



OXNARD COLLEGE

4000 S. Rose Ave., Oxnard, CA 93033

# Oxnard College LA Building STEM Classroom Alterations Project Manual

Date: 12/14/2023

DSA File No.: 56-C1  
DSA Application No.: 03-123842

RRM Design Group  
422 East Main St.  
Ventura, CA 93001



RRM Project No.: 3104-01-ED23

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OXNARD COLLEGE

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LA Building Classroom Alterations

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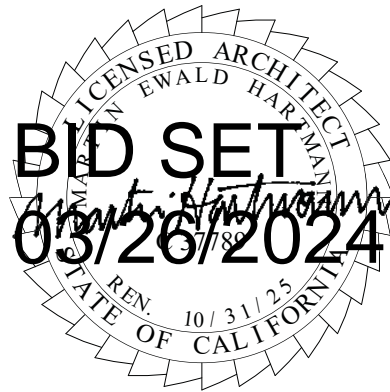
DSA Application Number: 03-123842

**Date:** December 14, 2023  
**Owner:** Ventura County Community College District  
761 East Daily Drive, Suite 200  
Camarillo, CA 93010

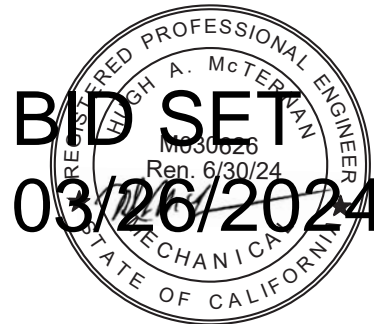
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**Section 01 1000**

**Summary**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: Oxnard College STEM Classroom Alteration
- B. District's Name: Ventura County Community College District
- C. Architect's Name: RRM Design Group.
- D. The Project consists of the construction of electrical, mechanical, and plumbing alterations to support a STEM vocational classroom. Features include a new heat removal hood, rooftop exhaust fan, suspended slot channel ceiling grid supporting electrical power cord reels, and replacement of an existing sink and cabinet. The work also includes anchorage of instructional equipment that is not part of the architecture or building systems..

**1.02 CONTRACT DESCRIPTION**

- A. Contract Type: A single prime contract based on a Stipulated Price under a Competitively Bid Public Contract.

**1.03 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of alterations work is indicated on drawings.
- B. Plumbing: Replace existing sink with accessible fixture. Replace existing drinking fountain along POT with new hi-lo fixture.
- C. HVAC: Add Type II exhaust hood and rooftop exhaust fan for odor removal. Add outside air intake vents and ductwork to compensate for hood exhaust intake..
- D. Electrical Power and Lighting: Add electrical receptacles around classroom walls. Add overhead power receptacle reels..
- E. Fire Alarm: No changes to fire alarm system.

**1.04 OWNER OCCUPANCY**

- A. District intends to continue to occupy buildings and site facilities adjacent to the Project site during the entire construction period.
- B. District intends to occupy the Project by the date stated in the Agreement as the contract completion date.
- C. Cooperate with District to minimize conflict and to facilitate District's operations.

- D. Schedule the Work to accommodate District occupancy.

### **1.05 CONTRACTOR USE OF SITE AND PREMISES**

- A. Arrange use of site and premises to allow:
1. Owner occupancy and access to areas adjacent to Project site..
- B. Provide access to and from site as required by law and by District:
1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Time Restrictions:
1. Limit conduct of especially noisy exterior work during the hours of instruction.
    - a. Instruction hours: Monday thru Friday 8:50am to 3:00pm .
  2. Limit delivery of materials during times of peak traffic on site as follows:
    - a. Drop-off Monday: 9:25am to 9:45am.
    - b. Drop-off Tuesday thru Friday: 8:35am to 8:55am
    - c. Pick up Monday thru Friday: 2:45pm to 3:10pm
- D. Utility Outages and Shutdown:
1. There shall be no disruption of utility services during hours of Instruction without notification to and prior authorization by District.
  2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to District and authorities having jurisdiction.
  3. Limit shutdown of utility services to non-instruction hours and at a time, arranged at least 24 hours in advance with District.
  4. Prevent accidental disruption of utility services to other facilities.
- E. Refer to 01 5000 Construction Facilities and Temporary Controls for additional information.

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

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**Section 01 3300**

**Submittals**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. To ensure that specified products are furnished and installed in accordance with plans and specifications, transmittal procedures have been established for submittals for review by the Construction Manager, the Architect, and the Owner.
- B. Make all following submittals in strict accord with provisions of this Section and with requirements of the General Conditions:
  - 1. Progress Schedule.
  - 2. Schedule of Values
  - 3. Safety Plan
  - 4. Certificates
  - 5. Shop Drawings.
  - 6. Descriptive Data/Material Lists.
  - 7. Samples.
  - 8. Test Reports
  - 9. Alternatives (Substitutions).
  - 10. Project Record Documents
- C. Electronic Data Transfer Agreement

**1.02 RELATED REQUIREMENTS**

- A. General Conditions.
- B. Section 01 3216 - Construction Progress Schedule
- C. Section 01 7700 - Contract Closeout:
- D. Test Reports: Pertinent Specification Sections.
- E. Test Reports: Pertinent Specification Sections.

**PART 2 - PRODUCTS**

**2.01 PROGRESS SCHEDULE**

- A. Prepare and submit progress schedule of procurement and fabrication activities, and component deliveries as required by Section 01 3216 and within the time of completion identified in Notice to Bidders.

## **2.02 SHOP DRAWINGS**

- A. Submittals shall be in electronic format (PDF) and include name and location of project, name of Contractor, and contract numbers and cross references to contract documents. Number shop drawings consecutively. Make drawings legible and complete in every respect. Refer to General Conditions.
- B. If shop drawings show variations from Contract requirements because of standard shop practice or other reason, make specific mention of such variations in letter of transmittal, as well as on drawings, in order that (if acceptable) suitable action may be taken for proper adjustment of Contract. Unless specific changes have been noted and accepted, no deviations from Contract Documents will be permitted.

## **2.03 PRODUCT DATA/MATERIAL LISTS**

- A. Manufacturer's Standard Schematic Drawings:
  - 1. Modify drawings to delete information, which is not applicable to Project.
  - 2. Supplement standard information to provide additional information applicable to Project.
- B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:
  - 1. Clearly mark each copy to identify pertinent materials, products, or models.
  - 2. Show dimensions and clearances required.
  - 3. Show performance characteristics and capacities.
  - 4. Show wiring diagrams and controls.
  - 5. Include calculations when applicable.
- C. Electronic submittal of product data in pdf format, unsecured, is acceptable.

## **2.04 SAMPLES**

- A. Where required by the specifications and by change orders, the Contractor shall provide at no additional cost:
  - 1. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.
  - 2. Where size of samples is not specified, office samples should be of sufficient size and quantity to clearly illustrate:
    - a. Functional characteristics of product or material, with integrally related parts and attachment devices.
      - 1) After review, samples may be used in construction of project.

## **PART 3 - EXECUTION**

### **3.01 SUBMISSION REQUIREMENTS**

- A. Schedule submissions at least four weeks before dates reviewed submittals will be needed. Some submissions may be required to be submitted even earlier.



- B. Identification: Identify all submittals with names and location of project, name of Contractor and contract numbers.
1. Submittals shall be accompanied by letter of transmittal addressed to Construction Manager following format and procedures established at the Preconstruction Conference.
  2. Each submittal shall be numbered by product 2-digit Specification Division and 4-digit Specification Section number and shall contain list of items submitted, properly identified as to drawing and/or page numbers.
  3. Digital submittals more than 10 pages in length shall be bookmarked or tabbed by each product component included for review in the submission for ease of reference.
  4. Submittals not adequately identified and bookmarked will be returned to Contractor for correction and resubmittal.
- C. Architect will review submittals for conformance with Contract Documents and acceptance by Architect covers only such conformance. Responsibility for accuracy and correction and resubmittal shall be the Contractor's.
- D. Acceptance of submittals will be general and shall not relieve Contractor from responsibility for proper fitting and construction of work, nor from furnishing materials and work required by Contract, which may not be indicated on submittals.
- E. No portion of work requiring submittals that affect the construction shall be commenced until submittal has been reviewed and accepted by Architect. All such portions of work shall be in accordance with accepted submittals.
- F. Number of copies required by Architect: Electronic PDF's are acceptable and preferred in lieu of hard copies. Only provide hard copies as follows if information is unable to be digitized.
1. Schedule of Values: Two (2) copies AIA form G107 with back up sheets.
  2. Certification: Three (3) copies
  3. Samples: As specifically indicated in pertinent Specification Section.
  4. Samples for Color/Pattern Selection. Three (3) sets of manufacturer's complete range for initial selection: and additional samples as requested of selected color/pattern for inclusion in final color schedule.
  5. Alternatives: Three (3) copies of all required related data and information.

**3.02 SUBMITTALS SHALL INCLUDE (WHERE APPLICABLE):**

- A. Date and revision dates.
1. Project title and work order number.
  2. Names of Contractor, subcontractor and supplier or manufacturer.
  3. Identification of product or material.
  4. Relation to adjacent structure or material.
  5. Field dimensions, clearly identified as such.
  6. Specification Section number.
  7. Consecutive submittal number.
  8. Blank space for Architect's stamp and approving agency as required.
  9. Contractor's stamp, initialed or signed, certifying review of submittal, verification of field measurements and compliance with Contract Documents.

**END OF SECTION**

**Section 01 4000  
Quality Control**

**PART 1 - GENERAL**

**1.01 DEFINITIONS**

- A. Soils Engineer and Testing Laboratory: The District will retain a qualified soils engineer and testing laboratory to perform tests and report on work as specified in the contract documents, and as otherwise required.
- B. Testing Agency: An organization other than the testing laboratory, retained and paid by the District to perform tests and report on whether or not designated items of work comply with the requirements of the contract documents.

**1.02 TESTS**

- A. The District will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the District's representative and not by the Contractor.
- B. The Contractor shall notify the District's representative a sufficient time in advance of the manufacture of material to be supplied by him under the contract documents, which must by terms of the Contract be tested, in order that the District may arrange for the testing of same at the source of supply.
- C. Any material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.
- D. The District will select and pay testing laboratory costs for all tests and inspections, but may be reimbursed by the Contractor for such costs under the contract documents.

**1.03 TESTING LABORATORY**

- A. General: Services of a testing laboratory are required for work specified in various individual specification Sections.
- B. Contractor Responsibilities:
  - 1. Contractor shall cooperate with testing laboratory personnel.
  - 2. Furnish copies of product test reports as specified.
  - 3. Furnish incidental labor and facilities:
    - a. To provide access to work to be tested
    - b. To obtain and handle samples at the project site or at the source of the product to be tested as requested by the testing lab
    - c. To facilitate inspections and tests

- d. To facilitate storage and curing of test samples
- e. To fabricate testing samples as indicated

#### **1.04 TEST REPORTS**

- A. The testing laboratory will distribute reports as follows:
  - 1. Construction Manager (1 copy)
  - 2. Architect (1 copy)
  - 3. Applicable Consultants (1 copy each)
  - 4. State Agencies as appropriate
  - 5. District's Project Inspector
- B. The Owner shall distribute reports in the same manner and number as for the testing laboratory.

#### **1.05 RETESTING**

- A. The District Representative shall have the right to order additional tests as instructed if he has reasonable doubt that materials comply with Specification requirements.
  - 1. If additional tests establish that materials comply with Specification requirements, costs for such tests will be paid by the District.
  - 2. If additional tests establish that materials do not comply with Specification requirements, costs for such retests shall be paid by the Contractor.

#### **1.06 INSPECTION BY THE DISTRICT**

- A. The District and Architect shall, at all times, have access for the purpose of inspection to all parts of the work and to the shops wherein the work is in preparation, and the Contractor shall at all times maintain proper facilities and provide safe access for such inspection.
- B. The District and Architect shall have the right to reject materials and quality of work, which are defective, or to require their correction. Rejected work quality shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the District. If the Contractor does not correct such rejected work within a reasonable time, fixed by written notice, the District may correct same and charge the expense to the Contractor.
- C. Should it be considered necessary or advisable by the District or Architect, at any time before final acceptance of the entire work to make an examination of the work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any respect due to the fault of the Contractor or his subcontractor, he shall defray all expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the Contract, the additional cost of labor and material necessarily involved in the examination and replacement shall be allowed the Contractor.

### **1.07 PROJECT INSPECTOR - DISTRICT'S**

- A. A Project Inspector retained by the District in accordance with the requirements of the California Code of Regulations, Title 24, will be assigned to the work. His duties are specifically defined in Title 24, Part I, Sec. 4-342.
- B. The work of construction in all stages of progress shall be subject to the personal continuous observation of the Project Inspector. He shall have free access to any or all parts of the work at any time. The Contractor shall furnish the Project Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from any obligation to fulfill this Contract.

### **PART 2 - PRODUCTS - NOT USED.**

### **PART 3 - EXECUTION**

#### **3.01 CONTROL OF INSTALLATION**

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

#### **3.02 MOCK-UPS**

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

### **3.03 TOLERANCES**

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

### **3.04 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.
  - 1. Submit qualifications of observer to Architect 30 days in advance of required observations.
  - 2. Observer subject to approval of District.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### **3.05 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

**Section 01 5000**  
**Construction Facilities & Temporary Controls**

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
  - 1. Water service and distribution.
  - 2. Temporary electric power and light.
  - 3. Sanitary facilities, including drinking water and washing facilities.
  - 4. Storm and sanitary sewer.
- C. Support facilities include, but are not limited to, the following:
  - 1. Field offices and storage sheds.
  - 2. Temporary enclosures.
  - 3. Waste disposal services.
  - 4. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
  - 1. Temporary fire protection.
  - 2. Barricades, warning signs, and lights.
  - 3. Enclosure fence for the site.
  - 4. Environmental protection.

**1.02 QUALITY ASSURANCE**

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
  - 1. Building code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, fire department, and rescue squad rules.
  - 5. Environmental protection regulations.
- B. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

**1.03 STANDARDS - COMPLY WITH THE FOLLOWING LISTED STANDARDS**

- A. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations
- B. ANSI A10 Series standards for "Safety Requirements for Construction and Demolition

01 5000 Construction Facilities & Temporary Controls

- C. NECA Electrical Design Library "Temporary Electrical Facilities
- D. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- E. NFPA 10 "Standard for Portable Fire Extinguishers"
- F. NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

#### **1.04 SUBMITTALS**

- A. Construction Site Plan: Provide plan showing proposed locations of temporary site constructions including temporary utilities, construction facilities, construction fencing and gates, and laydown areas.

#### **1.05 PROJECT CONDITIONS**

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. General: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chain link fabric fencing 6 feet (2 m) high and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

#### **2.02 EQUIPMENT**

- A. General: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of

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electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

- D. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockable entrances, operable windows, and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading.
- E. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. Provide self contained washing facilities, stocked with soap, disposable towels, and drinking cups; Use only potable water in Health Dept. approved containers.
- F. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### **3.02 TEMPORARY UTILITY INSTALLATION**

- A. General: As required to complete the work of the contract, engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
  - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Obtain easements to bring temporary utilities to the site where the District's easements cannot be used for that purpose.
  - 3. Use Charges: Cost or use charges for temporary facilities are not chargeable to the District or Architect. Neither the District nor Architect will accept cost or use charges as a basis of claims for Change Orders.
- B. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction

period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switchgear.

1. Install electric power service underground, except where overhead service must be used.
2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.

- C. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs. Maintain service until District allows use of permanent facilities.

1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

- D. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

### **3.03 SUPPORT FACILITIES INSTALLATION**

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.

1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.

- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Furnish and equip offices as follows:

1. Furnish with plan layout table and storage space for project documents and submittals.

- C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

- D. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.

### **3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."
  - 1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
  - 2. Store combustible materials in containers in fire-safe locations.
  - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
  - 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Enclosure Fence: Before excavation begins, install a minimum six foot tall enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering the site, except by the entrance gates.
- E. Provide open-mesh, chainlink fencing with posts set in a compacted mixture of gravel and earth or portable fencing, if appropriate, with sufficient hold down weight to prevent overturning. Portable fence post bases shall not extend into adjacent walkways.
- F. Provide visual screening of the construction site from specific areas if required by District.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- H. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- I. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or

that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

- J. Storm Water Protection: Provide rumble strips, straw wattles, silt fences or other measures as required to provide protection of storm water. Comply with all regulations for the protection of storm water resources.

### **3.05 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Maintain site as described in Section 01 7420 Cleaning, including sweeping up dirt and debris blown or tracked off site.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
  - 2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.
  - 3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

**END OF SECTION**

**Section 01 6000  
Product Requirements**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Substitution limitations.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 4000 - Quality Requirements: Product quality monitoring.
- B. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

**PART 2 PRODUCTS**

**2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the District; notify District promptly upon discovery; protect, remove, handle, and store as directed by District.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the District, or otherwise indicated as to remain the property of the District, become the property of the Contractor; remove from site.

**2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Made using or containing asbestos
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. Have longer documented life span under normal use.

2. Result in less construction waste. See Section 01 7419

### **2.03 MAINTENANCE MATERIALS**

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

## **PART 3 EXECUTION**

### **3.01 TRANSPORTATION AND HANDLING**

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

### **3.02 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Do not store products directly on the ground.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- K. Prevent contact with material that may cause corrosion, discoloration, or staining.
- L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

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**Section 01 7329  
Cutting and Patching**

**PART I - GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for cutting and patching as may be required to complete the work of this project.

**1.02 RELATED SECTIONS**

- A. Section 01 5000 - Construction Facilities and Temporary Controls
- B. Section 01 7135 - Restoration of Improvements
- C. Section 01 7420 - Cleaning
- D. Section 01 7419 - Construction Waste Management & Disposal
- E. Section 320505 - Selective Demolition for Exterior Improvements

**1.03 DEFINITIONS**

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

**1.04 QUALITY ASSURANCE**

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
- C. Miscellaneous Elements: Do not cut or patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut or patch in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic

qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

## **PART 3 – EXECUTION**

### **3.01 EXAMINATION**

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

### **3.03 PERFORMANCE**

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer, comply with original installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and 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. Proceed with patching after construction operations requiring cutting are complete.
  - 3. When possible, cut along existing control joints and score lines.
  
