONDUCTORS:**

- A. Unless otherwise indicated or specified, do not install conductors of less than No. 12 AWG size. For control conductors protected by 15 ampere or lower overcurrent protection, No. 14 AWG conductors will be installed. Where approved by Code, remote control and signal circuits utilize No. 18 or No. 16 AWG sizes. Increase No. 12 to No. 10 AWG for 120 volt home runs exceeding 75 feet.
- B. Color code power wire and cable for feeders and branch circuits.
- C. Install all electrical conductors, including signal and communications circuits in an approved raceway.
- D. Neatly group conductors in panels, switchgear and terminal cabinets, etc., and form in a manner to fan into terminals with regular spacing. Lace formed groups of conductors with No. 12 waxed twine, or Panduit Co. Nylon Straps Numbers "SST-4-H" or "SST-2". Lace larger conductors with marlin and secure with cleats, or Panduit Co. Nylon Sta-Straps Numbers "SSC-4-H" and tie anchors ETA-1, TA-2, or TM-1-2-3.

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- E. Install U.L. approved covered wire from all lighting fixture lamp sockets into outlet or junction box.

**3.9 WIRING COLOR CODE**

- A. 208Y/120 Volt System

- Phase A - Black.
  - Phase A Switch Leg - Black with "S" tag.
  - Phase B - Red.
  - Phase B Switch Leg - Red with "S" tag.
  - Phase C - Blue.
  - Phase C - Switch Leg - Blue with "S" tag.
  - Travelers - Yellow.
  - Neutral - White.
  - Equipment Ground - Green.

- B. Provide identification tags on each conductor entering panel, switch, junction box and pull box to identify conductor.

**3.10 UNDERGROUND PULL BOXES:**

- A. Set underground pull boxes at +3" above highest adjacent grade level
- B. No splices in Fire Alarm or signal System conductors are permitted
- C. Size per NEC
- D. Provide nameplate on all covers
  - 1. "ELEC"
  - 2. "LOW VOLTAGE"

**3.11 CONDUCTOR JOINTS AND TAPING:**

- A. Make joints in conductors smaller than No. 6 AWG with solderless, tapeless, wing nut type pressure cable connector. Join conductors No. 6 AWG and larger together with approved type or pressure connector and tape to provide insulation not less than that of the conductor. Make connections to switch or bus bar with one-piece copper lugs for conductors No. 8 AWG or larger.

**3.12 GROUNDING:**

- A. Provide grounding for entire electrical installation as required by the serving utility and codes mentioned in these specifications. Including:
  - 1. Conduit.
  - 2. Neutral or identified conductor of interior wiring system.
  - 3. Power and lighting panelboards.
  - 4. Non-current carrying metal parts or fixed equipment.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Wire pulling lubricant.
- F. Cable ties.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.03 REFERENCE STANDARDS**

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2023.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

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- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- M. UL 267 - Outline of Investigation for Wire-Pulling Compounds Current Edition, Including All Revisions.
- N. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- O. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- P. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.

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**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**1.05 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

**1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

**PART 2 PRODUCTS**

**2.01 CONDUCTOR AND CABLE APPLICATIONS**

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.

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**2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS**

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductor Material:
  - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
  - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  - 3. Tinned Copper Conductors: Comply with ASTM B33.
- I. Minimum Conductor Size:
  - 1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

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- 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
    - 4) 20A exterior circuits: 10 AWG.
  - 2. Control Circuits: 14 AWG.
- J. Conductor Color Coding:
  - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  - 2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  - 3. Color Code:
    - a. 480Y/277 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Neutral/Grounded: Gray.
    - b. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - c. Equipment Ground, All Systems: Green.

**2.03 SINGLE CONDUCTOR BUILDING WIRE**

- A. Manufacturers:



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1. Copper Building Wire:
  - a. Cerro Wire LLC: [www.cerrowire.com/#sle](http://www.cerrowire.com/#sle).
  - b. Encore Wire Corporation: [www.encorewire.com/#sle](http://www.encorewire.com/#sle).
  - c. Southwire Company: [www.southwire.com/#sle](http://www.southwire.com/#sle).
  - d. Rome Wire and Cable.
  - e. Okonite Wire
  - f. Pirelli Wire and Cable
  - g. Carol Cable
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
  1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
  1. Copper Building Wire: Type THHN/THWN-2, except as indicated below.
    - a. Size 4 AWG and Larger: Type XHHW-2.
    - b. Installed Underground: Type XHHW-2.

**2.04 WIRING CONNECTORS**

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
  1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

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2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

**2.05 ACCESSORIES**

- A. Electrical Tape:
1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight;

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- suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
  3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
  4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
  5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant:
1. Listed and labeled as complying with UL 267.
  2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
  3. Suitable for use at installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.

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- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

**3.02 PREPARATION**

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

**3.03 INSTALLATION**

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated without specific routing, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
  - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
  - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

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- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
  - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- G. Install conductors with a minimum of 12 inches of slack at each outlet.
- H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- K. Make wiring connections using specified wiring connectors.

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1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  3. Do not remove conductor strands to facilitate insertion into connector.
  4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
  5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
  2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
  3. Wet Locations: Use heat shrink tubing.
- M. Insulate ends of spare conductors using vinyl insulating electrical tape.

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- N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- O. Identify conductors and cables in accordance with Section 260553.
- P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section Firestopping.
- Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

**3.04 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
- C. Correct deficiencies and replace damaged or defective conductors and cables.

**END OF SECTION**

**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

**1.03 REFERENCE STANDARDS**

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2022.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.



**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**1.04 ADMINISTRATIVE REQUIREMENTS**

**A. Coordination:**

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**B. Sequencing:**

1. Do not install ground rod electrodes until final backfill and compaction is complete.

**1.05 SUBMITTALS**

- A. Product Data:** Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- B. Field quality control test reports.**
- C. Project Record Documents:** Record actual locations of grounding electrode system components and connections.

**1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.**
- B. Manufacturer Qualifications:** Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications:** An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.**

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**PART 2 PRODUCTS**

**2.01 GROUNDING AND BONDING REQUIREMENTS**

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- F. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):

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- a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
  - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
  - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
  - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
  - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
  - a. Provide two electrodes unless otherwise indicated or required.
  - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
  - c. Provide ground access well for each electrode.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

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- a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
  - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
  - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- G. Service-Supplied System Grounding:
- 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Bonding and Equipment Grounding:
- 1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  - 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  - 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

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4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
    - c. Metal process piping.
  8. Provide bonding for interior metal air ducts.
  9. Provide bonding for metal building frame.
  10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
- I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
  2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.

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**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

- c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

**2.02 GROUNDING AND BONDING COMPONENTS**

**A. General Requirements:**

- 1. Provide products listed, classified, and labeled as suitable for the purpose intended.
- 2. Provide products listed and labeled as complying with UL 467 where applicable.

**B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:**

- 1. Use insulated copper conductors unless otherwise indicated.
  - a. Exceptions:
    - 1) Use bare copper conductors where installed underground in direct contact with earth.
    - 2) Use bare copper conductors where directly encased in concrete (not in raceway).

**C. Connectors for Grounding and Bonding:**

- 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
- 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
- 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

**D. Ground Bars:**

- 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
- 2. Size: As indicated.

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- 3. Holes for Connections: As indicated or as required for connections to be made.
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Copper-bonded (copper-clad) steel.
  - 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

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- 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

**3.03 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

**END OF SECTION**



**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

**1.02 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
  - 2. Coordinate work to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
  - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.

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**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
  - a. NFPA 70.
  - b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.

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5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
  - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
  - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
  1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
  1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
  2. Comply with MFMA-4.
  3. Channel Material:
    - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.

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- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
  - 2. New Concrete: Use preset concrete inserts.
  - 3. Existing Concrete: Use expansion anchors.
  - 4. Solid or Grout-Filled Masonry: Use expansion anchors.
  - 5. Hollow Masonry: Use toggle bolts.
  - 6. Hollow Stud Walls: Use toggle bolts.
  - 7. Steel: Use welded threaded studs complying with AWS D1.1/D1.1M with lock washers and nuts or Beam clamps (MSS Type 19 21 23 25 or 27) complying with MSS SP-69.
  - 8. Sheet Metal: Use sheet metal screws.
  - 9. Wood: Fasten with lag screws or through bolts.
  - 10. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
  - 11. Plastic and lead anchors are not permitted.
  - 12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    - b. Comply with MFMA-4.
    - c. Channel Material: Use galvanized steel.

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13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Equipment Support and Attachment:
  1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
  2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

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3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- J. Secure fasteners in accordance with manufacturer's recommended torque settings.
- K. Remove temporary supports.

**3.03 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.  
Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete or Cast-in-Place Concrete (Limited Applications)" as applicable.
- C. Anchor equipment to concrete base.
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturers written instructions.

**3.04 FIELD QUALITY CONTROL**

- A. Inspect support and attachment components for damage and defects.

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- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

**END OF SECTION**

**SECTION 26 05 33.13**  
**CONDUIT FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. PVC-coated galvanized steel rigid metal conduit (RMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Galvanized steel electrical metallic tubing (EMT).
- F. Reinforced thermosetting resin conduit (RTRC).

**1.02 REFERENCE STANDARDS**

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- F. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
- G. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.



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- J. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- K. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- L. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- M. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
  - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
  - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

**1.04 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

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- B. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

**1.05 QUALITY ASSURANCE**

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

**PART 2 PRODUCTS**

**2.01 CONDUIT APPLICATIONS**

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
  - 1. Under Slab on Grade: Use rigid PVC conduit.
  - 2. Exterior, Direct-Buried: Use rigid PVC conduit.
  - 3. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.
  - 4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use PVC-coated galvanized steel rigid metal conduit elbows for bends.
  - 5. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion

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protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

6. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
- F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
- G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).
- I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
  1. Locations subject to physical damage include, but are not limited to:
    - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
- J. Exposed, Exterior: Use galvanized steel rigid metal conduit.
- K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.
- L. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), stainless steel electrical metallic tubing (EMT), or reinforced thermosetting resin conduit (RTRC).

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- M. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- N. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
  - 1. Maximum Length: 6 feet.
- O. Flexible Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit (FMC).
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
  - 3. Maximum Length: 6 feet unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.
- P. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

**2.02 CONDUIT - GENERAL REQUIREMENTS**

- A. Comply with NFPA 70.
- B. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4-inch trade size.
  - 3. Control Circuits: 1/2-inch trade size.