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean, piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

**END OF SECTION**

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**Section 01 7419  
Construction Waste Management and Disposal**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. District requires that this project generate the least amount of trash and waste possible with the goal of diverting 65% of waste from the landfill.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
  - 1. Aluminum and plastic beverage containers.
  - 2. Corrugated cardboard.
  - 3. Wood pallets.
  - 4. Clean dimensional wood.
  - 5. Land clearing debris, including brush, branches, logs, and stumps; see Section 31 1000 - Site Clearing for use options.
  - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
- E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, incineration, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.
- F. Develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
  - 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

## **1.02 RELATED REQUIREMENTS**

- A. Section 01 3300 - Submittals: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7329 - Cutting and Patching: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.
- E. Section 31 1000 - Site Clearing: Handling and disposal of land clearing debris.

## **1.03 DEFINITIONS**

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

#### **1.04 SUBMITTALS**

- A. Submit Waste Management Plan within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- B. Waste Management Plan: Include the following information:
  - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
  - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
  - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
  - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
  - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
  - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
  - 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
  - 2. Submit Report on a form acceptable to District.
  - 3. Landfill Disposal: Include the following information:
    - a. Identification of material.
    - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
    - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.

- d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Recycled and Salvaged Materials: Include the following information for each:
  - a. Identification of material, including those retrieved by installer for use on other projects.
  - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
  - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
  - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
  - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
5. Material Reused on Project: Include the following information for each:
  - a. Identification of material and how it was used in the project.
  - b. Amount, in tons or cubic yards.
  - c. Include weight tickets as evidence of quantity.
6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

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

## **PART 3 EXECUTION**

### **3.01 WASTE MANAGEMENT PROCEDURES**

- A. Waste management and diversion goals may be achieved by the following methods:
  1. Roll Off Waste Container: Contractor may hire a company which provides a roll off waste container which is then sorted off site.
  2. On Site Sorting: Contractor to sort waste on site.

### **3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, District, and Architect.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
  1. Prebid meeting.
  2. Preconstruction meeting.
  3. Regular job-site meetings.



- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
  - 1. Provide containers as required.
  - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
  - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

**END OF SECTION**

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**Section 01 7420**

**Cleaning**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Cleaning throughout the construction period, and final project cleaning prior to the acceptance tour.

**1.02 RELATED SECTIONS**

- A. Section 01 5000 - Construction Facilities and Temporary Controls

**1.03 QUALITY ASSURANCE**

- A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.
- B. Codes and Standards: In addition to the requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

**PART 2 - PRODUCTS**

**2.01 CLEANING MATERIALS AND EQUIPMENT**

- A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

**2.02 COMPATIBILITY**

- A. Use cleaning materials and equipment that are compatible with the surfaces being cleaned, as recommended by the manufacturer of the material to be cleaned.

**PART 3 - EXECUTION**

**3.01 PROGRESS CLEANING**

- A. General:
  - 1. Retain stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
  - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this work. Debris shall be removed from the site and disposed

- of in a lawful manner. Disposal receipts or dump tickets shall be furnished to Architect upon request.
3. At least twice each month, and more often if necessary, remove scrap debris, and waste material from the job site.
  4. Provide adequate storage for items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.
- B. Site:
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove items to the place designated for their storage. Flammable waste shall be kept in sealed metal containers until removed from the site.
  2. Weekly, and more often if necessary, inspect, arrangements of materials stored on the site; restack, tidy, or otherwise service arrangements to meet the requirements specified above.
  3. Maintain the site in a neat and orderly condition.
- C. Structures:
1. Weekly, and more often if necessary, inspect the structures and pick up scrap, debris, and waste material. Remove items to the place designated for their storage.
  2. Weekly, and more often if necessary, sweep interior spaces clean.
    - a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a handheld broom, i.e., "broom-clean".
  3. As required preparatory to installation of succeeding materials, clean the structures of pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the required cleanliness.
  4. Following the installation of finish floor materials, clean the finish floor daily, and more often if necessary, and while work is being performed in the space in which finish materials have been installed.
    - a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material that, in the opinion of the Architect, may be injurious to the finish floor material, i.e., "vacuum-clean".
- D. General: The General Conditions require general cleaning during construction. Prior to completion of the work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described below.
- E. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions. Unless otherwise specifically directed by the Architect, water and broom clean paved areas on the site and public paved areas directly adjacent to the site. Remove resultant debris
- F. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion.
1. Remove labels that are not permanent labels.

2. 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.
- G. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Sweep and mop vinyl and rubber surfaces.
- H. Structures:
  1. Exterior: In areas affected by the work under this contract, visually inspect exterior surfaces and remove traces of soil, waste material, smudges, and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure.
  2. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the District.
- I. Interior: In areas affected by the work under this contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only the cleaning materials and equipment instructed by the manufacturer of the surface material.
- J. Glass: Clean glass inside and outside.
- K. Polished surfaces: On surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished. Glossy surfaces shall be cleaned and shined as intended by the manufacturer
  1. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
  2. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted to a smooth, even-textured surface.
- L. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests.
- M. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- N. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the District's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully.
- O. Extra Materials: Where extra materials of value remain after completion of associated Work, they become the District's property. Dispose of these materials as directed by the Owner.

- P. Timing: Schedule final cleaning as accepted by the Architect to enable the District to accept a completely clean project.
  
- Q. Cleaning During District's Occupancy
  - 1. Should the District occupy the work or any portion thereof prior to its completion by the Contractor and acceptance by the District, responsibilities for interim and final cleaning of the occupied spaces shall be determined by the Architect in accordance with the General Conditions of the Contract.

**END OF SECTION**

**Section 02 4100**

**Demolition**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Abandonment and removal of existing utilities and utility structures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 01 1000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 01 5713 - Temporary Erosion and Sediment Control.
- E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- G. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.

**1.03 SUBMITTALS**

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS**

- A. Fill Material: As specified in Section 31 2323 - Fill.

## **PART 3 EXECUTION**

### **3.01 SCOPE**

- A. Remove the entire building designated on the Drawings..
- B. Remove paving and curbs as required to accomplish new work.
- C. Within area of new construction, remove foundation walls and footings in their entirety or as indicated on the Drawings.
- D. Outside area of new construction, remove foundation walls and footings to a minimum of 2 feet below finished grade or as needed to implement new construction.
- E. Remove fences and gates.
- F. Remove other items indicated, for salvage, relocation, and recycling.

### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
- B. Do not begin removal until receipt of notification to proceed from District.

### **3.03 EXISTING UTILITIES**

- A. Protect existing utilities to remain from damage.
- B. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to District.
- C. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to District.



- D. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- E. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

**3.04 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

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**Section 05 1200  
Structural Steel Framing**

**PART 2 PRODUCTS**

**1.01 MATERIALS**

- A. Steel Plates: ASTM A36/A36M, for non-weathered steel
- B. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.
- C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B for non-weathered steel
- D. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
- E. Unheaded Anchor Rods: ASTM F1554, Gr 36, 55 (with S1 weld supplement requirements) or 105 as indicated on the drawings, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436 Type 1 washers.
- F. Headed Anchor Rods: ASTM F1554 Grade 36, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
  - 1. Electrodes: AWS D5.1, E70XX Series Low Hydrogen Electrodes as required for intended use. All electrodes shall have a minimum Notch -Toughness of 20 FT-Lb at -20 degree F.

**1.02 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Cleaning and Straightening: Thoroughly wire brush material, clean of loose mill scale and rust, and straighten by methods that will not injure the steel prior to fabrication. Remove twists or bends after punching or working component parts of a member before the parts are assembled. Produce finished members free from twists, bends, and open joints when erected.
- C. Contact: Pin components parts of built-up members and maintain in close contact using clamps or temporary bolting during welding operations. Accurately mill compression bearing surfaces of joints depending on contact bearings or saw cut square to axis, or as detailed. Cut other joints straight and true.
- D. Joining: Provide members of the sizes, weights, shapes, and arrangements indicated, closely fitted and finished true to line and in precise position as necessary to allow proper joining of parts in the field. Drifting to enlarge unfair holes is not allowed without prior approval.
- E. Drilling, Punching, and Reaming: Hole burning to make or enlarge previous holes is allowed only with prior approval. Prepare required holes in structural steel members for attachment or passage of Work of other trades. Precisely locate finished holes to ensure passage of all bolts

through steel assemblies without drifting. Enlarge holes only by reaming. Poor matching of holes is cause for rejection.

- F. Holes For Anchor Bolts: Punch and drill or ream holes in base and bearing plates. Do not make or enlarge the holes by burning except for grouting holes in column bases without prior approval by the Architect.
- G. Gas Cutting: Use of a cutting torch is allowed where the metal being cut is not stressed during the operation, and provided stresses are not transmitted through a flame-cut surface. Make all gas cuts with a smooth regular contour. Deduct 1/8" from width of gas cut edges to determine effective width of members that are gas cut. Make radius of re-entrant gas cuts as large as possible, but 1" minimum.
- H. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized in largest practical sizes. Fabrication includes operations of shearing, punching, bending, forming, assembling or welding. Galvanized items shall be free from projections, barbs, or icicles resulting from the galvanizing process.
- I. Welding:
  - 1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the requirements of CBC Chapter 17A.
  - 2. Materials and workmanship shall conform to the requirements specified herein and to CBC requirements, modified as follows:
    - a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the Engineer of Record and the DSA.
    - b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.
  - 3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.
- J. Shop Finish:
  - 1. Notify the Inspector when Work is ready to receive shop prime coat. Work shall be inspected by the Inspector before installation of primer.
  - 2. Structural steel and fittings, except galvanized items, which will be exposed when building is completed, shall receive a coat of primer.
  - 3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2.0 mils.

### **1.03 CONNECTIONS**

- A. Make connections with bolts as noted on the Structural Drawings.

### **1.04 WELDING:**

- A. Conform to CBC Section 1705A.2, AWS D1.1 as modified by referenced AISC Standards, and as indicated or noted on Drawings. Employ welding operators qualified in accordance with AWS D1.1, as applicable, who are thoroughly trained and experienced in arc welding and that produce uniformly reliable groove and fillet welds in flat, vertical, and overhead positions, and

make neat and consistent welds. Weld all structural steel joints by shielded electric-arc method unless otherwise shown, specified, or approved. Conform welding in both shop and field, including the prequalification of welds and welder qualifications, to AWS D1.1.

- B. Preparation: Clean steel surfaces to be welded of all paint, grease, oil, mill scale, and foreign matter. Clean weld each time the electrode is changed. Chip full surface of hand guided and controlled flame cut edges before welding. Surfaces prepared with automatic or mechanically guided and controlled equipment need not be ground or chipped before welding.
- C. Weld Finishing: Grind exposed welds subject to contact to smooth surfaces free of holes, slag, or other defects, flush with the adjoining surfaces. No finish treatment is required for permanently concealed welds and other exposed welds.
- D. Procedures: During assembling and welding, hold components of a built-up member with adequate clamps or other means to keep parts straight and in close contact. Do no welding in wind until adequate protective screening is set up. Cut out defective welds or parts of welds with a chisel or air arc and replace.
- E. Weld Characteristics: Conform to AWS D1.1. Clean and wire brush all welds. Visual inspection of finished welds must show uniform section, smoothness of welded metal, feather edges without undercuts or overlays, freedom from porosity and inclusions, and good fusion and penetration into base metal at edges and ends of fillet welds.

#### **1.05 FINISH**

- A. Clean surfaces according to AISC Specifications. Apply one shop coat of specified metal primer to minimum 1.0 mil dry film thickness. Work primer into joints. Do not prime the following:
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

#### **1.06 SOURCE QUALITY CONTROL**

- A. A qualified special inspector shall inspect high-strength bolted connections. The Owner will provide an independent testing laboratory to perform tests and prepare test reports in accordance with the CBC. The Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- B. An AWS CWI certified special inspector shall inspect welded connections. The Owner will provide an independent testing laboratory to perform tests and prepare test reports in accordance with the CBC. The Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.
- C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

- D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.
- E. The independent testing laboratory may inspect and/or test structural steel at plant before shipment; however, the Engineer of Record reserves the right at any time before Final Completion to deem materials not in compliance with the specified requirements as defective Work.
- F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.
- G. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:
  - 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.
  - 2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods.
  - 3. Base metal thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.
  - 4. Any material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the SEOR.
  - 5. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.

## **PART 3 EXECUTION**

### **2.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.
- B. Verify governing dimensions and conditions of the Work before commencing erection Work. Verify elevations of concrete and masonry bearing surfaces, and locations of anchor rods, bearing plates and other Embedments.
- C. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

## **2.02 ERECTION**

- A. Erect structural steel in compliance with AISC 303.
- B. Employ qualified riggers and plan erection to require minimum cutting. Erect members plumb, true to line and level, and in precise positions. Provide temporary bracing and guying to resist loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation.
- C. Anchor Bolts: Furnish and deliver anchor bolts with setting drawings and templates. Verify position of bolts prior to delivery of steel; report errors or deviation for correction.
- D. Clean surfaces of base plates and bearing plates.
  - 1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.
- E. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.
- F. Align and adjust steel members. Adjust for variations in elevation or alignment. Level and plumb structural members.
- G. Do not permit thermal cutting during erection of structural steel.
- H. Connections: Hold steel in correct position during welding and bolting, and provide for dead loads, wind, and all erection stresses. Do no welding or final bolting until members have been aligned and plumbed.
  - 1. Field Welding: Conform to requirements for shop fabrication.
  - 2. Common Bolts: Tighten and upset bolt threads to preclude loosening, or use approved self-locking nuts.
- I. Where indicated for field connections, provide standard bolts complying with ASTM A325.
- J. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.
- K. Steel Columns: Set column bases in exact position for alignment, plumb and straight, supported on adjustable bolt supports or shims until grout has set. Set center of base true to column center within 1/16" and adjust column height exactly. Maintain bases at exact position and level during grouting. Fill grout space solid with non-shrink grout.
- L. Damaged Members: During erection, straighten or replace members which are bent, twisted, or damaged as directed. If heating is required, perform heating by methods that ensure a uniform temperature throughout the entire member. When directed, remove members damaged to an extent impairing appearance, strength, or serviceability and replace with new members at no

extra cost to the Owner.

- M. Do not field cut or alter structural members without approval of Architect.
- N. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### **2.03 FINISHING**

- A. After erection, spots or surfaces where paint has been removed, damaged, or burned off and field rivets, bolts, and other field connections not concealed in the Work, shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

### **2.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From true Alignment: 1/4 inch.

### **2.05 FIELD QUALITY CONTROL**

- A. Testing Agency The owner will engage An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.
- B. All welders shall be qualified for each process and position per AWS D1.1 Chapter 4, Part C - Performance Qualifications.
- C. Testing Agency The owner will engage An independent testing agency will perform field quality control tests for all field welds and bolted connections as detailed in Section 1.5 above.
  - 1. Welded Connections: Visually inspect all field-welded connections. For all CJP welds test 100 percent of welds using the following:

### **2.06 CLEAN UP**

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

### **2.07 PROTECTION**

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

**END OF SECTION**



**SECTION 05 4300**

**SLOTTED CHANNEL FRAMING  
(STRUT SYSTEMS)**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Continuous slot, bolted metal framing channels and all associated fittings and hardware.
- B. Trapeze type supports for cable tray, conduit, pipe and other similar systems.
- C. Use of bolted metal framing as a surface metal raceway.

**1.02 REFERENCES**

- A. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip
- B. ASTM A653 - General Requirements for Steel Sheet, Zinc-Coated Galvanized by the Hot-Dip Process
- C. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (*Formerly ASTM A570*)
- D. ASTM F1136 – Standard Specification for Chromium/Zinc Corrosion Protective Coatings for Fasteners
- E. ASTM A907 - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled, Structural Quality
- F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- G. MFMA - Metal Framing Manufacturers Association
- H. ANSI/NFPA 70– National Fire Protection Association (National Electrical Code)
- I. AISI - American Iron and Steel Institute

### 1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in the manufacture of bolted metal framing of the types required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. MFMA Compliance: Comply with the latest revision of MFMA Standards Publication Number MFMA-3, "Metal Framing Standards Publication".
- C. NEC Compliance: Comply with the latest revision NFPA 70 - Article 352 "Surface Metal Raceways and Surface Nonmetallic Raceways".
- D. UL Compliance: Comply with UL "Standard for Surface Metal Raceway and Fittings", UL 5.
- E. Bolted framing channels and fittings shall have the manufacturer's name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.
- F. Stainless steel bolted framing parts shall be stamped to identify the material. Material certification sheets and test reports must be made available by the manufacturer upon request.

### 1.04 SUBMITTALS

- A. Submit drawings of struts and accessories including clamps, brackets, hanger rods, and fittings.
- B. Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus ( $S_x$ ) and Moment of Inertia ( $I_x$ ).

### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver strut systems and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.
- B. Store strut systems and components in original cartons and in clean dry space; protect from weather and construction traffic.

**PART 2 PRODUCTS**

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with these specifications, strut systems to be installed shall be as manufactured by Cooper B-Line, Inc. or engineer approved equal.

2.02 STRUT CHANNELS AND COMPONENTS

- A. General: Strut shall be 1-5/8 inches wide in varying heights and welded combinations as required to meet load capacities and designs indicated on the drawings.
- B. Materials and Finish: Material and finish specifications for each strut type are as follows:
  - 1. Pre-galvanized Steel: Strut shall be made from steel meeting the minimum mechanical properties of ASTM A653 SS, Grade 33, and mill galvanized in accordance with coating designation G90. Fittings shall be manufactured from steel meeting the minimum requirements of ASTM A907 SS, Grade 33. All fittings and hardware shall be zinc plated in accordance with ASTM B633 (SC3 for fittings, SC1 for threaded hardware).