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- 4. Flexible Connections to Luminaires: 3/8-inch trade size.
- 5. Underground, Exterior: 1-inch trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

**2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
  - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
  - 2. Material: Use steel or malleable iron.
  - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

**2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)**

**2.05 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)**

**2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)**

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
- C. PVC-Coated Boxes and Fittings:
  - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
  - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.

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- 4. Material: Use steel or malleable iron.
- 5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

**2.07 FLEXIBLE METAL CONDUIT (FMC)**

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.

**2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)**

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.

**2.09 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)**

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
  - 3. Connectors and Couplings: Use compression/gland.

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- a. Do not use indenter type connectors and couplings.

**2.10 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)**

**2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)**

- A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
- B. Supports: As recommended by manufacturer.
- C. Fittings: Same type and manufacturer as conduit to be connected.

**2.12 ACCESSORIES**

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbs.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

**3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

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- D. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- E. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal conduits unless specifically indicated to be exposed.
  - 4. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  - 5. Arrange conduit to maintain adequate headroom, clearances, and access.
  - 6. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
  - 7. Arrange conduit to provide no more than 150 feet between pull points.
  - 8. Route conduits above water and drain piping where possible.
  - 9. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  - 10. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  - 11. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  - 12. Group parallel conduits in same area on common rack.
- F. Conduit Support:



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1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
  8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
  9. Use of spring steel conduit clips for support of conduits is not permitted.
  10. Use of wire for support of conduits is not permitted.
- G. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.

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4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

**H. Penetrations:**

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

**I. Underground Installation:**

1. Minimum Cover, Unless Otherwise Indicated or Required:
  - a. Underground, Exterior: 18 inches.

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- b. Under Slab on Grade: 12 inches to bottom of slab.
- 2. Provide underground warning tape in accordance with Section 260553 along entire conduit length.
- J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.
- K. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
  - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  - 2. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
  - 3. Where conduits are subject to earth movement by settlement or frost.
- L. Conduit Sealing:
  - 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
  - 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
    - a. Where conduits pass from outdoors into conditioned interior spaces.
    - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- M. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

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- N. Provide grounding and bonding; see Section 260526.
- O. Identify conduits; see Section 260553.

**3.03 FIELD QUALITY CONTROL**

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

**3.04 CLEANING**

- A. Clean interior of conduits to remove moisture and foreign matter.

**3.05 PROTECTION**

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

**END OF SECTION**

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

**1.02 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:

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**BOXES FOR ELECTRICAL SYSTEMS**

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

**1.04 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for floor boxes and underground boxes/enclosures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  1. See Section 016000 - Product Requirements, for additional provisions.
  2. Keys for Lockable Enclosures: Two of each different key.

**1.05 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**PART 2 PRODUCTS**

**2.01 BOXES**

**A. General Requirements:**

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

**B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:**

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.

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8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  10. Boxes for Supporting Luminaries: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
  11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
  12. Minimum Box Size, Unless Otherwise Indicated:
    - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    - b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
  13. Wall Plates: Comply with Section 262726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA 250 Environment Type, Unless Otherwise Indicated:
  3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
  4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:



**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

- a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
- b. Back Panels: Painted steel, removable.
- c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Box Locations:
  - 1. Locate boxes to be accessible. Provide access panels in accordance with Section Access Panels as required, where approved by the Architect.
  - 2. Unless dimensioned, box locations indicated are approximate.
  - 3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
  - 4. Locate boxes so that wall plates do not span different building finishes.

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
  - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.
  - b. Within joists in areas with no ceiling.
  - c. Electrical rooms.
  - d. Mechanical equipment rooms.

**H. Box Supports:**

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
- I. Install boxes plumb and level.
- J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.
- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 260526.

**3.02 CLEANING**

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

**SECTION 26 05 33.16**  
**BOXES FOR ELECTRICAL SYSTEMS**

**3.03 PROTECTION**

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

**1.03 REFERENCE STANDARDS**

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. NFPA 70E - Standard for Electrical Safety in the Workplace 2024.
- E. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**B. Sequencing:**

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

**1.05 SUBMITTALS**

- A. **Product Data:** Provide manufacturer's standard catalog pages and data sheets for each product.
- B. **Shop Drawings:** Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

**1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

**1.07 FIELD CONDITIONS**

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

**PART 2 PRODUCTS**

**2.01 IDENTIFICATION REQUIREMENTS**

**A. Identification for Equipment:**

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
  - a. **Switchboards:**
    - 1) Identify ampere rating and name.
    - 2) Identify voltage and phase.
    - 3) Identify power source and circuit number. Include location when not within sight of equipment.
    - 4) Use identification nameplate to identify main overcurrent protective device.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- b. Panelboards:
  - 1) Identify ampere rating and name.
  - 2) Identify voltage and phase.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
  - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
  - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
  - b. Industrial control panels.
  - c. Motor control centers.
  - d. Elevator control panels.
  - e. Industrial machinery.
4. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- a. Minimum Size: 3.5 by 5 inches.
  - b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
- B. Identification for Conductors and Cables:
- 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
  - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  - 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.
    - c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
  - 4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
- C. Identification for Raceways:
- 1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
  - 2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.



**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
  4. Use underground warning tape to identify underground raceways.
- D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
  2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
  2. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
  3. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

**2.02 IDENTIFICATION NAMEPLATES AND LABELS**

- A. Identification Nameplates:
1. Materials:
    - a. Indoor Clean, Dry Locations: Use plastic nameplates.
    - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
  2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

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**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
  3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
  4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
  5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
  2. Legend:
    - a. Equipment designation or other approved description.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height:
    - a. Equipment Designation: 1/2 inch.
    - b. Other Information: 1/4 inch.
  5. Color:
    - a. Normal Power System: White text on black background.
- D. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
  2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
  3. Text: All capitalized unless otherwise indicated.