**PART 3 EXECUTION**

3.01 INSTALLATION

- A. Install strut in accordance with MFMA-102 ‘Guidelines for the Use of Metal Framing’; in accordance with equipment manufacturer's recommendations, and with recognized industry practices.
- B. All nuts and bolts shall be tightened to the following values:

| <u>Bolt Size</u> | <u>Torque (ft-lbs)</u> |
|------------------|------------------------|
| 1/4 - 20         | 6                      |
| 5/16 - 18        | 11                     |
| 3/8 - 16         | 19                     |
| 1/2 - 13         | 50                     |

**END OF SECTION**

05 4300 SLOTTED CHANNEL FRAMING

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**Section 06 1000  
Rough Carpentry**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Structural dimension lumber framing.
- B. Nonstructural dimension lumber framing.
- C. Rough opening framing for doors, windows, and roof openings.
- D. Sheathing.
- E. Roof-mounted curbs.
- F. Roofing nailers.
- G. Preservative treated wood materials.
- H. Miscellaneous framing and sheathing.
- I. Concealed wood blocking, nailers, and supports.
- J. Miscellaneous wood nailers, furring, and grounds.
- K. Wall sheathing with factory applied water-resistive and air barrier sheet.
- L. Roof sheathing with factory applied roofing underlayment.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.
- B. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
- C. Section 06 1800 - Glued-Laminated Construction.

**1.03 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2023.

- B. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings 2018, with Errata (2019).
- C. AWWA U1 - Use Category System: User Specification for Treated Wood 2022.
- D. PS 1 - Structural Plywood 2019.
- E. PS 2 - Performance Standard for Wood Structural Panels 2018.
- F. PS 20 - American Softwood Lumber Standard 2021.

#### **1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
  - 2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

#### **2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Stud Framing (2 by 2 through 2 by 8 ):
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 2.

- D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16 ):
  - 1. Species and Grades: As indicated on drawings for various locations.
- E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: S4S, No. 2.

### **2.03 TIMBERS FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry (19 percent maximum).
- C. Beams and Posts 5 inches and over in thickness:
  - 1. Species: Douglas Fir-Larch.
  - 2. Grade: No. 1.

### **2.04 STRUCTURAL COMPOSITE LUMBER**

- A. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.
  - 1. Columns: Use laminated veneer lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum. Fb = 2,900 psi, minimum.
  - 2. Beams: Use laminated veneer lumber with manufacturer's published E (modulus of elasticity): 2,000,000 psi, minimum. Fb = 2,900 psi, minimum.

### **2.05 CONSTRUCTION PANELS**

- A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
  - 1. Bond Classification: Exterior.
  - 2. Span Rating: 32.
  - 3. Performance Category: 1/2 PERF CAT.
- B. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
- C. Other Applications:
  - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
  - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
  - 3. Other Locations: PS 1, C-D Plugged or better.

### **2.06 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions.

1. Provide hangers manufactured by Simpson Strong-Tie.

## **2.07 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

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

### **3.03 FRAMING INSTALLATION**

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



- G. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

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

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

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

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

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

- A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
  - 1. Nail panels to framing; staples are not permitted.
- B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

### **3.07 SITE APPLIED WOOD TREATMENT**

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.
- B. Allow preservative to dry prior to erecting members.

### **3.08 TOLERANCES**

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

### **3.09 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.

### **3.10 CLEANING**

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

**Section 06 4100**  
**Architectural Wood Casework**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Plastic laminate countertops.
- C. Hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 07 9200 - Joint Sealants
- C. Division 22 Plumbing
- D. Division 23 Mechanical
- E. Division 26 Electrical

**1.03 REFERENCE STANDARDS**

- A. AWI/AWMA/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMA/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- C. BHMA A156.9 - Cabinet Hardware 2020.
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- E. WI (CCP) - Certified Compliance Program (CCP) Current Edition.
- F. WI (MCP) - Monitored Compliance Program (MCP) Current Edition.
- G. ASTM D 1037 - 99 Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

#### **1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes. Shop Drawings shall have WI, Certified Compliance Label affixed to first page of drawing set.
- C. Product Data: Provide data for hardware accessories. Provide MSDS Sheets for all composite wood and agrifiber products, adhesives, and sealants used.
- D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.
- E. Samples: Submit actual sample items of proposed pulls, hinges, and shelf standards, demonstrating hardware design, quality, and finish.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with WI Manual of Millwork, Custom quality, unless other quality is indicated for specific items. The millwork supplier shall issue a W.I. Certificate Compliance Certificate indicating the grade of millwork products to be furnished for this job and certifying that they will fully meet all the requirements of the grade specified. Each unit of casework shall bear the W.I. Certificate Compliance label. Each plastic laminate countertop shall bear the W.I. Certified Compliance label. Upon the completion of the installation, a W.I. Certified Compliance shall be issued for the installation. The type of construction used must meet the seismic force requirements of Title 24.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.
- B. Delivery shall only be made when the area of operation is enclosed, all wet work is dry, all overhead work is complete, and the area broom clean.

#### **1.07 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.
- B. The HVAC system shall be on and functioning, and the architectural millwork shall be acclimated to these conditions for 72 hours prior to installation.

## **PART 2 PRODUCTS**

### **2.01 CABINETS**

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

### **2.02 WOOD-BASED COMPONENTS**

- A. Hardwood Faced Plywood: HPVA HP-1; graded in accordance with WI Manual of Millwork, core of lumber; exterior glue ; thickness 3/4";
  - 1. Exposed Open Shelving
  - 2. Semi Exposed Shelving
- B. Particleboard shall not be used
- C. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in WI Manual of Millwork; composed of wood fibers pressure bonded with moisture resistant formaldehyde free adhesive to suit application; sanded faces; thickness as indicated.
  - 1. Medite II, as manufactured by Roseburg, or approved equal
  - 2. Located at all casework construction, except as identified above.

### **2.03 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 2. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  - 3. Wilsonart LLC; (District Standard): [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  - 4. Or approved equal, prior to bidding
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for all exposed applications as scheduled.
  - 1. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
- C. Melamine finish at all semi-exposed cabinet shelving, divisions and faces.
- D. Interior faces of cabinet doors to be faced with the same material as exposed surfaces.

### **2.04 COUNTERTOPS**

- A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, post-formed, with bullnose edge or 3mm PVC edge banding.
- B. No drip waterfall edge at all countertops containing sinks

06 4100 Architectural Wood Casework

## **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by WI to suit application.
- B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's full range to match cabinet face.
  - 2. Use at all exposed shelf edges.
  - 3. Use at door and drawer edges.
  - 4. All adhesives must meet or exceed the VOC limits of the South Coast Air Quality Management District Rule # 1168 ([http://www.aqmd.gov/rules/reg/reg11\\_tofc.html](http://www.aqmd.gov/rules/reg/reg11_tofc.html))
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

## **2.06 HARDWARE**

- A. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards and coordinated self rests, satin finish, for nominal 9/16 inch spacing adjustments.
  - 1. Standards, SP-1820, manufactured by Sugatsune or approved equal.
  - 2. Supports; SP-15, manufactured by Sugatsune or approved equal.
- B. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, ~ 4" inch centers
  - 1. Hafele #116.07.621 by Hafele
  - 2. EPCO
  - 3. Sugatsune
- C. Cabinet Catches and Latches:
  - 1. Product: MC0099 manufactured by Sugatsune
  - 2. Product: 323A92 manufactured by Ives
  - 3. Substitutions: See Section 01600 - Product Requirements.
- D. Drawer Slides:
  - 1. Type: Full extension.
  - 2. Static Load Capacity: Heavy Duty grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
  - 5. Features: Provide self closing/stay closed type.
  - 6. Manufacturers:
    - a. Accuride International, Inc; Heavy-Duty Drawer Slides: [www accuride.com/#sle](http://www accuride.com/#sle).
    - b. Hettich America, LP; \_\_\_\_\_: [www.hettich.com/#sle](http://www.hettich.com/#sle).

- c. Knappe & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: [www.knappeandvogt.com/#sle](http://www.knappeandvogt.com/#sle).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
- E. Hinges: Full-mortise 5-knuckle institutional type, steel with nickel-plated finish.
- 1. Manufacturers:
    - a. Rockford Process Control, Inc: [rockfordprocess.com](http://rockfordprocess.com) - 450 series.
    - b. Or approved equal,
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- F. Silencers: Clear vinyl silencers to be installed at each cabinet door
- G. Wardrobe Hook
- 1. # 582 Double, Aluminum, Manufactured by Ives or approved equal.

## **2.07 FABRICATION**

- A. Cabinets shall be fabricated to Woodwork Institute standards
- 1. Grade: Premium
- B. Exceptions to WI standards
- 1. Wall Hung Cabinets : Depth 14 inches
  - 2. Shelves shall be designed as per schools and libraries, for a 50lb per square foot live load as per table 15-1.
  - 3. Exterior Edges: Include doors, drawer fronts, and front edge of vertical end panels and leg panels. Exterior edges are to be edged with heavy-duty 3mm PVC edgebanding, color to match door or drawer front.
  - 4. Locate grommets as directed by Owner. Assume one per workstation
- C. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- E. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- F. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
- 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
  - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- G. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

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

#### **3.02 CASEWORK INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.
- H. Secure upper cabinets, counter bases, full height cabinets, and counter partitions to floor and wall using appropriate angles and anchorages to obtain seismic restraint per Title 24 Section 2336

#### **3.03 ADJUSTING**

- A. Adjust moving or operating parts to function smoothly and correctly.

#### **3.04 CLEANING**

- A. Defective work shall be repaired or replaced as directed by the Owner or his representative upon completion of installation.
- B. Shop finished surfaces shall be cleaned, touched-up as required and damaged or unrepairable areas shall be refinished or replaced as directed.
- C. Clean cabinetry free of debris. Installer shall be responsible for the immediate removal of all trash, crating, etc., associated with the cabinet installation.



**3.05 SCHEDULES**

- A. Finishes to be selected by architect from full line of colors and patterns. (Colors and Patterns are based on Formica Brand as a standard of quality unless otherwise noted.)

**END OF SECTION**

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**Section 07 3216  
Concrete Roof Tiles**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete roof tiles.
- B. Underlayment.
- C. Underlayment with ice dam protection.
- D. Wood attachment members.
- E. Wood nailing battens and counter battens.
- F. Metal roof flashing.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Material requirements for attachment members.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Roof flashing.
- C. Section 07 7200 - Roof Accessories: Expansion Joint Covers.

**1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer 2016.
- C. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- D. ASTM C1492 - Standard Specification for Concrete Roof Tile 2022.
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- F. ASTM D3909/D3909M - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules 2014 (Reapproved 2021).

- G. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces 2011 (Reapproved 2019).
- H. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques 2019.
- I. CBC, Chapter 7A - Materials and Construction Methods for Exterior Wildfire Exposure 2022.

#### **1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Manufacturer's data sheets on tile and underlayment, indicating material characteristics, installation instructions, and limitations and precautions.
- C. Shop Drawings: For metal flashings and counterflashings, indicate overall configurations and thicknesses, details at complex intersections, jointing methods and locations, and fastening details.
- D. Selection Samples: Submit color chips representing manufacturer's full range of available tile colors and finishes.
- E. Verification Samples: Set of tiles representing actual product in color, finish, and style, including special shapes and fittings.
- F. Manufacturer's Certificates: Certify that tiles supplied for the project meet or exceed specified requirements.

#### **1.05 MOCK-UPS**

- A. Provide a mock-up for evaluation of concrete roof tile installation workmanship, including typical eave, rake, valley, and ridge detail.
  - 1. Size of Mock-Up: 4 feet by 4 feet, minimum.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.
- B. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

#### **1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Manufacturer shall warrant the products against manufacturing defects and shall include material and labor to repair or replace defective materials as specified in manufacturer's warranty.
- C. Warranty Period: Lifetime Product Warranty for concrete roof tile.

## **1.08 EXTRA MATERIALS**

- A. Supply 5 percent of tile actually installed for District's use in maintenance of project, including appropriate quantities for each color, size, and shape of tile installed.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Concrete Roof Tiles:
  - 1. Boral Roofing; Saxony 900 Slate: [www.boralamerica.com](http://www.boralamerica.com)
  - 2. Eagle Roofing Products; Bel Air: [www.eagleroofting.com](http://www.eagleroofting.com) (Basis of Design)
  - 3. Vande Hey-Raleigh Manufacturing, Inc; Modern Slate: [www.vrmtile.com](http://www.vrmtile.com)

### **2.02 ROOF TILES**

- A. Concrete Roof Tiles:
  - 1. Comply with requirements of ASTM C1492, including certification for passing the freeze-thaw testing, and with nail holes made before curing.
  - 2. Weight: Normal weight tile, using ASTM C33/C33M aggregates.
  - 3. Profile: Flat interlocking tile with smooth texture and square-cut butt.
  - 4. Tile Size: As selected from manufacturer's standards.
  - 5. Finish: Natural, uncoated, with integral color from metal oxide pigments.
  - 6. Color: Concord Blend.
  - 7. Color Properties:
    - a. Reflectance: 0.15 per ASTM C1549
    - b. Aged reflectance: 0.17 per ASTM C1549
    - c. Emisivity: 0.92 per ASTM E408
    - d. Aged emisivity: 0.92 per ASTM E408
    - e. Solar Reflective Index (SRI): 14 per ASTM E1980
    - f. Aged Solar Reflective Index A.SRI): 15 per ASTM E1980
- B. Special Shapes and Fittings: Supply special shapes and fittings of same material and finish as adjacent tile, factory-formed, as indicated on drawings or as required for specific project conditions, including but not limited to hip caps, ridge caps, rake edges, eave edges, and termination caps.

## **2.03 SHEET MATERIALS**

- A. Underlayment, with Ice Dam Protection: Self-adhering, polymer-modified asphalt sheet complying with ASTM D1970/D1970M; minimum thickness of 40 mil, 0.040 inch; with strippable release paper and slip-resistant embossed polyethylene sheet top surface.
  - 1. Self Adhering Underlayment is to provided over entire roof to achieve waterproofing due to low slope of roof.
  - 2. Wildland Urban Interface Requirement: Additional Underlayment shall be a minimum of 72 lb mineral surface with non perforated cap sheet to meet ASTM D3909/D3909M and CBC, Chapter 7A, Section 705.A.2.
    - a. If one layer of underlayment is used it must meet both low slope roofing requirements and wild land urbam interface requirements. Otherwise the requirements are to be met by using two separate roofing underlayment layers.
- B. Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; minimum thickness of 40 mil, 0.040 inch; with strippable release paper and slip-resistant embossed polyethylene sheet top surface.

## **2.04 METAL FLASHING**

- A. Metal Flashings: Provide as indicated and required for watertight roofing system, including eave edge, gable edge, ridge vent, open valley, chimney, parapet, and dormer flashing.
  - 1. Form flashings to profiles indicated, or as required to shed water and protect building from water damage.
  - 2. Form sections square, flat, and accurate to profile, in maximum possible lengths, free from distortion or other defects detrimental to function or appearance.
  - 3. Hem exposed edges of flashings minimum 1/4 inch on underside.
  - 4. Coat concealed surfaces of flashings with bituminous paint.
- B. Galvanized Steel Flashing: ASTM A653/A653M, with G90/Z275 zinc coating; 26-gauge, 0.0179-inch minimum base metal thickness.
  - 1. Wildland Urban Interface Requirement: Valley Flashing shall be continuous full length of valley and corrosion resistant and meet ASTM D3909 and CBC, Chapter 7A, Section 705.A.2.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine structural roof deck for compliance with specified requirements, and verify that roof penetrations and roof openings are correctly installed in proper locations.
- B. Do not begin installation of tile roofing until substrates have been properly prepared, and if substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 INSTALLATION**

- A. Underlayment:
  - 1. Roof Slopes Less than 4:12: Install one layer of underlayment over entire roof area, perpendicular to roof slope, with ends and edges weather lapped a minimum of 4 inches, and staggering end laps of each layer.
- B. Valley Protection Membrane: Install full width elastomeric membrane underlayment centered at valleys, in accordance with manufacturer's installation instructions for project substrate, and weather lap joints a minimum of 12 inches.
- C. Metal Valley Flashings:
  - 1. Open Valleys: Install minimum 36 inch wide flashing over valley protection membrane, centered over valley and crimped to guide water; fasten to deck with cleats; overlap end joints minimum 8 inches, blind nailing upper end of each sheet; do not solder joints.
- D. Sheet Metal Flashing: Install flashing at other locations as indicated and as required by project conditions.
  - 1. Install flashing at locations where concrete roof tiles intersect other roofs, walls, parapets, chimneys, ventilators, and similar projections.
  - 2. Install drip edge flashing at eaves prior to installing underlayment.
- E. Elastomeric Membrane Flashing: Apply self-adhering membrane flashing in concealed locations where metal flashing would be difficult or impossible to apply effectively.
- F. Concrete Tile:
  - 1. Install first row of tile at eaves with minimum projection of 1 inch.
  - 2. Lay tile square with building lines and parallel with roof slope, and install filler, closure, and mitered pieces as required.
  - 3. Unless otherwise indicated or recommended by tile manufacturer, install tile with minimum of 3-inch headlaps.
  - 4. Miter tile at valleys to form straight edge using masonry saw.
  - 5. Cut and fit tiles neatly around vents, pipes, and other projections.
  - 6. Install accessories in accordance with manufacturer's details and recommendations.

### **3.03 PROTECTION**

- A. Minimize traffic over finished roof surface, and where walking on roof is absolutely necessary, wear soft-soled shoes and walk on abutting tiles to avoid breakage.
- B. Remove and replace damaged or broken tile before Date of Substantial Completion.
- C. Remove excess and broken tile and roof installation debris from project site.

**END OF SECTION**

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**Section 07 6200  
Sheet Metal Flashing and Trim**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM B32 - Standard Specification for Solder Metal 2020.
- E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- H. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- J. CDA A4050 - Copper in Architecture - Handbook current edition.
- K. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

07 6200 Sheet Metal Flashing and Trim

#### **1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

#### **1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

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

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Sheet Metal Flashing and Trim:
  - 1. ATAS International, Inc. : [atas.com](http://atas.com)
  - 2. Petersen Aluminum Corporation: [www.pac-clad.com](http://www.pac-clad.com)
  - 3. Berridge Manufacturing Co.: [berridge.com](http://berridge.com)
- B. Exterior Penetration Flashing Panel:
  - 1. Quickflash Weatherproofing Products, Inc: [www.quickflashproducts.com](http://www.quickflashproducts.com)
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.
  - 1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
  - 2. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
  - 3. Color: As selected by Architect from manufacturer's full colors.

- C. Note: Flashing directly contacting the thermoplastic roof membrane is to be flashed with clad metal by the roofing manufacture.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 2 inches over roofing . Return and brake edges.

### **2.04 GUTTER FABRICATION**

- A. Gutters: SMACNA (ASMM) Rectangular profile.
- B. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
  - 2. Gutter Supports: Brackets.im think
  - 3. Downspout Supports: Brackets.
- C. Downspout Boots: Plastic.
- D. Seal metal joints.

### **2.05 EXTERIOR PENETRATION FLASHING PANELS**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

### **2.06 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.

- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.
- F. Screens: Tightly fitted screens to prevent the accumulation of leaves and debris in the gutter in accordance with CBC 705A.4

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.
- C. In the event of a discrepancy, immediately notify the Architect.

#### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

#### **3.03 INSTALLATION**

- A. Gutters and exposed flashings to be prefinished aluminum.
- B. Galvanized sheet metal flashings are only to be used in locations not exposed to view, such as pan flashings at windows.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Secure gutters and downspouts in place with concealed fasteners.

**END OF SECTION**

**Section 07 8400**

**Firestopping**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 REFERENCE STANDARDS**

- A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- B. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- C. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- D. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems 2007 (Reapproved 2011).
- E. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops 2014.
- F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2010a.
- G. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2015a.
- H. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013.
- I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- J. ITS (DIR) - Directory of Listed Products Current Edition.
- K. FM (AG) - FM Approval Guide Current Edition.
- L. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.

- M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- N. UL (DIR) - Online Certifications Directory Current Edition.
- O. UL (FRD) - Fire Resistance Directory Current Edition.

### **1.03 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Installer's qualification statement.

### **1.04 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Verification of minimum three years documented experience installing work of this type.
  - 2. Verification of at least five satisfactorily completed projects of comparable size and type.

### **1.05 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products; \_\_\_\_\_: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 2. Hilti, Inc; \_\_\_\_\_: [www.hilti.com/#sle](http://www.hilti.com/#sle).
  - 3. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).

## **2.02 MATERIALS**

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

## **2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
  - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
  - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
  - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- B. Acoustically Rated Firestopping: Provide system tested in accordance with ASTM E90 with STC rating of 50, minimum.

## **2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

## **2.05 FIRESTOPPING SYSTEMS**

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

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

## **3.02 PREPARATION**

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

## **3.03 INSTALLATION**

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

**3.04 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by District, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

**3.05 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.06 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**



**Section 07 9200  
Joint Sealants**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

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

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 07 4646 - Fiber Cement Siding: Sealants installed as part of installation
- C. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- D. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.
- E. 32 1313 - Concrete Paving: Sealant at expansion joints

**1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  2. List of backing materials approved for use with the specific product.
  3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  4. Substrates the product should not be used on.
- B. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Nonsag Sealants:
1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  3. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  4. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  5. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  6. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  7. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  8. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  9. W.R. Meadows, Inc: [www.wrmeadows.com/sle](http://www.wrmeadows.com/sle).
- B. Self-Leveling Sealants:
1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  2. Dow Corning Corporation: [www.dowcorning.com/construction/sle](http://www.dowcorning.com/construction/sle).
  3. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  4. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  5. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  6. W.R. Meadows, Inc: [www.wrmeadows.com/sle](http://www.wrmeadows.com/sle).

### **2.02 JOINT SEALANT APPLICATIONS**

- A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
    - a. Wall expansion and control joints.
    - b. Joints between different exposed materials.
    - c. Expansion joints in paving.
    - d. Other joints indicated below.
  2. Do Not Seal:
    - a. Intentional weep holes in masonry.
    - b. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

- c. Joints where sealant installation is specified in other sections.
- B. Exterior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
  - 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use nonsag polyurethane polyurethane sealant, unless otherwise indicated.
  - 1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex Acrylic emulsion latex sealant.
  - 2. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white white.
  - 3. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
- D. Interior Wet Areas: restrooms; fixtures in wet areas include plumbing fixtures, countertops, and cabinets.

### **2.03 JOINT SEALANTS - GENERAL**

- A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 6116.
- B. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- C. Colors: As as selected by architect from manufacturer's full range

### **2.04 NONSAG JOINT SEALANTS**

- A. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Color: Match adjacent finished surfaces.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: White.
- C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
  - 1. Color: Standard colors matching finished surfaces, Type OP (opaque).

### **2.05 SELF-LEVELING JOINT SEALANTS**

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
  - 1. Movement Capability: Plus and minus 25 percent, minimum.

2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: Gray.
4. Products:
  - a. Pecora Corporation; Urexpam NR-200 and/or Dynatred: [www.pecora.com](http://www.pecora.com).
  - b. Sherwin-Williams Company; Loxon SL1 Polyurethane Self-Leveling Sealant: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - c. Sherwin-Williams Company; Loxon SL2 Polyurethane Self-Leveling Sealant: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - d. Sika Corporation; Sikaflex-1c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - e. Sika Corporation; Sikaflex-2c SL: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).

## **2.06 ACCESSORIES**

- A. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- B. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- C. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

### **3.03 INSTALLATION**

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

### **3.04 POST-OCCUPANCY**

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

**END OF SECTION**

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**Section 09 2116  
Gypsum Board Assemblies**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Cementitious backing board.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.
- D. Textured finish system.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry.
- B. Section 07 2100 - Board and Batt Insulation
- C. Section 07 9200 - Joint Sealants
- D. Section 09 3000 - Tiling

**1.03 REFERENCE STANDARDS**

- A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.
- C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- D. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel 2017.
- E. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2022.
- F. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- H. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

#### **1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

### **PART 2 PRODUCTS**

#### **2.01 BOARD MATERIALS**

- A. Manufacturers - Gypsum-Based Board:
  - 1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 2. Georgia-Pacific Gypsum: [www.gpgypsum.com](http://www.gpgypsum.com).
  - 3. National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  - 4. USG Corporation: [www.usg.com](http://www.usg.com).
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required within 10 feet of a sink and other plumbing fixtures and within at least 2 feet around and perpendicular to exterior door openings.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
- C. Backing Board For Wet Areas:
  - 1. Application: Surfaces behind tile in wet areas including full length of walls in toilet rooms and vestibule where plumbing fixtures are mounted..
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
- D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
  - 1. Application: Walls and ceilings at toilet rooms and vestibule where there is no plumbing fixture mounted..
  - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 3. Regular Board Thickness: 5/8 inch.
  - 4. Edges: Tapered.
  - 5. Products:



- a. American Gypsum Company; M-Bloc: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
- b. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.
- c. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
- d. Georgia-Pacific Gypsum; DensShield Tile Backer.
- e. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  1. Place continuous bead at perimeter of each layer of gypsum board.
- C. Caulking for Sound Control: Insulate construction with caulk as indicated on Drawings. In addition, caulk penetrations at conduit, pipes, ducts, registers, etc., so that such openings are sealed tight against passage of airborne sound.
  1. Holes smaller than 1" but too large to caulk shall be packed with glass fiber, sealed over with 1/16 inch thick sheet lead and then caulked airtight.
  2. Seal the back of electrical boxes in sound insulated construction airtight using specified resilient sealer pads.
  3. Conceal caulking and sealing where possible; where caulking must remain exposed, use skinning type material and neatly tool.

### **3.03 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Cementitious Backing Board: Install over wood framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Installation on Wood Framing: For nonrated assemblies, install as follows:
  1. Single-Layer Applications: Screw attachment.

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- F. Installation over concrete curbs: adhesive application

### **3.04 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Corner Beads: Install at external corners, using longest practical lengths.
- B. Edge Trim: Install at exposed edges and ends and at untrimmed joints lwhere gypsum board abuts dissimilar materials. Where edge trim is required at wallboard edget, and headers, studs, still or other backing are not available for positive fastening of trim, apply trim to board with contact type adhesive..
- C. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

### **3.05 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

### **3.06 CLEANING**

- A. Do not allow the accumulation of scraps and debris arising from the work of this Section but maintain the premises in a neat and orderly condition. In the event of spilling or splashing compound onto other surfaces, immediately remove the spilled or splashed material and trace residue to the approval of the Architect.

**END OF SECTION**

**Section 09 2216  
Non-Structural Metal Framing**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 5000 - Metal Fabrications: Metal fabrications attached to stud framing.
- B. Section 05 5000 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
- C. Section 06 1000 - Rough Carpentry: Wood blocking within stud framing.
- D. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.

**1.03 REFERENCE STANDARDS**

- A. AISI S201 - IEEE Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers 2009.
- B. AISI S220 - North American Standard for Cold-Formed Steel Framing - Nonstructural Members 2015.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2015.
- E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.

- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
  1. CEMCO; \_\_\_\_: [www.cemcosteel.com/#sle](http://www.cemcosteel.com/#sle).
  2. ClarkDietrich; \_\_\_\_: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  3. Simpson Strong Tie; \_\_\_\_: [www.strongtie.com/#sle](http://www.strongtie.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 FRAMING MATERIALS**

- A. Non-Loadbearing Framing System Components: AISI S220; sheet steel, of size and properties necessary for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
  1. Studs: C-shaped with flat faces.
  2. Studs: C-shaped with triangular-shaped, lipped holes.
  3. Runners: U-shaped, sized to match studs.
- B. Non-Loadbearing Framing Accessories:
  1. Sheet Metal Backing: 0.036 inch thick.
  2. Fasteners: ASTM C1002 self-piercing self-tapping screws.
  3. Anchorage Devices: Powder actuated.
  4. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness \_\_\_\_ inch.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.

### **3.02 INSTALLATION OF STUD FRAMING**

- A. Comply with requirements of AISI S220.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.

- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- D. Align and secure top and bottom runners at 24 inches on center.
- E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- F. Install studs vertically at spacing indicated on drawings.
- G. Align stud web openings horizontally.
- H. Secure studs to tracks using crimping method. Do not weld.
- I. Stud splicing is not permissible.
- J. Fabricate corners using a minimum of three studs.
- K. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- L. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- M. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.
- N. Use sheet metal backing for reinforcement of equipment anchorage.

**END OF SECTION**

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**Section 09 5100  
Acoustical Ceilings**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 6223 - Tubular Skylights
- B. Section 23 0013 - General Mechanical Requirements: Air diffusers in ceiling
- C. Section 26 5100 - Interior Lighting
- D. Section 28 3100 - Fire Alarm and Detection Systems

**1.03 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.
- C. IR 25-2.13 - Metal Suspension System for Lay-In Panel Ceiling 2017.
- D. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

**1.05 SUBMITTALS**

- A. See Section 01 3300 - Submittals for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.

- C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.
- E. Maintenance Materials: Furnish the following for District's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: 80 sq ft of each type and size.

### **1.06 QUALITY ASSURANCE**

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

### **1.07 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.
- B. Before installing canopies, permit them to reach room temperature and a stabilized moisture content.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. USG Corporation; (Basis of design): [www.usg.com](http://www.usg.com).
- B. Suspension Systems:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. USG Corporation; (Basis of design): [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).

### **2.02 ACOUSTICAL UNITS**

- A. Acoustical Panels: Painted mineral fiber, with the following characteristics:
  - 1. Classification: ASTM E1264 Type III.
  - 2. Size: 24 by 24 inches 24 by 24 inches and 24 by 48 inches as depicted on Drawings.
  - 3. Thickness: 3/4 inch.
  - 4. NRC Range: 70, determined in accordance with ASTM E1264.
  - 5. Ceiling Attenuation Class (CAC): 40, determined in accordance with ASTM E1264.
  - 6. Panel Edge: Square.

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7. Suspension System: Exposed
8. Products:
  - a. USG Corporation; Radar Education Acoustical Panels: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).

### **2.03 SUSPENSION SYSTEM(S)**

- A. Exposed Suspension System: Hot-dip galvanized steel grid and cap.
  1. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
  2. Profile: Tee; 15/16 inch face width.
  3. Finish: Baked enamel.
  4. Products:
    - a. USG Corporation; Donn Brand DX/DXL 15/16 inch Acoustical Suspension System: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

### **2.04 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 INSTALLATION - SUSPENSION SYSTEM**

- A. Installation shall be in conformance with IR 25-2.13
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

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- F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- H. Do not eccentrically load system or induce rotation of runners.
- I. Form expansion joints per approved details. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

### **3.03 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

### **3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**

**Section 09 9123  
Interior Painting**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Prime surfaces to receive wall coverings.
  - 3. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Glass.
  - 9. Acoustical materials, unless specifically indicated.
  - 10. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 08 1416 - Wood Doors
- C. Section 09 9113 - Exterior Painting.

### **1.03 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

### **1.04 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

### **1.05 SUBMITTALS**

- A. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
  - 2. Cross-reference to specified paint system products to be used in project; include description of each system.
- B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
  - 2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
  - 3. Allow 30 days for approval process, after receipt of complete samples by Architect.
  - 4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as factory finished metals and wood cabinets, have been approved.
- C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.08 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 fc measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer.
- B. Paints:
  - 1. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Substitutions: Specified products are District standard - no substitutions.

### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: See Section 01 6116.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.

1. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to District.
2. Extend colors and sheens to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

### **2.03 INTERIOR SCHEDULE - NEW CONSTRUCTION**

- A. Drywall - walls & ceilings - all areas:
  1. 1st Coat: Pro Mar 200 VOC Interior Acrylic Primer B28W2600.
  2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
  3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
- B. Ferrous Metal - doors & frames and miscellaneous ferrous metal:
  1. 1st Coat: Shop applied primer.
  2. 2nd Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
  3. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
  4. 4th Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
- C. Galvanized metal - only paint metal 8' and above:
  1. Pretreatment: Jasco Metal Prep & Primer.
  2. 1st Coat: Pro-Cryl Universal Acrylic Metal Primer B66W310 Series.
  3. 2nd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
  4. 3rd Coat: Sher-Cryl HPA Acrylic Semi-Gloss Coating B66W351 Series.
- D. Concrete:
  1. 1st Coat: Loxon Int/Ext Acrylic Masonry Primer A24W8300.
  2. 2nd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
  3. 3rd Coat: Pro Mar 200 0 VOC Interior Acrylic Semi-Gloss Enamel B31W2651 Series.
- E. Concrete - floors at utility closets:
  1. 1st Coat: Macropoxy 646 Fast Cure Epoxy B58W610/B58V600 Series.
  2. 2nd Coat: Macropoxy 646 Fast Cure Epoxy B58W610/b58V600 Series.
- F. Wood - paint-grade:
  1. 1st Coat: Premium Interior Acrylic Wall & Wood Primer B28W8111.
  2. 2nd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.
  3. 3rd Coat: Pro Classic Interior Acrylic Semi-Gloss Enamel B31W1151 Series.

### **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
  - 1. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- F. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- G. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- H. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**END OF SECTION**



**Section 10 1400**

**Signage**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Room identification signs
- B. Restroom door signs

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry

**1.03 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. CBC Chapter 11B - California Building Code - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing 2022.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- E. NFPA 170 - Standard for Fire Safety and Emergency Symbols 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Shop Drawings and Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from District through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by District through Architect prior to fabrication.

- D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: Submit samples showing colors specified.

### **1.05 QUALITY ASSURANCE**

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

### **1.07 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Flat Signs:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com](http://www.bestsigns.com). Basis of Design
  - 2. Mohawk Sign Systems, Inc: [www.mohawksign.com/#sle](http://www.mohawksign.com/#sle).
  - 3. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).
- B. Dimensional Letter Signs:
  - 1. Cosco Industries; Cast Aluminum: [www.coscoarchitecturalsigns.com](http://www.coscoarchitecturalsigns.com)
  - 2. A.R.K. Ramos; Cast Aluminum: [www.arkramos.com](http://www.arkramos.com)

### **2.02 SIGNAGE APPLICATIONS**

- A. Accessibility Compliance: Signs are required to comply with CBC Chapter 11B, ADA Standards, and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room Identification Signs: As indicated on drawings
  - 1. Sign Type: Flat signs with applied character panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 5/8 inch.

4. Sign Height: 4 inches, unless otherwise indicated.
  5. Classrooms: Identify with the room numbers indicated on drawings.
  6. Restrooms: Identify as "ALL-GENDER", and duplicate in braille.
- C. Restroom Door Plaques: Provide superimposed geometric symbols that comply with applicable requirements of CBC 11B-703.7.2.6 and as indicated on drawings.
1. Sign Type: Laminated colored acrylic
  2. Non-tactile sign

### **2.03 SIGN TYPES**

- A. Flat Signs: Signage media without frame.
1. Edges: Square.
  2. Corners: Radiused.
  3. Wall Mounting of One-Sided Signs: Stainless steel vandal-proof pin-in-head torx screw surface mounted to wall with concealed anchors.
- B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
  2. Character Case: Upper case only.
  3. Background Color: As scheduled.
  4. Character Color: White color.

### **2.04 TACTILE SIGNAGE MEDIA**

- A. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
1. Total Thickness: 1/8 inch.
  2. Letter Thickness: 1/8 inch.
  3. Letter Edges: Square.

### **2.05 NON-TACTILE SIGNAGE MEDIA**

- A. Color coated acrylic plastic sheet: Use nonfading colored coatings recommended by acrylic manufacturer for optimum adherence to surface.
1. Sign Color: #204 Bright White circle; #902 Pine Green triangle
  2. Thickness: 1/4" thick triangle superimposed on a 1/4" thick circle

### **2.06 ACCESSORIES**

- A. Exposed Screws: Stainless steel.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with CBC Chapter 11B, ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**3.03 FIELD INSPECTION**

- A. Per CBC Chapter 11B signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per Chapter 1, Division II, Section 111, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.

**END OF SECTION**

**Section 10 4400  
Fire Protection Specialties**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Roughed in wall openings

**1.03 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3300 - Submittals, for submittal procedures.
- B. Product Data: Provide extinguisher ratings and classifications and color and finish.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Larsen's Manufacturing Co; MP5 - Basis of Design: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Potter-Roemer; 3005: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
- B. Fire Extinguisher Cabinets and Accessories:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Academy Series : [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).