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**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

4. Minimum Text Height: 1/2 inch.
  5. Color: Black text on yellow background unless otherwise indicated.
- E. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Power source and circuit number or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.
- F. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
  2. Legend: Load controlled or other designation indicated.
  3. Text: All capitalized unless otherwise indicated.
  4. Minimum Text Height: 3/16 inch.
  5. Color: Black text on clear background.

**2.03 WIRE AND CABLE MARKERS**

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**2.04 VOLTAGE MARKERS**

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- C. Minimum Size:
  - 1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
  - 2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  - 3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- D. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
- E. Color: Black text on orange background unless otherwise indicated.

**2.05 UNDERGROUND WARNING TAPE**

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

**2.06 WARNING SIGNS AND LABELS**

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials: Anodized Aluminum Nameplates; minimum thickness of 1/32 inch; engraved or laser-etched text. Durable, corrosion resistant; in compliance with ANSI Z535.
  - 2. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:

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**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

**3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
  1. Surface-Mounted Equipment: Enclosure front.
  2. Flush-Mounted Equipment: Inside of equipment door.
  3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  4. Elevated Equipment: Legible from the floor or working platform.
  5. Branch Devices: Adjacent to device.
  6. Interior Components: Legible from the point of access.
  7. Conduits: Legible from the floor.
  8. Boxes: Outside face of cover.
  9. Conductors and Cables: Legible from the point of access.
  10. Devices: Outside face of cover.

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Mark all handwritten text, where permitted, to be neat and legible.

**3.03 FIELD QUALITY CONTROL**

- A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

**END OF SECTION**

## **SECTION 26 24 16**

### **PANELBOARDS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

##### **1.03 REFERENCE STANDARDS**

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less 2023.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

## **SECTION 26 24 16**

### **PANELBOARDS**

- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### **1.05 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes,



## **SECTION 26 24 16**

### **PANELBOARDS**

short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

- C. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. Panelboard Keys: Two of each different key.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. ABB/GE: [www.electrification.us.abb.com/#sle](http://www.electrification.us.abb.com/#sle).

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### **PANELBOARDS**

- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

#### **2.02 PANELBOARDS - GENERAL REQUIREMENTS**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

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### **PANELBOARDS**

- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- J. Load centers are not acceptable.

#### **2.03 POWER DISTRIBUTION PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

## **SECTION 26 24 16**

### **PANELBOARDS**

2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  1. Phase and Neutral Bus Material: Copper.
  2. Ground Bus Material: Copper.
- D. Circuit Breakers:
  1. Provide bolt-on type.
  2. Provide thermal magnetic circuit breakers for circuit breaker frame sizes less than 225 amperes.
  3. Provide electronic trip circuit breakers for circuit breaker frame sizes 225 amperes and above.
- E. Enclosures:
  1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.

#### **2.04 LIGHTING AND APPLIANCE PANELBOARDS**

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:

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### **PANELBOARDS**

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  2. Phase and Neutral Bus Material: Copper.
  3. Ground Bus Material: Copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
  2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
  3. Provide clear plastic circuit directory holder mounted on inside of door.

## **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      - 2) 14,000 rms symmetrical amperes at 480 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

## **SECTION 26 24 16**

### **PANELBOARDS**

3. Conductor Terminations:
  - a. Provide mechanical lugs unless otherwise indicated.
  - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
  - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
8. Do not use tandem circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.

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### **PANELBOARDS**

- D. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Provide filler plates to cover unused spaces in panelboards.

#### **3.03 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than \_\_\_\_\_ amperes. Tests listed as optional are not required.

**SECTION 26 24 16**  
**PANELBOARDS**

- C. Test GFCI circuit breakers to verify proper operation.
- D. Test shunt trips to verify proper operation.
- E. Correct deficiencies and replace damaged or defective panelboards or associated components.

**3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

**3.05 CLEANING**

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**



## **SECTION 26 28 13**

### **FUSES**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Fuses.

##### **1.02 REFERENCE STANDARDS**

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses Current Edition, Including All Revisions.

##### **1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

##### **1.04 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

##### **1.05 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

## **SECTION 26 28 13**

### **FUSES**

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Bussmann, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
- B. Littelfuse, Inc: [www.littelfuse.com](http://www.littelfuse.com).
- C. Mersen: [ep-us.mersen.com](http://ep-us.mersen.com).

### **2.02 APPLICATIONS**

- A. Individual Motor Branch Circuits: Class RK1, time-delay.

### **2.03 FUSES**

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

### **3.02 INSTALLATION**

Torrance Transit System

1<sup>st</sup> and 2<sup>nd</sup> Floor Renovation

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## **SECTION 26 28 13**

### **FUSES**

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

**END OF SECTION**

**SECTION 26 28 16.16**  
**ENCLOSED SWITCHES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Enclosed safety switches.

**1.02 RELATED REQUIREMENTS**

- A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 28 13 - Fuses.

**1.03 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:

## **SECTION 26 28 16.16 ENCLOSED SWITCHES**

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

### **1.05 SUBMITTALS**

- A. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
- C. Project Record Documents: Record actual locations of enclosed switches.

### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

**SECTION 26 28 16.16**  
**ENCLOSED SWITCHES**

- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. ABB/GE: [www.geindustrial.com/#sle](http://www.geindustrial.com/#sle).
- B. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

**2.02 ENCLOSED SAFETY SWITCHES**

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

**SECTION 26 28 16.16**  
**ENCLOSED SWITCHES**

2. Minimum Ratings:
  - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
  1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
  1. Comply with NEMA KS 1.
  2. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

## **SECTION 26 28 16.16 ENCLOSED SWITCHES**

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

#### **3.03 FIELD QUALITY CONTROL**

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- C. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.



**SECTION 26 28 16.16**  
**ENCLOSED SWITCHES**

**3.04 ADJUSTING**

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

**3.05 CLEANING**

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

**END OF SECTION**

**SECTION 26 05 13**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Basic electrical methods.
  - 2. Grounding.
  - 3. Hangers and support.
  - 4. Electrical identification.
  - 5. Electrical system testing and inspection.
- B. Related Documents: The Contract Documents, as defined in Section 01 0110 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

**1.2 BASIC ELECTRICAL METHODS**

- A. Drawings are schematic and diagrammatic. Use judgment and care to install electrical Work to function properly and fit within building construction and finishes. Electrical conductors, conduit, components, not shown or specified, which are required for any device or system to produce a complete and operative system are required to be furnished and installed.
- B. Exact locations of fixtures are determined from dimension on Drawings, manufacturer's shop drawings, or as may be determined at Project Site. Do not scale Drawings for exact location of any item. Verify item mounting heights as required by project conditions prior to rough-in.
- C. Surface mounted raceways or conduit permitted only at locations directed by.
- D. Circuit grouping, conduit or cable runs and home runs with number of conductors required by code in each raceway to clarify operation and function of various systems. Provide proper number of conductors and conduits or cables to provide operative system as indicated on Contract Documents. Do not regroup any feeder circuits, branch circuits, home runs, and zone alarms at any point, from that shown on Contract Documents.
- E. Do not connect two ungrounded conductors to same circuit breaker/fused switch in any panel. Circuit runs consist of a maximum of five conductors; 3 phase conductors, 1 neutral conductor, and 1 equipment ground conductor, unless otherwise noted. Do not splice branch circuit conductors in any panels, safety switches, or non-automatic circuit breakers in separate enclosures.

**SECTION 26 05 13**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

- F. Seal and make permanent watertight penetrations by electrical raceways or equipment through ceilings, walls, or floors.
  - 1. Seal penetrations in non-fire rated ceilings, walls or floors material specified in Section 07 9200 - Sealants.
- G. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A, and NFPA 70.
- H. Install equipment and materials to provide required maintenance and code working clearance for servicing and maintenance. Coordinate final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow required space for removal of parts that require replacement or servicing.
- I. Remove existing equipment, lighting fixtures, switches, and receptacles as required to facilitate new installation. Remove existing wiring and conduit serving items to be removed. Conduit in inaccessible areas shall be cut off below finished surfaces and existing surface patched to match existing. Provide blank plates on existing flush mounted outlet boxes that will be abandoned. Remove all abandoned conductors from raceways.

**PART 2 - PRODUCTS**

**2.1 GROUNDING**

- A. Wire:
  - 1. Material: Stranded copper.
  - 2. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

**2.2 HANGERS AND SUPPORTS**

- A. Product Requirements: Furnish and install approved materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and conduit, including weight of wire in conduit plus 300 pounds.
- B. Materials and Finishes: Corrosion resistive.

**SECTION 26 05 13**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

- C. Anchors and Fasteners:
  - 1. Steel Structural Elements: Beam clamps and welded fasteners.
  - 2. Concrete Surfaces: Self-drilling anchors and expansion anchors.
  - 3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
  - 4. Solid Masonry Walls: Expansion anchors.
  - 5. Sheet Metal: Sheet metal screws.
  - 6. Wood: Wood screws.

**2.3 ELECTRICAL IDENTIFICATION**

- A. Wire and Cable Markers:
  - 1. Description: Cloth tape or tubing type wire markers.
  - 2. Locations: Each conductor at panel board gutters, pull boxes, outlet and junction boxes, and each load connection.
  - 3. Legend:
    - a. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.

**PART 3 - EXECUTION**

**3.1 INSTALLATION - GROUNDING**

- A. Provide grounding in conformance with NFPA 70.
- B. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- C. Testing and Inspection:
  - 1. Inspect and test in accordance with NETA ATS, except Section 4.
  - 2. Perform inspections and tests listed in NETA ATS, Section 7.13.

**3.2 INSTALLATION - HANGERS AND SUPPORTS**

- A. Install products in accordance with manufacturer's published instructions.
- B. Furnish and install anchors, fasteners, and supports in accordance with NECA SI.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Do not use spring steel clips and clamps.