2. Larsen's Manufacturing Co; Architectural Series - Basis of Design  
: www.larsensmfg.com.
  3. Potter-Roemer; Alta Series #7042: www.potterroemer.com.
- C. Fire extinguishers and cabinets shall be furnished from single manufacturer.
- D. Cabinets shall meet CBC requirements for mounting height and projection from wall.

## **2.02 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Stored Pressure Operated: Deep Drawn.
  2. Class: A:B:C type.
  3. Size: 5 pound.
  4. Finish: Baked polyester powder coat red color.
  5. Model: MP5 as manufactured by Larsen's
  6. Temperature range: Minus 40 degrees F to 120 degrees F.

## **2.03 FIRE EXTINGUISHER CABINETS**

- A. Cabinet Configuration: Semi-recessed type.
1. Size to accommodate accessories.
  2. Trim: 2-1/2" Rolled edge
- B. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- C. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- D. Finish of Cabinet Exterior Trim and Door: clear anodized.
- E. Finish of Cabinet Interior: Clear anodized aluminum.
- F. Lettering: Vertical, Red
- G. Model: Larsen's Architectural Series AL 2409-6R Vertical Duo

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify rough openings for cabinet are correctly sized and located.

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**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, maximum 48" inches from finished floor to top of cabinet pull handle.

**END OF SECTION**

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**Section 12 3600**

**Countertops**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

**1.02 DESCRIPTION OF WORK**

- A. Replacement of existing classroom cabinet, sink, and countertop.

**1.03 RELATED REQUIREMENTS**

- A. Section 06 4100 - Architectural Wood Casework.
- B. Section 22 4000 - Plumbing Fixtures: Sinks.

**1.04 REFERENCE STANDARDS**

- A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2014.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. California Green Building Code 2022 Residential Mandatory Measures; Section 4.504 Pollution Control.
- D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168 Adhesive and Sealant Applications; current edition; [www.aqmd.gov](http://www.aqmd.gov).
- E. PS 1 - Structural Plywood 2019.

**1.05 SUBMITTALS**

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- B. Verification Samples: For each finish product specified, minimum size 3 inches square, representing actual product, color, and patterns.

- C. Materials must be compliant with the VOC restrictions of California Green Building Standards Code, Section 4.504
  - 1. Adhesive, adhesive bonding primers, adhesive primer, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rule where applicable or SQAQMD Rule 1168 VOC limits, as shown in Table 4.504.1 or 4.504.2, as applicable. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene), except for aerosol products, as specified in subsection 2 below.
  - 2. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than 1 pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of *California Code of Regulations*, Title 17, commencing with Section 94507.

## **1.06 QUALITY ASSURANCE**

- A. A. Fabricator and Installer Qualifications: Minimum [2] years experience in work of this Section.

## **1.07 FIELD CONDITIONS**

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

## **PART 2 PRODUCTS**

### **2.01 COUNTERTOPS**

- A. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
  - 1. Flat Surface Thickness: 1 inch, nominal.
  - 2. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
  - 3. Surface Finish: Smooth, non-glare.
  - 4. Color: Black.
  - 5. Exposed Edge Shape: 3/16 inch radius corner.
  - 6. Back and End Splashes: Same material, same thickness; separate for field attachment.

### **2.02 ACCESSORY MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

### **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches, unless otherwise indicated.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Plumber to provide cut out templates and countertop fabricator to prepare cut out for sink, whether rim set or bottom mounted, as well as fixtures.

### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach epoxy resin countertops using compatible adhesive.
- C. Seal joint between back/end splashes and vertical surfaces.

**3.04 CLEANING**

- A. Clean countertops surfaces thoroughly.

**3.05 PROTECTION**

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

**END OF SECTION**

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**Section 22 0500  
Common Work Results for Plumbing**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Basic Mechanical Requirements specifically applicable to Division 22 Sections, in addition to the general requirements.
- B. Plumbing work includes the following: furnish and install all piping and plumbing fixtures shown on the plumbing, mechanical, and architectural drawings described in these specifications. In connection with this work, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said systems properly and safely operable, including, but not limited to, support hardware, insulation, valves, flashing, cleanouts, cutting and patching.

**1.02 WORK SEQUENCE**

- A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.
- B. Coordinate related work and modify surrounding work as required.

**1.03 SUBMITTALS**

- A. Submit on the following:
  - 1. All pipe, fittings, insulation, hangers and supports, labels, fixtures, adhesives and sealants, and equipment that is planned to be installed on this project.
- B. Proposed Products List: Include Products specified in the following Sections:
  - 1. Division 22 - Plumbing.
  - 2. Project Drawings.
- C. Submit product data grouped to include complete submittals of related systems, products, and accessories in a single submittal bound in a three ring binder with table of contents and section tabs. See General Conditions and other sections for additional submittal requirements. Submittals shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.
- D. Equipment and materials shall be ordered only after satisfactory review by Architect and Engineer.
- E. The following statement applies to all items reviewed: "Checking is only for general conformance with the design concept of the project and general compliance with the

information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work.”

- F. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.
- G. The first submittal shall be comprehensive and complete. Partial submittals will be returned without review.

#### **1.04 REGULATORY REQUIREMENTS**

- A. Conform to 2022 California Building Code.
- B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.
- C. Plumbing: Conform to 2022 California Plumbing Code.
- D. Mechanical: Conform to 2022 California Mechanical Code.
- E. Electrical: Conform to 2022 California Electrical Code.
- F. Obtain approved inspections from authority having jurisdiction.
- G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

#### **1.05 PROJECT / SITE CONDITIONS**

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of Owner before proceeding.
- C. Piping Locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes.
- D. Construction Observation: In addition to the requirement for obtaining inspections by the local jurisdiction, Contractor shall notify Engineer and commissioning agent at appropriate times during the construction process so that they can visit site to become generally familiar with the progress and quality of Contractor’s work and to determine if the work is proceeding in general accordance with the contract documents.

- E. Scaling of Drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime Contractor shall request in writing that the Architect or the Engineer provide clarification or the specific dimension.

#### **1.06 QUALITY ASSURANCE**

- A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.
- B. Qualification of Installer: Use adequate number of skilled workmen, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.
- C. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power-using equipment shall meet the California energy efficiency standards as defined in the current Title 24 requirements.
- D. Welding procedures and testing shall comply with ANSI Standard B31.1.0 standard code for pressure piping and the American Welding Society – Welding Handbook. Welding shall also comply with Division of the State Architect and structural plan requirements for materials, procedures, qualifications, and inspections.

#### **1.07 DRAWINGS AND SPECIFICATIONS**

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, the contractor shall immediately and before commencing work, request clarification from Engineer.
- B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and the sufficiency of the materials and workmanship furnished there under shall be accepted as final and conclusive.
- C. In case of conflicts not clarified prior to bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award, and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

## **1.08 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- 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**

### **2.01 PRODUCTS**

- A. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- B. Provide products and materials that are new, clean, free from defects, damage, and corrosion.
- C. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.
- D. Protect materials stored at site and installed from damage. Verify dimensions of equipment and fixtures prior to ordering. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.
- B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences. Provide offsets as needed to avoid other trades.



1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
2. Provide offsets, transitions, and changes in directions of pipes as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required. It is the intent of this paragraph that all cost associated with compliance be borne by the contractor.
3. All equipment shall be firmly anchored to building structural elements per DSA approved plans.
4. Carefully check space requirements with other trades and existing conditions to ensure material, fixtures or equipment can be installed in the spaces allotted. Coordination is required and essential.

### **3.2 FIRESTOPPING**

- A. Firestop all penetrations of rated elements with approved firestop material such as Hilti FS-1 per manufacturer's plates. Provide plates to project inspector prior to installation.

**END OF SECTION**

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**Section 22 0510  
Plumbing Piping**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings, notes, and general provisions of the Contract, including General and Supplemental Conditions apply to this section.

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Pipe and fittings for domestic water, waste, and vent.
  - 2. Escutcheons.
  - 3. Cleanouts.
  - 4. Vandal-proof vent caps.
  - 5. Supply tubes.

**1.03 REFERENCES**

- A. ANSI B31.9 - Building Service Piping.
- B. ASME B16.3 - Malleable Iron Threaded Fittings.
- C. ASME B16.22 - Wrought Copper and Bronze Solder-Joint Pressure Fittings.
- D. ASTM A47 - Ferritic Malleable Iron Castings.
- E. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- F. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- G. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.
- H. ASTM B32 - Solder Metal.
- I. ASTM B88 - Seamless Copper Water Tube.
- J. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- K. ASTM D1785 - Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- L. ASTM D2241 - Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- M. ASTM D2466 - Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

- N. ASTM D2564 - Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
- O. ASTM D2855 - Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings.
- P. ASTM D3034 - Poly Vinyl Chloride (PVC) Plastic Sewer Pipe SDR-35.
- Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.
- S. ASTM D2513 - SDR11.5 Polyethylene Gas Pipe.

**1.04 SUBMITTALS**

- A. Product Data: For the following products:
  - 1. Piping and fittings.
  - 2. Escutcheons.
  - 3. Cleanouts.
  - 4. Vandal-proof vent caps.
  - 5. Supply tubes.
- B. Project Record Documents
  - 1. Submit the following:
  - 2. Record actual locations of valves and piping.
- C. Operation and Maintenance Data
  - 1. Submit the following:
  - 2. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

**1.05 REGULATORY REQUIREMENTS**

- A. Perform Work in accordance with 2022 California plumbing code.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of the general requirements.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## **PART 2 - PRODUCTS**

### **2.01 DOMESTIC WATER PIPING, ABOVE GROUND**

- A. Hard Copper Tube: ASTM B88, Type L water tube, drawn temper. US – Manufactured.
  - 1. Wrought-copper solder-joint fittings: ASME B16.22, wrought-copper pressure fittings, with lead-free solder.
  - 2. Bronze Flanges: ASME B16.24, class 150, with solder-joint ends.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

### **2.02 SANITARY WASTE AND VENT PIPING**

- A. Hubless cast-iron pipe and fittings: ASTM A888 or CISPI 301. US – Manufactured.
- B. All sewer and vent piping within building and out 5 feet beyond the building shall be no-hub cast iron.
- C. Standard shielded couplings, stainless steel: CISPI 310.
- D. Heavy-duty couplings, stainless steel: ASTM C564. Use four-band clamps at all rainwater piping.
- E. All cast-iron pipe and fittings shall be manufactured in the U.S.
- F. Minimum slope ¼” per foot to drain with no bellies in piping. All underground waste piping shall be installed per details on plumbing and structural drawings.

### **2.03 ESCUTCHEONS**

- A. Escutcheons for water and waste piping penetrations.
  - 1. Manufacturers: subject to compliance with requirements, provide products by the following: Brasscraft.
  - 2. Description: chrome-plated cast brass with set screws.

### **2.04 CLEANOUTS**

- A. Cleanouts for waste piping.
  - 1. Manufacturers: subject to compliance with requirements, provide products by one of the following:
    - a. J.R. Smith

b. Zurn.

2. Description: cast-iron with threaded bronze plug. 18 gage stainless cover with vandal-proof screws for wall cleanout. Polished brass non-slip cover for floor cleanout.

## **2.05 VANDAL-PROOF VENT CAPS**

A. Vandal-proof vent caps

1. Manufacturers: subject to compliance with requirements, provide products by one of the following:
  - a. J.R. Smith
  - b. Zurn.
2. Description: cast-iron dome secured with recessed Allen Key Set screws.

## **2.06 SUPPLY TUBES**

A. Supply tubes:

1. Manufacturers: subject to compliance with requirements, provide products by the following:
  - a. Brasscraft.
  - b. No-Burst.
2. Description: braided stainless steel, 1/2" FIP x 1/2" compression.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### **3.02 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### **3.03 INSTALLATION**

- A. Install in accordance with Manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Establish elevations of buried piping outside the building to ensure not less than 30 inch of cover. Exception: Localized areas may be 18" deep to accommodate existing conditions.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.
- M. Excavate in accordance with this Section for work of this Section.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Seal all penetrations through exterior walls and fire rated walls with 3M Firestopping materials for fire rating capacity per the architectural plans and UBC requirements.
- Q. Test all piping per 2022 California Plumbing Code Requirements.
- R. Disinfect all water piping per AWWA requirements
  - 1. Acceptable Disinfectants
    - a. Sodium Hypochlorite
    - b. Calcium Hypochlorite.
  - 2. Flush system prior to disinfection. Provide connections for adding solution. Add solution to bring system to 25 PPM for 24 hours. Neutralize solution prior to dumping to sewer.
  - 3. Testing Requirements for demonstration of compliance with the Maximum Containment Level (MCLs) of the Safe Drinking Water Act:

- a. Total chlorine concentration of less than 1 mg/L (1 ppm) or incoming water concentration, whichever is greater.
  - b. The absence of any coliform bacteria.
  - c. Less than 200 non-coliform bacteria per 100 mL sample
  - d. Test out all drinking fountains and one sink / lav at each building. Sample shall be taken per lab requirements.
4. Repeat disinfection if test results are not satisfactory.
- S. As-built locations of pipe with dimensions from easily identified building elements.

### **3.04 APPLICATION**

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

### **3.05 ERECTION TOLERANCES**

- A. Establish invert elevations, slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.
- B. Slope water piping and arrange to drain at low points.

**END OF SECTION**



**Section 22 0523  
General-Duty Valves for Plumbing Piping**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Brass angle stops.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

**1.03 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

**1.04 SUBMITTALS**

- A. Product Data: For each type of valve indicated.

**1.05 QUALITY ASSURANCE**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.1 for power piping valves.
  3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- D. Lead-free construction per California requirements.

## **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
  2. Protect threads, flange faces, grooves, and weld ends.
  3. Set angle, gate, and globe valves closed to prevent rattling.
  4. Set ball and plug valves open to minimize exposure of functional surfaces.
  5. Set butterfly valves closed or slightly open.
  6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
  2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL REQUIREMENTS FOR VALVES**

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- E. Valve-End Connections:
1. Flanged: With flanges according to ASME B16.1 for iron valves.
  2. Grooved: With grooves according to AWWA C606.

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3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

## **2.02 BRASS ANGLE STOPS**

- A. Brass angle stops, heavy pattern.
  1. Subject to compliance with requirements, provide products by the following:
    - a. Brasscraft.
    - b. Chicago Faucet.
  2. Description: Lead-Free, heavy pattern, angle, ½” FIP inlet x ½” compression, loose key.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### **3.02 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

**3.03 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Domestic Water Shutoff Service: Ball valves.
  - 2. Throttling Service: Globe valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, 2" and Smaller: Soldered ends.
  - 2. For Copper Tubing, 2-1/2" to NPS 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Steel Piping, 2-1/2" and Smaller: Threaded ends.
  - 4. For Steel Piping, 2-1/2" TO 4". Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 5. For Steel Piping, NPS 5 and Larger: Flanged ends.

**END OF SECTION**

**Section 22 0529  
Hangers and Supports for Plumbing Piping and Equipment**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.

**1.03 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.04 PERFORMANCE REQUIREMENTS**

- A. Equipment supports shall be capable of supporting combined operating weight of supported equipment and connected systems and components.
- B. Design seismic-restraint hangers and supports for piping and equipment per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is "A."
- C. All exterior steel support components shall be hot-dipped galvanized. All welds shall be ground smooth and painted with three coats of zinc-rich paint.

**1.05 SUBMITTALS**

- A. Product Data: For the following:
    - 1. Steel pipe hangers and supports.
    - 2. Thermal-hanger shield inserts.
    - 3. Mechanical fastener systems.
    - 4. Pipe positioning systems.
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5. Trapeze pipe hangers. Include Product Data for components.
6. Metal framing systems. Include Product Data for components.
7. Pipe stands. Include Product Data for components.
8. Equipment supports.

B. Welding certificates.

## **1.06 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel." Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.2, "Structural Welding Code--Aluminum."
  3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  4. ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
  2. ERICO/Michigan Hanger Co.
  3. Unistrut
  4. Superstrut
- C. Galvanized, Metallic Coatings: Hot dipped.
- D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### **2.03 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.
1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.

- b. Unistrut Corp.; Tyco International, Ltd.

#### **2.04 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. Power-Strut Div.; Tyco International, Ltd.
  - 4. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated. Exterior components shall be hot-dipped galvanized.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

#### **2.05 THERMAL-HANGER SHIELD INSERTS**

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- E. Provide submittal.

#### **2.06 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated (interior use) Type 304 stainless steel (exterior use), for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Anchor must have ICC report. Provide report with submittal and one copy to the inspector. See State Architect Requirements for testing.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Or equal.
- C. Pre- placed concrete inserts

1. Manufacturers:
  - a. B-Line Systems, Inc.; a division of Cooper Industries.
  - b. or equal.

## **2.07 PIPE STAND FABRICATION**

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. See plans for details.
- B. All exterior steel supports shall be hot dipped galvanized.
- C. No piping supports shall be mounted directly on roof membrane.

## **2.08 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## **2.09 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel supports shall be hot dipped galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.01 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.



### **3.02 HANGER AND SUPPORT INSTALLATION**

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install concrete inserts prior to concrete placement per manufacturer's listing.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
- G. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface.
- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install lateral bracing with pipe hangers and supports to prevent swaying.
- L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

- N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- O. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  - 4. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.03 EQUIPMENT SUPPORTS**

- A. Provide 20 gauge sheet metal backing as needed to support equipment and fixture.

### **3.04 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports or 4x between framing with Simpson A-34 clips at each side, both ends..
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### **3.05 ADJUSTING & PERSONNEL PROTECTION**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1/2 inches below nut.
- C. Provide personnel protection at mechanical rooms, equipment areas and any equipment maintenance area from strut and threaded rods ends. Install soft protective materials to prevent skin and skull injuries. Install protection as soon as practicable after installation.

**3.06 PAINTING**

- A. Touch Up: Clean and touch up painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

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**Section 22 4000  
Plumbing Fixtures and Equipment**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following plumbing fixtures, equipment, and related components:

- 1. Sink.

**1.03 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

**1.04 SUBMITTALS**

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

- B. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- C. Warranty: Special warranty specified in this Section.

**1.05 QUALITY ASSURANCE**

- A. Accessible Plumbing Fixture Regulatory Requirements: Accessible plumbing fixtures shall comply with all of the requirements of 2022 CBC Chapter 11B.
- B. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in 2022 CEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Vitreous-China Fixtures: ASME A112.19.2M.
  - 3. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  - 1. Faucets: ASME A112.18.1.
  - 2. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  - 3. NSF Potable-Water Materials: NSF 61.
  - 4. Pipe Threads: ASME B1.20.1.
  - 5. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  - 6. Supply Fittings: ASME A112.18.1.

7. Brass Waste Fittings: ASME A112.18.2.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  1. Brass Waste Fittings: ASME A112.18.2.
  2. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  1. Flexible Water Connectors: ASME A112.18.6.
  2. Floor Drains: ASME A112.6.3.
  3. Hose-Coupling Threads: ASME B1.20.7.
  4. Hot-Water Dispensers: ASSE 1023 and UL 499.
  5. Off-Floor Fixture Supports: ASME A112.6.1M.
  6. Pipe Threads: ASME B1.20.1.
  7. Plastic Toilet Seats: ANSI Z124.5.
- L. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **PART 2 - PRODUCTS**

### **2.01 SINK**

- A. Sink:
  1. Manufacturers: subject to compliance with requirements, provide products by the following:
    - a. Elkay
  2. Description: Single bowl, 18 Ga. 304 stainless steel.
    - a. Type: drop-in.
    - b. Faucet Hole Punching: 4-inch centers.
    - c. With strainers, tailpieces, traps, and insulation.
    - d. ADA compliant.

### **2.02 FAUCET**

- A. Faucet:
  1. Manufacturers: subject to compliance with requirements, provide products by the following:
    - a. Chicago Faucet

### **2.03 PROTECTIVE SHIELDING COVERS**

- A. Protective Shielding Pipe Covers:
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Truebro Guard.

**2.04 DRINKING FOUNTAIN**

- A. DRINKING FOUNTAIN:
  - 1. Manufacturers: subject to compliance with requirements, provide products by the following:
    - a. Elkay
  - 2. Description: Bi-level, stainless steel.
    - a. Type: wall mount.
    - b. Bubbler: Vandal resistant, mechanical front bubbler button.
    - c. ADA compliant.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install fixtures level and plumb according to roughing-in drawings.
- C. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- D. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- E. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
- F. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- G. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."



1. All sealants and adhesives to be field-applied, within the building envelope must comply with VOC limits in Division 01 Section "Indoor Air Quality (IAQ) Management".

### **3.03 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

**END OF SECTION**

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**Section 23 0500  
Common Work Results for HVAC**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Basic Mechanical Requirements specifically applicable to Division 23 Sections, in addition to the General Requirements.
- B. Mechanical work includes the following: furnish and install all mechanical equipment shown on the mechanical, plumbing, architectural, electrical, and civil engineering drawings and described in these specifications. Contractor shall furnish and install, make operable, and test all mechanical equipment shown on the plans. In connection therewith, contractor shall also furnish and install all necessary work, devices, hardware and systems required to make said equipment properly and safely operable, including but not limited to, mounting hardware and framing, insulation, vibration control devices, duct systems, flashing, piping, valves, systems, energy management systems, cutting and patching.

**1.02 WORK SEQUENCE**

- A. Install work in phases to accommodate Owner's construction requirements. Refer to Architectural, Structural, Civil, and Electrical Drawings for the construction details and coordinate the work of this division with that of other divisions. Order the work of this division so that progress will harmonize with that of other divisions and all work will proceed expeditiously. During the construction period, coordinate mechanical schedule and operations with General Contractor and any other related subcontractor.

**1.03 ALTERNATES**

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work as required.

**1.04 SUBMITTALS**

- A. Submit the following:
- B. Proposed Products List: Include Products specified in the following Sections:
  - 1. Section 23 - Mechanical.
  - 2. Project Drawings
- C. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal. Submittals shall be specific to the

fixtures/device/unit being submitted; the data shall be highlighted or marked to be quite clear as to the fixtures/devices/units that shall be provided.

- D. Equipment and materials shall be ordered only after satisfactory review by Owner and Engineer.
- E. The following statement applies to all items reviewed. "Checking is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for dimensions which shall be confirmed at the job site; fabrication processes and techniques of construction; coordination of his work with that of other trades; and the satisfactory performance of his work."
- F. Contractor shall clearly mark the submittal sheet as to which model number, size, color, etc. when there is more than one choice available.
- G. Maintain a complete set of the most current reviewed submittal and shop drawings on site during construction.
- H. Submittals shall have table of contents organized by specification section and shall clearly identify electrical characteristics, options provided, color, model number and equipment tag as indicated on the drawings.

#### **1.05 REGULATORY REQUIREMENTS**

- A. Conform to 2022 California Building Code.
- B. Fire Protection: Conform to 2022 California Fire Code, and California State Fire Marshall Regulations, Title 19, Public Safety.
- C. Plumbing: Conform to 2022 California Plumbing Code.
- D. Mechanical: Conform to 2022 California Mechanical Code.
- E. Electrical: Conform to 2022 California Electrical Code.
- F. Obtain approved inspections from authority having jurisdiction.
- G. Conflicts: Where conflict or variation exists amongst Codes, the most stringent shall govern.

#### **1.06 PROJECT/SITE CONDITIONS**

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of owner before proceeding.

- C. Piping locations: Piping locations shown are diagrammatic only. Contractor shall verify locations of all lateral stubs, offsets, etc. required in the field. The actual locations of lines, cleanouts and connections may vary provided that complete systems are installed in compliance with codes. It is not the intent of the drawings to show necessary offsets required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.
- D. Construction observation: In addition to the requirement for obtaining inspections by the local jurisdiction, contractor shall notify Engineer at appropriate times during the construction process so that Engineer can visit site to become generally familiar with the progress and quality of contractor's work and to determine if the work is proceeding in general accordance with the contract documents.
- E. Scaling of drawings: In no case shall working dimensions be scaled from plans, sections, or details from the working drawings. If no dimension is shown on the architectural drawings, the prime contractor shall request in writing that the architect or engineer provide clarification or the specific dimension.
- F. As equal: For an item to be substituted "as equal" the contractor must provide to the engineer a complete submittal no later than 7 days prior to the bid opening. Contractor shall be responsible for any cost associated with the change including architectural design, mechanical, structural and electrical engineering and changes in any element of the building.
- G. Unit and duct locations: Heating and air conditioning unit and duct locations shown are approximate only. Contractor shall verify locations of all structural members, other trades, and existing conditions in the field, and locate units and ductwork to avoid interference. All clearances required by unit manufacturer shall be maintained. Entire installation shall be in accordance with codes and the recommended installation procedures published by the manufacturers. It is not the intent of the drawings to show necessary offsets and transitions required to avoid structure or other trades. It is the intent of this paragraph that all costs associated with this paragraph be borne by the contractor.
- H. Contractor will verify with owner and site conditions the exact existing roofing system in place and provide compatible roofing materials and products. Contractor to provide written statement regarding existing roofing system and proposed roofing system and provide manufacturer information prior to procurement and installation.
- I. Proceed with roofing work only when existing and forecasted weather conditions will permit a unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.
- J. Flashings and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Complete flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- K. Patching Materials, General: As required for original installation and to match surrounding construction.

1. Contractor shall provide same products or types of construction as that in existing structure, as needed to patch, extend or match existing.
  2. Generally, the Contract Documents will not define products or standards of workmanship present in existing construction. Contractor shall determine products by inspection and necessary testing and determine quality of workmanship by using existing as a sample for comparison.
  3. The presence of a product, finish, or type of construction requires that patching, extending or matching shall be performed as necessary to make work complete and consistent with identical standards of quality.
- L. Patching of Building Finish Materials: Contractor shall match existing products and finishes. Contractor shall confirm colors, patterns, and textures with Architect/Owner. The contractor shall custom cut new materials to fit and to match joint patterns with existing materials. The contractor shall custom cut new materials to size to match existing constructions.
- M. Patching of Roof: Contractor shall patch and match existing adjacent surface. Where penetrations have occurred to finish surface to remain, contractor shall patch penetrations and repair. Restore exposed finishes of patch areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing. All shall be performed by a licensed roofing contractor.

#### **1.07 QUALITY ASSURANCE**

- A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.
- B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications. Engage an experienced installer to perform work who has specialized in installing roofing similar to that required for this project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the standard roofing manufacturer's warranty.
- C. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- D. Provide products and materials that are new, clean, free from defects, damage, and corrosion.
- E. Provide name/data plates on major components with manufacturer's name, model number, serial number, date of manufacturer, capacity data, and electrical characteristics permanently attached in a conspicuous location on the equipment.
- F. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards. Power using equipment shall be meet the California energy efficiency standards as defined in the current Title 24 requirements.

#### **1.08 DRAWINGS AND SPECIFICATIONS**

- A. Drawings and specifications are intended to complement each other. Where a conflict exists between the requirements of the drawings and/or specifications, immediately and before commencing work, request clarification from Engineer.
- B. The Engineer shall interpret the drawings and the specifications, and the Engineer's decision as to the true intent and meaning thereof and the quality, quantity, and sufficiency of the materials and workmanship furnished thereunder shall be accepted as final and conclusive.
- C. In case of conflicts not clarified prior to Bidding deadline, use the most costly alternative (better quality, greater quantity, or larger size) in preparing the Bid. A clarification will be issued to the successful Bidder as soon as feasible after the Award and if appropriate a deductive change order will be issued.
- D. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".
- E. Examine and compare the contract drawings and specifications with the drawings and specifications of other trades. Report any discrepancies to the architect. Install and coordinate the work in cooperation with the other trades.

**PART 2 – NOT USED**

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install all equipment per the manufacturer's instructions for installing, connecting, and adjusting. A copy of the instructions shall be kept at the equipment during installation and provided to the engineer at his/her request.
- B. Adjust pipes, ducts, panels, equipment, etc., to accommodate the work to prevent interferences.
  - 1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. Lines whose elevations cannot change have right-of-way over lines whose elevations can be changed.
  - 2. Provide offsets, transitions, and changes in directions of pipes and ducts as required to maintain proper head room and pitch on sloping lines. Provide traps, air vents, drains, etc., as required.
- C. All equipment shall be firmly anchored to building structural elements.
- D. Install all equipment to permit proper service of equipment. Arrange pipes, ducts, conduits, etc to allow accessibility to equipment.
- E. Do not install equipment, pipes, or ducts above electrical room

- F. Install accessible plumbing fixtures at height shown on architectural drawings. Report any discrepancies or layout issues to Architect promptly.

### **3.02 COORDINATION OF WORK**

- A. The contract documents establish scope, materials, and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. The contract documents show the general arrangement of equipment, ductwork, piping, and accessories. Provide offsets, fittings, and accessories which may be required but are not shown on the drawings. Investigate the site and review the other trades installation locations and requirements to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- C. Whenever work interconnects with the work of other trades, coordinate to insure that all parties concerned have the necessary information required for a proper installation.
- D. Provide access doors as required to allow service and accessibility to valves, dampers, coils, etc. Install fire rated access doors in rated assemblies. Coordinate with framing and ceiling contractors.
- E. Furnish and set sleeves for passage of pipes, ducts, and conduits that pass through structural masonry and concrete walls, roofs, floors and elsewhere as required for the proper protection of each item passing through the building elements. See structural drawings for further details.
- F. Install UL Approved firestopping around all pipes, conduits, ducts, etc which pass through rated walls, partitions, and floors in strict accordance with manufacturer's listing and element rating.

### **3.03 OPERATING INSTRUCTIONS AND OPERATOR TRAINING**

- A. Provide two copies of all operating and maintenance manuals to owner. Include parts lists and suppliers' names and phone numbers.
- B. Provide four hours of training to the owner for the proper operation (start-up, operation, and shutdown) and servicing of the installed equipment. Provide three weeks notice to the owner and engineer of the date of the training. Arrange for subcontractors to attend and participate where applicable.

### **3.04 RECORD DRAWINGS**

- A. Maintain on a daily basis at the project site a complete set of record drawings reflecting an accurate dimensional record of all deviations between work shown on the drawing and that actually installed.
- B. Show any changes to specified equipment such as manufacturer, voltage, model number, capacity, etc. on record drawings.



- C. Provide two reproducible copies of the record drawing to the owner.

**3.05 COMMISSIONING**

- A. At the conclusion of the installation the contractor shall convene a pre-commissioning meeting to review the implementation of the commissioning process.
- B. Contractor shall verify that all building services, gas, electric, water, sewer, and information technologies are functional prior to beginning commissioning.
- C. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the owner will exercise right to correct the Work under terms of the Construction of the Contract.
- D. The commissioning team shall comprise the general, mechanical, electrical, controls and plumbing contractors, the project manager, test and balance company, and the mechanical engineer. Provide sample forms for review to the mechanical engineer prior at pre-commissioning meeting.
- E. The commissioning process shall be including function testing all equipment, controls, natural gas, and electrical systems. All testing shall be documented in an item by item report with dates of test, test parameters and results.
- F. Provide commissioning report to project manager within two weeks of completion.

**END OF SECTION**

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**Section 23 0529  
Hangers and Supports for HVAC Equipment**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
  - 1. Metal framing systems.
  - 2. Fastener systems.
  - 3. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

**1.03 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.04 PERFORMANCE REQUIREMENTS**

- A. Design seismic-restraint hangers and supports for piping and equipment per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Hazard level is "A."

**1.05 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Strut and fittings.
  - 2. Fasteners.

**1.06 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 5. ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.02 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-Line Systems, Inc.; A Division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Refrigerant Pipe Support Options:
  - 1. EPDM clamp insert at all pipe clamps at refrigerant piping.
  - 2. Strut Mount Insulation Couplings (Hydra Zorb Klo Shure 7 Series or similar)

### **2.03 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### **2.04 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: At Interior - Manufacturer's standard finish – At exterior - Hot dipped galvanized.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## **2.05 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type interior/exterior steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. Install per ICC listing.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Hilti, Inc.
  - b. ITW Ramset/Red Head.
- C. Wood Screws for secure pipe and duct supports to wood structure
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Simpson SDS Screws
    - b. or equal with self drilling feature and ICC report
- D. Sheet Metal Screws
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. TEK Screws
    - b. or equal with self drilling feature and ICC report

## **2.06 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## **2.07 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized. All exterior steel shall be hot dipped aluminized.

## **PART 3 - EXECUTION**

### **3.01 HANGER AND SUPPORT APPLICATIONS**

- A. Use hangers and supports with hot dipped galvanized, at exterior locations.
- B. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
  - 1. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- C. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:
  - 1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- D. Use mechanical-expansion anchors where required in concrete construction.

### **3.02 HANGER AND SUPPORT INSTALLATION**

- A. Steel Pipe Hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

- F. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. All pipes and ducts shall be braced per 2008 SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems. Seismic hazard level is “A”.

### **3.03 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Provide lateral bracing, to prevent swaying, for equipment supports.
- C. Anchor all equipment to resist seismic motion.

### **3.04 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### **3.05 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.06 PAINTING**

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. If material is galvanized spray with cold galvanizing.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply three coats of galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**



**Section 23 0593**  
**Testing, Adjusting, and Balancing for HVAC**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.

**1.03 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, Adjusting, and Balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

**1.04 SUBMITTALS**

- A. Certified TAB reports.
- B. Sample report forms.
- C. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

## **1.05 QUALITY ASSURANCE**

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.
- B. TAB Conference: Meet with Engineer on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Coordination and cooperation of trades and subcontractors.
    - d. Coordination of documentation and communication flow.
- C. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.
- E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

## **1.06 COORDINATION**

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

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

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.02 PREPARATION**

- A. Prepare a TAB plan that includes strategies and step-by-step procedures where applicable.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### **3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", or SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing" and in this Section.
  - 1. Comply with requirements in ASHRAE 62.1-2004, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

### **3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and –treating equipment.

- a. Report the cleanliness status of filters and the time static pressures are measured.
  4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  2. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Adjust using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### **3.06 PROCEDURES FOR MOTORS**

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
3. Manufacturer's name, model number, and serial number.
  4. Motor horsepower rating.
  5. Motor rpm.
  6. Efficiency rating.
  7. Nameplate and measured voltage, each phase.
  8. Nameplate and measured amperage, each phase.
  9. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### **3.07 TOLERANCES**

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
  3. Heating-Water Flow Rate: Plus or minus 10 percent.
  4. Cooling-Water Flow Rate: Plus or minus 10 percent.

### **3.08 REPORTING**

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### **3.09 FINAL REPORT**

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
10. Report date.
11. Signature of TAB supervisor who certifies the report.
12. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
13. Summary of contents including the following:
  - a. Indicated versus final performance.
  - b. Notable characteristics of systems.
  - c. Description of system operation sequence if it varies from the Contract Documents.
14. Nomenclature sheets for each item of equipment.
15. Data for terminal units, including manufacturer's name, type, size, and fittings.
16. Notes to explain why certain final data in the body of reports vary from indicated values.
17. Test conditions for fans and pump performance forms including the following:
  - a. Settings for outdoor-, return-, and exhaust-air dampers.
  - b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Face and bypass damper settings at coils.
  - e. Fan drive settings including settings and percentage of maximum pitch diameter.
  - f. Inlet vane settings for variable-air-volume systems.
  - g. Settings for supply-air, static-pressure controller.
  - h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:



1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
    - e. Manufacturer's serial number.
    - f. Unit arrangement and class.
    - g. Discharge arrangement.
    - h. Sheave make, size in inches, and bore.
    - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - j. Number, make, and size of belts.
    - k. Number, type, and size of filters.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  3. Test Data (Indicated and Actual Values):
    - a. Total air flow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Preheat-coil static-pressure differential in inches wg.
    - g. Cooling-coil static-pressure differential in inches wg.
    - h. Heating-coil static-pressure differential in inches wg.
    - i. Outdoor airflow in cfm.
    - j. Return airflow in cfm.
    - k. Outdoor-air damper position.
    - l. Return-air damper position.

- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.
- c. Coil type.
- d. Number of rows.
- e. Fin spacing in fins per inch o.c.
- f. Make and model number.
- g. Face area in sq. ft..
- h. Tube size in NPS.
- i. Tube and fin materials.
- j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.
- l. Refrigerant expansion valve and refrigerant types.
- m. Refrigerant suction pressure in psig.
- n. Refrigerant suction temperature in deg F.
- o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Fuel type in input data.
- g. Output capacity in Btu/h.

- h. Ignition type.
  - i. Burner-control types.
  - j. Motor horsepower and rpm.
  - k. Motor volts, phase, and hertz.
  - l. Motor full-load amperage and service factor.
  - m. Sheave make, size in inches, and bore.
  - n. Center-to-center dimensions of sheave, and amount of adjustments in inches.
2. Test Data (Indicated and Actual Values):
- a. Total air flow rate in cfm.
  - b. Entering-air temperature in deg F.
  - c. Leaving-air temperature in deg F.
  - d. Air temperature differential in deg F.
  - e. Entering-air static pressure in inches wg.
  - f. Leaving-air static pressure in inches wg.
  - g. Air static-pressure differential in inches wg.
  - h. Low-fire fuel input in Btu/h.
  - i. High-fire fuel input in Btu/h.
  - j. Manifold pressure in psig.
  - k. High-temperature-limit setting in deg F.
  - l. Operating set point in Btu/h.
  - m. Motor voltage at each connection.
  - n. Motor amperage for each phase.
  - o. Heating value of fuel in Btu/h.
- H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave, and amount of adjustments in inches.
  - 2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

- g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Suction static pressure in inches wg.
- I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  - 1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated air flow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual air flow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- J. Air-Terminal-Device Reports:
  - 1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Air velocity in fpm.
    - c. Preliminary air flow rate as needed in cfm.
    - d. Preliminary velocity as needed in fpm.

- e. Final air flow rate in cfm.
  - f. Final velocity in fpm.
  - g. Space temperature in deg F.
- K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
- 1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  - 2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm.
    - b. Entering-water temperature in deg F.
    - c. Leaving-water temperature in deg F.
    - d. Water pressure drop in feet of head or psig.
    - e. Entering-air temperature in deg F.
    - f. Leaving-air temperature in deg F.
- L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
- 1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in gpm.
    - g. Water pressure differential in feet of head or psig.
    - h. Required net positive suction head in feet of head or psig.
    - i. Pump rpm.
    - j. Impeller diameter in inches.
    - k. Motor make and frame size.
    - l. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. Full-load amperage and service factor.
    - p. Seal type.
  - 2. Test Data (Indicated and Actual Values):

- a. Static head in feet of head or psig.
- b. Pump shutoff pressure in feet of head or psig.
- c. Actual impeller size in inches.
- d. Full-open flow rate in gpm.
- e. Full-open pressure in feet of head or psig.
- f. Final discharge pressure in feet of head or psig.
- g. Final suction pressure in feet of head or psig.
- h. Final total pressure in feet of head or psig.
- i. Final water flow rate in gpm.
- j. Voltage at each connection.
- k. Amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

### **3.10 INSPECTIONS**

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 5 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Verify that balancing devices are marked with final balance position.
  - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.

3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
  4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make any adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

**END OF SECTION**

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**Section 23 3113  
Metal Ducts**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2022.

**1.04 SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Ductwork materials
  - 2. Sealants and gaskets.
- B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  - 2. Structural members to which duct will be attached.

## **1.05 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
  - 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2022, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2022, Section 6.4.4 - "HVAC System Construction and Insulation."

## **PART 2 - PRODUCTS**

### **2.01 SINGLE-WALL ROUND DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
    - f. Omni Duct Systems.

### **2.02 SHEET METAL MATERIALS**

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 or G-90 at exterior.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
  - 3. Beaded coupling connections sealed with high-temperature silicone.
- C. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

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- D. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  - E. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
  - F. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
  - G. Self-tapping metal screws; compatible with duct materials.
  - H. Trapeze and Riser Supports:
    - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
    - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
    - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

### **2.03 SEISMIC-RESTRAINT DEVICES**

- A. Manufacturers: Subject to compliance with requirements, provide a product by one of the following:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Ductmate Industries, Inc.
  - 3. Hilti Corp.
  - 4. Mason Industries.
  - 5. Unistrut Corporation; Tyco International, Ltd.

## **PART 3 - EXECUTION**

### **3.01 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### **3.02 DUCT SEALING**

- M. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- N. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Conditioned Space, Exhaust Ducts: Seal Class B.

### **3.03 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### **3.04 SEISMIC-RESTRAINT-DEVICE INSTALLATION**

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.

### **3.05 CONNECTIONS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.06 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

### **3.07 DUCT SCHEDULE**

- A. Elbow Configuration:
  - 1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.
- B. Branch Configuration:

1. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees."
  - a. Velocity 1000 fpm or less 45-degree lateral.

**3.08 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
  1. Visually inspect duct system to ensure that no visible contaminants are present.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

**END OF SECTION**

**SECTION 23 3300  
AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Backdraft and pressure relief dampers.
  - 2. Manual volume dampers.
  - 3. Flange connectors.
  - 4. Flexible connectors.
  - 5. Duct accessory hardware.
  - 6. Penthouse Louvers
- B. Related Sections:
  - 1. Division 23 Section "Metal Ducts".

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.04 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 (Z180) and G90 (Z275).

2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

## **2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Air Balance Inc.; a division of Mestek, Inc.
  2. Duro Dyne Inc.
  3. Greenheck Fan Corporation.
  4. Nailor Industries Inc.
  5. Pottorff; a division of PCI Industries, Inc.
  6. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm (10 m/s).
- D. Maximum System Pressure: 1-inch wg (0.25 kPa).
- E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.
- H. Blade Seals: Felt.
- I. Blade Axles:
  1. Material: Galvanized steel.
  2. Diameter: 0.20 inch (5 mm).
- J. Tie Bars and Brackets: Galvanized steel.
- K. Return Spring: Adjustable tension.



- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
  - 1. Adjustment device to permit setting for varying differential static pressure.
  - 2. Counterweights and spring-assist kits for vertical airflow installations.
  - 3. Electric actuators.
  - 4. Chain pulls.
  - 5. Screen Mounting: Front mounted in sleeve.
    - a. Sleeve Thickness: 20-gage (1.0-mm) minimum.
    - b. Sleeve Length: 6 inches (152 mm) minimum.
  - 6. Screen Mounting: Rear mounted.
  - 7. Screen Material: Galvanized steel.
  - 8. Screen Type: Insect.
  - 9. 90-degree stops.

### **2.03 MANUAL VOLUME DAMPERS**

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Balance Inc.; a division of Mestek, Inc.
    - b. McGill AirFlow LLC.
    - c. METALAIRE, Inc.
    - d. Nailor Industries Inc.
    - e. Pottorff; a division of PCI Industries, Inc.
    - f. Ruskin Company.
  - 2. Standard leakage rating.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 5. Blades:
    - a. Single blade for ducts up to 24". Multiple blades for ducts greater than 24".
    - b. Opposed blade design for multiple blade dampers.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  - 6. Blade Axles: Galvanized steel.

- 7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.
- 9. Where damper is not accessible install remote damper operator adjustment assembly.

#### **2.04 FLANGE CONNECTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
- B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel for galvanized steel ducts.
- D. Material: Stainless steel for stainless steel ducts.
- E. Gauge and Shape: Match connecting ductwork.

#### **2.05 TURNING VANES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. METALAIRE, Inc.
  - 4. SEMCO Incorporated.
  - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.
- E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

## **2.06 FLEXIBLE CONNECTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Ventfabrics, Inc.
  4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
  2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
  3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
  2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

## **2.07 DUCT ACCESSORY HARDWARE**

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## **2.08 PENTHOUSE LOUVER**

### **A. Manufacturer**

- 1.. Ruskin
2. Aluminum Louvers, aluminum roof, bird screen with 8” high sheet metal curb, custom baked enamel finish

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and stainless-steel accessories in stainless-steel ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  1. Install steel volume dampers in steel ducts.
  2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Connect ducts to duct silencers rigidly.

- I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. On both sides of duct coils.
  - 2. Upstream from duct filters.
  - 3. At outdoor-air intakes and mixed-air plenums.
  - 4. At drain pans and seals.
  - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
  - 7. At each change in direction and at maximum 50-foot (15-m) spacing.
  - 8. Upstream from turning vanes.
  - 9. Upstream or downstream from duct silencers.
  - 10. Control devices requiring inspection.
  - 11. Elsewhere as indicated.
  
- J. Install access doors with swing against duct static pressure.
  
- K. Access Door Sizes:
  - 1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
  - 2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
  - 3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
  - 4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
  - 5. Body Access: 25 by 14 inches (635 by 355 mm).
  - 6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
  
- L. Label access doors according to Division 22 Section "Identification for Plumbing Piping and Equipment" to indicate the purpose of access door.
  
- M. Install flexible connectors to connect ducts to equipment.
  
- N. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
  
- O. Install Penthouse louvers with duct connection and backdraft damper on reliefs where shown.

### **3.02 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Inspect turning vanes for proper and secure installation.

4. Operate remote damper operators to verify full range of movement of operator and damper.

**END OF SECTION**

**Section 23 3416  
Centrifugal HVAC Fans**

**PART 1 - GENERAL**

**1.01 SECTION INCLUDES**

- A. Exhaust Fan.

**1.02 REFERENCES**

- A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. AMCA 99 - Standards Handbook.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes
- E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
- F. AMCA 301 - Method of Calculating Fan Sound Ratings from Laboratory Test Data.
- G. NEMA MG1 - Motors and Generators.
- H. NFPA 70 - National Electrical Code.
- I. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

**1.03 SUBMITTALS**

- A. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- B. Manufacturer's Installation Instructions.

**1.04 OPERATION AND MAINTENANCE DATA**

- A. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, protect and handle products to site under provisions of Division 1.
- B. Protect motors, shafts, and bearings from weather and construction dust.

**1.06 ENVIRONMENTAL REQUIREMENTS**

- A. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

**1.07 EXTRA MATERIALS**

- A. Furnish under provisions of Division 01.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. See equipment schedule on plans.

**2.02 GENERAL**

- A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- C. Fabrication: Conform to AMCA 99.
- D. Performance Base: Sea level conditions.
- E. Temperature Limit: Maximum 600 degrees F (315 degrees C).
- F. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

**2.03 FANS**

- A. Manufacturer
  - 1. Greenheck
    - a. With manufacturer sloped curb

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install in accordance with Manufacturer's instructions.

**END OF SECTION**



**Section 23 3813  
Ventilation System**

**PART 1 - GENERAL**

**1.01 GENERAL REQUIREMENTS**

- A. The contract documents shall apply in their entirety to the work specified herein.
- B. Submit shop drawings and manufacturer's data on hood and ventilation equipment specified in accordance with the Division 01 section on submittals.
- C. Materials and Installation: Except as specifically noted, materials and installation shall conform to applicable of Section 23 0500.

**1.02 SCOPE**

- A. Furnish and install Ventilation system as indicated in Mechanical and Architectural Drawings and specified herein. Items required but not limited to:
  - 1. Hood
  - 2. Exhaust Fan
  - 3. Ductwork & appurtenances

**1.03 RELATED SECTIONS**

- A. Section 23 0500 – Common Work Results for HVAC
- B. Section 23 3113 – Metal Ducts
- C. Section 23 3300 – Air Duct Accessories
- D. Section 23 0593 – Testing, Adjusting and Balancing

**1.04 REFERENCES**

- A. In addition to the requirements of Division 01 and Section 23 0500, comply with the following
  - 1. 2022 California Mechanical Code.
  - 2. 2022 California Building Code.
  - 3. 2022 California Fire Code.

- B. Priorities: Where conflicts occur between specifications and the above referenced codes and standards, the more restrictive shall apply.

#### **1.05 SYSTEM DESCRIPTION**

- A. Ventilation system shall be complete with a separate HVAC system as specified on the plans. HVAC system shall be totally separate from exhaust hood system. A room thermostat at the location shown on the plans shall control HVAC system.
- B. Exhaust hood shall be supplied as specified on the plans. Submit shop drawings on all equipment to be installed. All features considered standard by the manufacturer and which are required for a complete system shall be included without respect to specific detailing in this section.
- C. Provide bracing of hood to resist seismic induced motion. Anchor all curbs to structure and fans to curb to resist seismic induced motion.

#### **1.06 QUALITY ASSURANCE**

- A. Qualification of Manufacturer: Products used in work shall be produced by manufacturers regularly engaged in the manufacture of similar items.
- B. Qualification of Installer: Use adequate number of skilled workman, thoroughly trained and experienced in the necessary crafts, and completely familiar with the specified requirements contained in the plans and specifications.

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

- A. Hoods: The exhaust hoods shall be a Type II hood. It shall be tested and listed by both Underwriters Laboratory and National Sanitation Foundation and shall conform to all applicable requirements of NFPA and UMC.
- B. Hood Exhaust Fans: Hood Exhaust Fans shall be installed on factory supplied curbs and shall be wired to provide simultaneous operation with Make-up Air Fan. See "EQUIPMENT SCHEDULE" for more details.
- C. Ductwork shall be constructed and installed per CMC and NFPA requirements. See section 23 3113 for duct requirements.

#### **PART 3 - INSTALLATION**

- A. The ventilation system shall be installed according to the requirements of all applicable current codes, the plans, and manufacturer's instructions.

- B. Installing contractor shall coordinate this installation with general contractor and all related trades including but not limited to; electrical, plumbing, framing, and fire alarm contractor.
- C. Contractor shall supply to owner the system operation and balancing report for the Exhaust Hood/ Make-Up Air Systems.
- D. See sections 23 3113 and 23 3416 for ducting and exhaust fan installation details.
- E. Install duct temperature sensor and wire back to control panel.

**END OF SECTION**

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**SECTION 26 0500  
COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section Includes:
1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
  2. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, cooling towers, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
  3. Plumbing Electrical: Conduit, conductors and terminations for plumbing equipment with power requirements including necessary fusible and/or non-fusible safety disconnect devices. Provide motor starters where required unless provided by mechanical specification.
  4. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
  5. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property. Minimum two week advance notice shall be coordinated with the Owner and his representatives. Training shall be as outlined in individual system specifications identified to follow.
- B. Related Sections Under Other Divisions:
1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
  2. Painting of electrical equipment where exposed and required by the Architect to be painted as described elsewhere in the specification.
  3. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical specifications, shall be furnished and installed as required by Division 25 and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in

Division 26 (the DDC systems/EMS systems and components are installed in accordance with Division 25).

### **1.03 SYSTEM DESCRIPTION**

- A. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
- B. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.
- C. Verify all power and communications utility company requirements prior to commencement of utility work. Make proper adjustments to the construction to satisfy the serving utility requirements if they differ from the construction documents. It shall be the Contractor's responsibility to contact each utility company for obtaining finalized utility design drawings and/or approval, and for scheduling inspection of utility infrastructure installations.
- D. Charges imposed by the electric and communications utility companies shall be paid by Owner directly to utility companies.

### **1.04 SUBMITTALS AND SHOP DRAWINGS**

- A. Before construction, submit in (accordance with the General Conditions of this Specification) a complete list of all materials proposed to be furnished and installed under this section. Any material procured without review and approval of the engineer and/or owner's representative, will solely be at the contractor's risk.
- B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:
  - 1. Distribution equipment including main switchboards, distribution switchgear, transformers, distribution panels and breakers, motor controls, distribution and branch circuit panels, grounding, transient voltage surge suppressors, etc.
  - 2. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
  - 3. Conduit including all fittings, etc.
  - 4. Wiring and cable, terminations, etc.
  - 5. Fire rating penetration materials, details, etc.
- C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Samples of the proposed and substitute materials may be required for inspection prior to approval. Costs, if any, for

evaluation of substitutions shall be the Contractor's responsibility. The decision of the Architect shall be final. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

**D. SUPPORTING DEVICES (DSA)**

1. Provide all details of suspension and support for ceiling hung equipment.
2. Where walls, floor, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the submittals must include spacing, static loads and seismic loads at all attachment and support points.
3. Provide seismic details of seismic restraints and anchors; including number, size and locations for each piece of equipment.

**1.05 DELIVERY, STORAGE AND HANDLING**

- A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.
- B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, supply the current product model or series which meets the specification and intended use of the specified component.

**2.02 SUPPORTING DEVICES**

- A. Hangers: Kindorf B-905-2A Channel, H-119-D washer, C105 strap, 3/8" rod with ceiling flange.
- B. Concrete Inserts: Kindorf D-255, cast in concrete for support fasteners for loads up to 800 lbs.
- C. Pipe Straps: Two-hole galvanized or malleable iron.
- D. Luminaire Chain: Campbell Chain 75031, 90-lb. test with steel hooks.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.
- B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards.
  - 1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.
  - 2. Before each journeyman electrician commences work, deliver to Owner at the project site, a photocopy of the journeyman's valid Pocket Card.
- C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2019 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction. Refer to general conditions of specifications.
- D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Any damage which results must be properly repaired at no extra cost to the Owner. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.
- E. Supporting Devices:
  - 1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
  - 2. Install vertical support members for equipment and luminaires, straight and parallel to building walls. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over furred or suspended ceilings.



3. Do not use other trade's fastening devices as supporting means for electrical equipment, materials or luminaires. Do not use supports or fastening devices to support other than one particular item.
  4. Support conduits within 18" of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed 8' spacing.
  5. Securely suspend all junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.
  6. Provide seismic bracing per UBC requirements for this building location.
  7. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category "SDC" [C, D, E] per Structural Engineer.
- F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.
- G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor. A written response to all items shall be submitted for Owner's review once complete. When Electrical Engineering representative performs a field observation, the Electrical Contractor shall be present and available to remove equipment covers as needed.
- H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date on a daily basis reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.
- I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc. The Contractor shall hold all parties harmless of negligent safety practices that may cause injury to others on or near the job site.

- K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.
- L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.
- M. Lighting Acceptance Testing: Provide two copies of lighting acceptance testing results and equipment operating manuals as specified in Section 26 5670, LIGHTING ACCEPTANCE TESTING. Instruct the Owner on operation of control systems.

**END OF SECTION**

**SECTION 26 0501  
SELECTIVE ELECTRICAL DEMOLITION**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section Includes:
  - 1. Electrical demolition.