**SECTION 26 05 13**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

- E. Do not use powder-actuated anchors.
  - F. Obtain permission from City Engineer before drilling or cutting structural members.
- 3.3 **INSTALLATION:** Installation of materials and equipment shall be in strict accordance with manufacturer's recommendations, instructions, industry standards, as indicated on the drawings and as specified herein. Provide all mounting facilities for securing or hanging fixtures, equipment, and outlets to the satisfaction of the Engineer. Details shown on the plans are for the purpose of establishing the extent and general methods required. Provide all sleeves, inserts, expansion joints, vibration fitting, etc. Provide storage facilities and protect all work, materials and equipment from damage during process of work. Materials and equipment shall not be stored exposed to weather. Replace all damaged or defective work, materials, and equipment without additional cost to the Owner.
- 3.4 **CONDUIT AND WIRING:** All conduit and wiring shall be installed concealed in walls, above ceilings and below floor slabs or exposed in accordance with applicable regulations and the Electrical Drawings. All penetrations of fire-rated walls or ceilings to be coordinated with Owner. Conduit runs are shown diagrammatically. Exact routing and location of the equipment to be determined in the field.
- 3.5 **MOISTURE PROTECTION:** Where required by regulations, all electrical devices in the spray radius of sprinklers shall be installed with weatherproof enclosures in compliance with these regulations.
- 3.6 **FIELD QUALITY CONTROL - ELECTRICAL TESTING AND INSPECTION**
- A. Section 01 4000 - Quality Control: Field testing and inspection.
  - B. Regulatory Requirements:
    - 1. Safety Practices: Include, but not limited to, the following requirements:
      - a. Occupational Safety and Health Act of 1970 - OSHA.
      - b. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
      - c. Applicable State and Local Safety Operating Procedures.
      - d. NETA Safety/Accident Prevention Program.
      - e. NFPA 70E - Electrical Safety Requirements for Employee Workplace.
      - f. American National Standards for Personnel Protection, ANSI Z244.1.
    - 2. Perform tests with apparatus de-energized except where otherwise specifically required herein.

**SECTION 26 05 13**  
**BASIC ELECTRICAL MATERIALS AND METHODS**

3. Power Circuits: Conductors shorted to ground by a hot line grounded device approved for the purpose.
- C. Tests and inspections include, but are not limited to the following:
1. Proper operation of lights and equipment.
  2. Continuity of raceway system.
  3. Insulation leakage and impedances.
  4. Sub-system tests indicated in other Sections.

**END OF SECTION**

**SECTION 26 05 19**  
**LOW-VOLTAGE WIRES (600 VOLT AC)**

**PART 1 – GENERAL**

**1.1 SUMMARY**

- A. Provisions of Division 01 apply to this section.
- B. Section Includes: Low-voltage wire, splices, terminations, and installation.

**1.2 SUBMITTALS**

- A. Provide in accordance with Division 01.

**PART 2 - PRODUCTS**

**2.1 WIRES**

- A. Wires shall be single conductor type THHN or THWN insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, and 75 degrees C. in wet locations and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN, or THHN.
- B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

**2.2 STANDARDS**

- A. THWN/THHN wires shall comply with the following standards:
  - 1. UL 83 for thermoplastic insulated wires.
  - 2. UL 1063 for machine tool wires and cables.

**PART 3 – EXECUTION**

**3.1 INSTALLATION**

- A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at site shall be protected from physical damage until they are installed, and walls are completed.

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- B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values
- C. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.
- D. At outlets for light, power, and signal equipment, pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.
- E. Pressure cable connectors, pre-insulated 3M Scotchlok, Hubbell Power, O-Z/Gedney or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems; except public address and telephone systems.
- F. Joints, splices, taps, and connections to switchboard neutral, bonding, or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V, and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.
- G. Connections to any bussing and high-pressure cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.
- H. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.
- I. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.
- J. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.
- K. Maintain the conductor required bending radius.



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**LOW-VOLTAGE WIRES (600 VOLT AC)**

- L. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.
- M. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, LED drivers and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.
  - 1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.
    - a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).
    - b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.
    - c. Test reports shall include the following:
      - 1) Identification of the testing organization.
      - 2) Equipment identification.
      - 3) Ambient conditions.
      - 4) Identification of the testing technician.
      - 5) Summary of project.
      - 6) Description of equipment being tested.
      - 7) Description of tests.
      - 8) Test results.
      - 9) Analysis, interpretation, and recommendations.
  - 2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.
    - a. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.

**SECTION 26 05 19**  
**LOW-VOLTAGE WIRES (600 VOLT AC)**

3. Tests shall be performed in the presence of the Project Inspector.
4. Insulation resistance shall not be less than 100 mega-ohms.

**3.2 COLOR CODES**

- A. General Wiring: Color code conductor insulation as follows:

| SYSTEM VOLTAGE |          |              |
|----------------|----------|--------------|
| Conductor      | 208Y/120 | 480Y/277     |
| Phase A        | Black    | Brown        |
| Phase B        | Red      | Orange       |
| Phase C        | Blue     | Yellow       |
| Neutral        | White    | Natural Gray |

1. Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.
2. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

**3.3 FEEDER IDENTIFICATION**

- A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

**3.4 TAPE AND SPLICE KITS**

- A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for

**SECTION 26 05 19**  
**LOW-VOLTAGE WIRES (600 VOLT AC)**

installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

**3.5 PROTECTION**

- A. Protect the Work of this section until Substantial Completion.

**3.6 CLEANUP**

- A. Remove rubbish, debris and waste materials and legally dispose of them off the Project site.

**END OF SECTION**

## **SECTION 26 27 26 WIRING DEVICE DETAILS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Wall switches.
  - 2. Dimmers
  - 3. Receptacles.
  - 4. Device plates and box covers.
- B. Related Documents: The Contract Documents, as defined in Section 01 10 00 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.
- C. Related Sections:
  - 1. As specified in Section 26 0500 - Common Work Results for Electrical.
  - 2. Section 26 0533.16 - Boxes for Electrical Systems.
  - 3. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

#### **1.2 REFERENCES**

- A. As specified in Section 26 0500 - Common Work Results for Electrical.
- B. National Electrical Manufacturers Association (NEMA):
  - 1. NEMA WD 1 - General Requirements for Wiring Devices.
  - 2. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
  - 3. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
  - 4. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification) 2014g, with Amendment (2017).
  - 5. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
  - 6. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
  - 7. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
  - 8. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
  - 9. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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### **WIRING DEVICE DETAILS**

10. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
11. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
12. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

#### **1.3 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination
  1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others
  2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
  1. Do not install wiring devices until final surface finishes and painting are complete.

#### **1.4 SUBMITTALS**

- A. As specified in Section 26 0500 - Common Work Results for Electrical.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations

#### **1.5 QUALITY ASSURANCE**

- A. As specified in Section 26 0500 - Common Work Results for Electrical.
- B. Qualifications:
  1. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.
- C. Comply with requirements of NFPA 70.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.

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**WIRING DEVICE DETAILS**

**PART 2 - PRODUCTS**

**2.1 WIRING DEVICE APPLICATIONS**

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.

**2.2 WIRING DEVICE FINISH**

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.

**2.3 WALL SWITCHES**

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:

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1. Hubbell, Inc.
  2. Leviton Manufacturing, Company, Inc.
  3. Pass & Seymour.
  4. Division 1 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings
- C. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- D. Single Pole Switch:
1. Leviton Cat. No.1221-2.
  2. P&S Cat. No. PS20AC1I.
  3. Hubbell Cat. No. HBL1221.
- E. Color: White unless indicated otherwise.

**2.4 DIMMER SWITCHES**

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. Hubbell, Inc.
  2. Leviton Manufacturing, Company, Inc.
  3. Pass & Seymour.
  4. Division 1 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Provide 20 Amp, 120/277V, 0-10V dimming, specification grade, flush, slide adjustor with single pole toggle switch with side and back wired screw terminals. All dimmers shall be equipped with grounding screws.
- C. Dimmers:
1. Leviton.
  2. P&S.
  3. Hubbell.

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- D. Color: White unless indicated otherwise

**2.5 RECEPTACLES**

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. Leviton Manufacturing, Company, Inc.
  2. Pass & Seymour.
  3. Hubbell, Inc.
  4. Lutron Electronics Company, Inc; Designer Style: [www.lutron.com/#sle](http://www.lutron.com/#sle)
  5. Division 1 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  2. NEMA configurations specified are according to NEMA WD 6.
- C. Provide duplex, specification grade, 20 Amp, 120 Volt, 1 pole, 3 wire receptacles with grounding screw.
- D. Duplex Convenience Receptacle:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
  3. Leviton Cat. No. 5362
  4. P&S Cat. No. 5362.
  5. Hubbell Cat. No. HBL5352.
- E. GFCI Receptacle (Side Wired Feed-Thru):
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.



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2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Leviton Cat. No. 6599
5. P&S Cat. No. 2091-SHG.
6. Hubbell Cat. No. HBLGF5362.

F. Color: White unless indicated otherwise.

### 2.6 WALL PLATES

- A. Manufacturers: Subject to compliance with project requirements, manufacturers offering specified items which may be incorporated in the Work include the following:
1. P&S Sierra.
  2. Hubbell.
  3. Leviton.
  4. Division 1 - Product Requirements: Product options and substitutions. Substitutions: Permitted.
- B. Cover Plate: Stainless steel
- C. Weatherproof Cover Plate: Gasketed lockable cast metal with hinged gasketed device, listed as weather proof while in use.
1. Red Dot cast aluminum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. As specified in Section 26 0500 - Common Work Results for Electrical.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates, and conditions are as required, and ready to receive Work.
1. Verify that outlet boxes are installed at proper height.
  2. Verify that wall openings are neatly cut and will be completely covered by wall plates.
  3. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
  4. Verify that final surface finishes are complete, including painting.

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**WIRING DEVICE DETAILS**

5. Verify that conditions are satisfactory for installation prior to starting work

**3.2 PREPARATION**

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris, plaster, and other foreign materials from outlet boxes .

**3.3 INSTALLATION**

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated."
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section
  1. Mounting Heights: Unless otherwise indicated, as follows.
    - a. Wall Switches: 48 inches above finished floor
    - b. Receptacles: 18 inches above finished floor or 6 inches above counter
  2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
  5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install devices plumb and level.
- D. Install switches with OFF position down.
- E. Install receptacles with grounding pole on bottom.
- F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

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### **WIRING DEVICE DETAILS**

- G. Connect wiring devices by wrapping conductor 2/3 of screw diameter in clockwise direction around screw terminal. Tighten screw to 12 pound-inches. Do not use spring pressure devices for wire connections.
- H. Install cover plates on switch, receptacle, and blank outlets.
- I. Install wiring devices in accordance with manufacturer's instructions.
- J. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- K. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- L. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- M. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- N. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- O. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- P. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- Q. Install wall switches with OFF position down.
- R. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- S. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- T. Identify wiring devices in accordance with Section 260553.

#### **3.4 CONSTRUCTION**

- A. Interface with other work:

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1. Coordinate locations of outlet boxes provided under Division 26 to obtain mounting heights indicated on Drawings.

**3.5 FIELD QUALITY CONTROL**

- A. As specified in Section 26 0500 – Common Work Results for Electrical.
- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify that each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

**3.6 ADJUSTING**

- A. Adjust devices and wall plates to be flush, level, and plumb with wall.

**3.7 CLEANING**

- A. Division 1 - Execution: Cleaning installed work.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

**END OF SECTION**

## **SECTION 26 50 00 LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Interior and exterior luminaires and accessories.
  - 2. Drivers.
- B. Substitutions:
  - 1. Or approved equal if permitted in Division 1 - Product Requirements: Product options and substitutions.
- C. Related Documents: The Contract Documents, as defined in Division 1 - Summary of Work, apply to the work of this section. Additional requirements and information necessary to complete the work of this section may be found in other documents.
- D. Related Sections:
  - 1. Section 26 0500 – Electrical.

#### **1.2 REFERENCES**

- A. As specified in Section 26 0500 - Electrical.

#### **1.3 SUBMITTALS**

- A. Division 1 - Submittal Procedures: Procedures for submittals.
- B. As specified in Section 26 0500 – Electrical.
  - 1. Product Data: Provide dimensions, ratings, and performance data for each fixture specified.
  - 2. Assurance/Control Submittals:
    - a. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
- C. Division 1 - Closeout Procedures and Training: Procedures for closeout submittals:
  - 1. Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each type of fixture.

#### **1.4 MOUNTING REQUIREMENTS**

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- A. Design of lighting fixtures, accessories, supports, and method of fixture installation shall comply with requirements for earthquake-resistant construction of the State of California.
- B. Provide suspension points at no more than two feet from fixture ends. The space between supports shall not exceed eight feet.

### **1.5 QUALITY ASSURANCE**

- A. As specified in Section 26 0500 - Electrical.

### **1.6 WARRANTY**

- A. Provide a two-year labor warranty.
- B. Special Warranty for LEDs and Drivers: Manufacturers standard form in which manufacturer of LED's and drivers agrees to replace components that fail in materials or workmanship within specified warranty period.
  - 1. LED arrays: 10 years from date of Beneficial Occupancy.
  - 2. Drivers: 10 years from date of Beneficial Occupancy.

### **1.7 MAINTENANCE**

- A. Division 1 - Closeout Procedures and Training: Procedures for closeout submittals.

## **PART 2 - PRODUCTS**

### **2.1 LED LUMINAIRES**

- A. General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules. Furnish and install LED light fixture with permanently-fixed LED lamp module, complete with dedicated LED drivers and required mounting hardware. Prior to ordering fixtures, verify mounting methods and finishes.
- B. Luminaires to be provided under this scope include the following:
  - 1. H.E. Williams 2'x4' Lay-in Troffer LED Light ATS-24-L40/835-D
  - 2. Alcon Lighting 8' Linear Suspended Mount LED Light 12100-40-P
  - 3. Alcon Lighting 6' Linear Surface Mount LED Light 12100-40-S
  - 4. Alcon Lighting 4' Linear Recessed Mount LED Light 12100-40-R
  - 5. Alcon Lighting 4' Linear Surface Mount LED Light 12100-40-S
  - 6. Alcon Lighting 6" Round Recessed Downlight LED Light 14008-6-R
- C. Material and specifications for each luminaire are as follows:

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1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
2. Each luminaire shall be rated for a minimum operational life of 50,000 hours at an average operating time of 12.0 hours per day. This life rating must be conducted at 40°C ambient temperature.
3. The rated operating temperature range shall be -30°C to +40°C.
4. Each luminaire can operate above 100°F [37°C], but not expected to comply with photometric requirements at elevated temperatures.
5. Photometry must be compliant with IESNA LM-79 and shall be conducted at 25°C ambient temperature.
6. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
7. Luminaire shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
8. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. As specified in Section 26 0500 - Electrical.

#### **3.2 INSTALLATION**

- A. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- B. Install surface mounted luminaires and exit luminaire signs plumb and adjust to align with building lines and with each other. Secure to prevent movement. Mount exit signs to outlet box mounted flush in wall or ceilings. Outlet box for ceiling mounted exit signs: Connect to rigid conduit system.
- C. Install recessed luminaires to permit removal from below.
- D. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating. In fire rated ceilings recessed luminaires must carry 1-hour UL fire rating classification.
- E. Install suspended luminaires using mounting accessories and at height as identified on Architectural Plans.
- F. Install earthquake clips to secure recessed grid-supported luminaires in place.
- G. Install wall mounted luminaires and exit luminaire signs at height as scheduled.

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- H. Install accessories furnished with each luminaire.
- I. Bond products and metal accessories to branch circuit equipment grounding conductor.

### **3.3 FIELD QUALITY CONTROL**

- A. As specified in Section 26 0500 - Electrical.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### **3.4 ADJUSTING**

- A. Aim and adjust luminaires as directed by the Engineer

### **3.5 CLEANING**

- A. Conform to Division 1 - Execution: Cleaning installed work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by the manufacturer.
- E. Clean finishes and touch up damage.

Payment for items of work identified in Division 26 as identified in the plans and these specifications shall be based on the unit bid pricing for items of work identified as Electrical on the Bid Schedule.

**END OF SECTION**