**PART 2 - PRODUCTS**

**2.01 MATERIALS AND EQUIPMENT**

- A. Materials and equipment for patching and extending work shall be as specified in individual sections.

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Contractor to walk job to observe existing conditions and account for variance as needed.
- B. Verify field measurements and circuiting arrangements as shown on drawings.
- C. Verify that abandoned wiring and equipment serve only abandoned facilities.
- D. Demolition Drawings are based on limited field observation and existing record documents. Report discrepancies to Owner/Architect before disturbing existing installation.

**3.02 PREPARATION**

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate utility service outages with utility company.

- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Coordinate outages with Owner and local fire service. Notify Owner/Owner's representative at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Notify Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

### **3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

- A. Demolish and extend existing electrical work under provisions of this section.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Allow the owner first right to retain ownership of salvaged materials, otherwise the Electrical Contractor is responsible for its removal from the site and proper disposal or recycling.
- D. Remove abandoned wiring to source of supply.
- E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- G. Disconnect and remove abandoned panelboards and distribution equipment.
- H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

- J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.
- K. Repair adjacent construction and finishes damaged during demolition and extension work.
- L. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- M. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

**3.04 CLEANING AND REPAIR**

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Cleaning light fixtures. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace ballasts and broken electrical parts as required for any inoperative fixtures. Provide new lamps for all fixtures that are to remain.

**3.05 INSTALLATION**

- A. Install relocated materials and equipment as shown and/or as required.

**END OF SECTION**

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**SECTION 26 0519  
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Wires and cables.
  - 2. Connectors.
  - 3. Lugs and pads.

**1.03 SYSTEM DESCRIPTION**

- A. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

**1.04 SUBMITTALS**

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Provide product data for the following equipment:
  - 1. Wires.
  - 2. Cables.
  - 3. Connectors.
  - 4. Lugs.
  - 5. Splice Kits.
  - 6. Strain Relief Fittings.
  - 7. Cable Racking and Insulators.
- C. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

**1.05 REGULATORY REQUIREMENTS**

- A. Conform to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
- B. Furnish products listed by UL or other testing firm acceptable to AHJ.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.
- B. Connectors: Burndy, IlSCO, Thomas & Betts, or approved equal.
- C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 volt, 105 degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.
- D. Splices:
  - 1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
  - 2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
  - 3. Screw Terminal Lugs.
  - 4. Kearney Split Bolt.
- E. MC and HFC Cable: Alflec, AFC, or approved and shall meet all CEC Article 334 provisions.

**2.02 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS. WIRE AND CABLE SHALL BE:**

- A. Copper, 600 volt rated throughout. Conductors 14AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
- B. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.
- C. Color Code Conductors as Follows:

| <b>PHASE</b> | <b>208 VOLT</b> | <b>240 VOLT DELTA</b> | <b>480 VOLT</b> |
|--------------|-----------------|-----------------------|-----------------|
| A            | Black           | Black                 | Brown           |
| B.           | Red             | Orange (High Leg)     | Orange          |
| C.           | Blue            | Blue                  | Yellow          |
| Neutral      | White           | White                 | Gray            |



|                 |                      |                      |       |
|-----------------|----------------------|----------------------|-------|
| Ground          | Green                | Green                | Green |
| Isolated Ground | Green w/yellow trace | Green w/yellow trace | N/A   |

- D. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600-volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.
- E. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
- F. Refer to signal and communications specification sections for cable requirements.

**2.03 CONNECTORS**

- A. Copper Pads: Drilled and tapped for multiple conductor terminals.
- B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.
- C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 18 through 8AWG.

**2.04 LUGS AND PADS**

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be

obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

- B. Insulation: Use proper insulation types where temperature and environment are a factor.
- C. Splices at or below grade level shall be made with wet location rated and approved mechanical connectors and shall be encapsulated in epoxy or plastic molded poured kits. The connections must be assured to be watertight. Splices at or below grade shall always be avoided and minimized. Prior approval is required for feeder splices below grade. Submit proposed materials and exhibit showing location of intended splices for Engineer's review and approval prior to commencing with the work.
- D. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. In manholes and vaults, provide embossed brass tags identifying system serviced and function. See Section 26 0553 IDENTIFICATION OF ELECTRICAL SYSTEMS.
- E. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non waterproof cabling is not allowed in any below grade or wet application.
- F. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.
- G. Cable and conductors routed through pull boxes and vaults shall be properly supported on porcelain or equal insulators mounted on steel rack inserts. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.
- H. Wires and Cables:
  - 1. Conductor Installation:
    - a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
    - b. Install conductors with care to avoid damage to insulation.
    - c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
    - d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
  - 2. Conductor Size and Quantity:
    - a. Install no conductors smaller than 12AWG unless otherwise shown.
    - b. Provide all required conductors for a fully operable system.
  - 3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in the following single phase circuits:
    - a. Dimmer controlled circuits.
    - b. Isolated ground circuits.

- c. Ground fault and arc fault protected circuits where a GFI and arc fault breakers are used in panelboards.
  - d. Other electronic equipment which produces a high level of harmonic distortion including but not limited to computers, printers, plotters, copy machines, fax machines, where indicated.
4. Conductors in Cabinets:
- a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
  - b. Tie and bundle feeder conductors in wireways of panelboards.
  - c. Hold conductors away from sharp metal edges.
  - d. Connectors: Retighten mechanical type lugs and connectors for conductors to equipment prior to Notice of Completion.

### **3.02 FIELD QUALITY CONTROL**

- A. Tests:
- 1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.
  - 2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

**END OF SECTION**

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**SECTION 26 0533  
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Conduit and fittings.
  - 2. Outlet boxes.
  - 3. Junction and pull boxes.
  
- B. Related Work:
  - 1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground on site and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
  - 2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
  - 3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, security, access control, sound systems, data system, energy management systems, power distribution, lighting, lighting controls, video, CATV, voice communications, intercom, nurse call, HVAC and other building low voltage/communications systems controls as may be required. Raceways, boxes and duct paths required for utility companies shall be installed per plans unless utility company requirements are more restrictive at which time those requirements shall take precedence.
  - 4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
  - 5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor's responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall

- obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor's responsibility to insure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
  7. Minimum conduit size shall be 1/2" except if plan shows or code requires larger size. Exception: Use minimum 3/4" for underslab and below grade applications outside of building exterior walls.
  8. All electrical, control, communications systems shall be installed in metallic conduit system. This shall include but not be limited to all systems described in Section B.3 above, except for voice and data systems which shall be installed as described on these plans and as specified here-in but shall not be less than the recommendations of EIA/TIA standards.
  9. All line voltage wiring within the building shall be installed in metallic conduit.
  10. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
  11. Exterior installations: After conductors are installed, seal conduit ends to prevent entrance of foreign material using pliable duct seal, caps or waterproof expanding foam.
  12. All low voltage systems including intercom, fire alarm, public address, etc. shall be in dedicated conduit systems. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 1300, INTERCOMMUNICATIONS SYSTEMS and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
  13. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
  14. Separate Raceway System: Provide a separate dedicated raceway system for each system installed, do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed.
  15. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
  16. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
  17. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
  18. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
  19. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

**1.03 SUBMITTALS**

- A. Provide Shop Drawings and Product Data for the Following Equipment:
  - 1. Conduit and fittings.
  - 2. Outlet boxes.
  - 3. Weatherproof outlet boxes.
  - 4. Junction and pull boxes.
  - 5. Putty pads.
  - 6. Raceways

**1.04 REGULATORY REQUIREMENTS**

- A. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
- B. Furnish products listed by UL or other independent and nationally recognized testing firm.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.
- C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
- D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
- E. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes.
- F. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

- G. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.
- H. Surface mount raceway shall only be used where shown on the plans. The raceway and cover shall be ["Ivory"] colored by Wiremold but be capable of being over-painted in the field if required. The raceway and fittings shall meet all requirements of CEC Article 386 and be U.L. listed. Raceway shall be mechanically connected to structure with backing and anchor bolts.
- I. Manufacturers:
  - 1. Outlet Boxes: Bowers, Raco, Steel City or equal.
  - 2. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
  - 3. Box Extension Adapter: Bell, Red Dot, [Carlton] or equal.
  - 4. Conduit Fittings: O-Z Gedney, Thomas & Betts, or equal.
  - 5. Putty pads: 3M, Hilti, or equal.
  - 6. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
  - 7. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
  - 8. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
  - 9. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
  - 10. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes.
  - 11. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
  - 12. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
  - 13. Surface mount raceway, Wiremold, Three Compartment Series 5500 or equal

## **2.02 OUTLET BOXES**

- A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.
- B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as "MYERS" gasketed type hub or equal.
- C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4"



square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco Series 681 and 686 or equal.

- D. Luminaire Outlet: minimum 4" square with correct plaster ring depth, minimum 1 1/2" deep with 3/8" luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.
- E. Multiple Devices: Three or more devices at common location. Install 1 piece gang boxes with 1 piece device plastering. Install one device per gang unless otherwise allowed.
- F. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.
- G. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

### **2.03 JUNCTION AND PULL BOXES**

- A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.
- B. Location:
  - 1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
  - 2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
  - 3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24" shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
  - 4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

### **2.04 BOX EXTENSION ADAPTER**

- A. Construction: **[Diecast aluminum]** ~~or [cast iron with gasket]~~

- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

## **2.05 CONDUIT FITTINGS**

- A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.
- B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

## **2.06 PUTTY PADS**

- A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.
- B. Designed to install around outside of outlet boxes.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as Educational, Health Care, wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without the permission and approval of the Architect. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with minimum 12" wide redwood blocks set in mastic unless otherwise detailed in roof requirements or as specified in roofing specification, by the Architect. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8' above finished grade shall be strapped at a minimum of 5' spacing.
- B. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Minimum 4" of bedding and cover of backfill material 1/4" size grain and smaller maximum. Conduit shall be heavy wall Schedule 40 or 80, rigid

PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints. All non-metallic conduit runs over 150' in length and over 1 1/4" trade size conduit shall utilize galvanized rigid steel elbows.

- C. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'-0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.
- D. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be ~~steel or diecast~~ ~~[insulated/non-insulated]~~ set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.
- E. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 30' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit system in a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture. "Master" "Slave" fixtures are permitted to use manufactured flexible cable of longer dimension up to 12' between "Master" and "Slave" only and only as a U.L. listed system component.

- F. Underground conduits and transition to above grade/slab shall be as follows:
1. PVC elbows allowed if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
  2. GRS elbows are required if conduit run is 150' or greater.
  3. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
  4. GRS elbows/risers to be PVC coated or 10 MIL taped wrapped (1/2" lapped) to 3" above finish grade or top of slab.
- G. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.
- H. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.
- I. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).
- J. Conduit Seals: Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3" into conduit.
  2. Fill 3" of conduit with 3M #2123 sealing compound.
  3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
  4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
  5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
  6. Provide cable drip loop minimum 12" high.
- K. Marker tape: Place plastic yellow marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.
- L. Conduits for high voltage (12kv) systems shall be separated from all other conduits by a minimum of 12". All power system conduits shall be separated from low voltage systems by a minimum of 12" when running parallel to each other and no less than 6" when running perpendicular to each other at conduit crossings.

- M. Medium voltage system conduits including 4,000 volt and above, shall be installed in conduit systems or duct banks that are concrete encased by a minimum of 3" of concrete. Depth of conduits shall remain as specified elsewhere in this specification or as required by the CEC.
- N. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed, however 18" on all sides of a utility crossing must be concrete encased.
- O. Duct bank defined here-in shall be four or more conduits in a common trench, conduit spacers and saddles shall be required in all trenches where more than two conduits over 2" in diameter travel in the same trench. Proper spacing between systems as outlined above shall be required and spacers shall be located each 5' (maximum) along trench route from point to point.
- P. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.
- Q. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.
- R. Expansion Joints
  1. Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
  2. Provide conduits smaller than 3" with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between the end. All conduit shall have a copper green grounding bonding conductor installed.
- S. Seismic Joints
  1. At seismic joints, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes or approved fittings, on both sides of the joint. Connect conduits to junction boxes with sufficient slack flexible conduit such that these slack conduits are 1 1/2 times the distance between conduit ends. Flexible conduit shall have a copper green ground bonding jumper installed.
- T. Ladder tray shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.
- U. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations

shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

- V. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- W. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
- X. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.
- Y. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.
- Z. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
  - 1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
  - 2. Outlet above counter (measured to top of outlet box): +46".
  - 3. Control (light) Switches. (measured to top of outlet box): +48".
  - 4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
  - 5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
  - 6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- AA. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.
- BB. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.
- CC. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

**END OF SECTION**

**SECTION 26 0553  
IDENTIFICATION OF ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section Includes:
  - 1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
    - a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
      - 1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
      - 2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
      - 3) Wall switches not within sight of outlet controlled.
      - 4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
      - 5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
  - 2. Conductor and Cable Identification.
- B. Related Work:
  - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
  - 3. Section 26 1300, MEDIUM VOLTAGE SWITCHGEAR (ABOVE 600 VOLTS).
  - 4. Section 26 1302, SWITCHES, MEDIUM VOLTAGE (ABOVE 600 VOLTS).
  - 5. Section 26 2416, PANELBOARDS.
  - 6. Section 26 2816, ENCLOSED SWITCHES AND CIRCUIT BREAKERS.
  - 7. Section 26 1200, MEDIUM VOLTAGE TRANSFORMERS.
  - 8. Section 26 2414, DISTRIBUTION SWITCHBOARD.
  - 9. Section 26 0534, CABINETS.
  - 10. Section 26 2413, SERVICE AND DISTRIBUTION SWITCHBOARD.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.

**PART 2 - PRODUCTS**

**2.01 EQUIPMENT LABEL DESIGNATIONS**

- A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.
- B. Panelboard labels showing panel designation, voltage, phase and source.
- C. In accordance with CEC 110.16, provide arc flash protection warning labels on all switchboards, panelboards, distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

**2.02 MATERIALS**

- A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.
- B. For Emergency Equipment: Use engraved white letters over red background.
- C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel finish.
- D. Arc flash labels shall be provided as required by CEC Article 70E.
- E. Conductor tape number markers: ABB Thomas and Betts WM-0-45 Series non-fading permanent adhesive.

**PART 3 - EXECUTION**

**3.01 MOUNTING**

- A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.
- B. Conductor tape markers shall be consistently placed for ready conductor identification.



**3.02 HEIGHTS ON LABELS**

- A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8" identify voltage rating and source.
- B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16" identify circuit and load served, including location of equipment.
- C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16" identify load served.
- D. Transformers: 3/16" identify equipment designation; 1/8" identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

**3.03 WARNING SIGNS**

- A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.
- B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16" stroke minimum.
- C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

**END OF SECTION**

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**SECTION 26 2726  
WIRING DEVICES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section Includes:
  - 1. Wiring devices.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
  - 1. Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
  - 2. Section 26 0533, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
  - 3. Section 26 0519, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
  - 4. Section 26 0526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

**PART 2 - PRODUCTS**

**2.01 RECEPTACLES**

- A. General: All receptacles shall be listed by Underwriters Laboratories, Inc.
  - 1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self-grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
  - 2. Receptacles shall be of a screw terminal type, "pressure type quick wire" terminations are not allowed.
  - 3. 15 ampere and 20 ampere, 125-volt and 250-volt non-locking receptacles shall be tamper resistant type receptacles unless the application is specifically listed as an exception to CEC 406.12.
  - 4. Receptacles shall be "wet rated" when used in an exterior location.

- 
- B. Duplex receptacles shall be [premium specification grade] ~~[commercial grade]~~ ~~[Style Line/Decora]~~ single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal.
1. Bodies shall be ~~[ivory]~~ [white] ~~[almond]~~ [gray] ~~[brown]~~ [black] in color. ~~[Wiring device color selection to be provided by Architect]~~ Contractor to verify device color with Architect prior to procurement.
  2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The remaining receptacle shall be unswitched.
  3. Controlled receptacles; installed per requirements of 2016 BUILDING ENERGY EFFICIENCY STANDARDS / Efficiency Standards, California Code of Regulations, Title 24, Part 6. SECTION 130.5 (d) – ELECTRICAL POWER DISTRIBUTION SYSTEMS as Circuit Controls for 120-Volt Receptacles and / or Controlled Receptacles. Shall be provided with an approved means of including a permanent and durable marking identifying the controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits. Where shown on associated floor plans, and or required by the Standards; a duplex noted to be controlled shall be 'split-wire', so the top outlet shall be switched and the bottom outlet shall be unswitched. A double duplex (fourplex) noted to be controlled: one of the duplex receptacles shall be controlled and the other duplex receptacle shall be unswitched.
  4. Duplex Receptacles on Emergency Circuit: Receptacle bodies shall be red in color. Wall plates shall also be powder coat painted red finish. Cover shall be labeled with panel and circuit number.
  5. Ground Fault Interrupter Duplex Receptacles: Shall be an integral unit suitable for mounting in a standard outlet box.
    - a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.
- C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.
- D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. Approved manufacturers: Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

## 2.02 SWITCHES AND DIMMERS

- A. ~~[Toggle switches]~~ ~~[Style Line/Decora rocker switches]~~ shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified.

- 
1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plaster ears and be of a screw terminal type.
  2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
  3. Ratings:
    - a. 120 volt circuits: 20 amperes at 120-277 volts AC.
    - b. 277 volt circuits: 20 amperes at 277 volts AC.
  4. The switches shall be mounted on the strike plate side of doors.
  5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
  6. All toggle switches shall be of the same manufacturer.
- B. Dimmers: Incandescent lamp loads. Wall-mounted incandescent dimmers shall be specification grade with capability of raising and lowering the lighting from completely off to full intensity. Dimmers shall maintain full load rating even when two or more units are installed adjacent to one another. All wall-mounted dimmers shall be of the same manufacturer and of a “slide” type. Color shall match all other wiring devices on project.
- C. Dimmers: Fluorescent lamp loads. Wall-mounted fluorescent lamp dimmers shall be specification grade and shall be capable of raising and lowering the lighting from five percent light output. Dimmers shall have low end intensity adjustment and maintain full load rating even when two or more units are installed adjacent to one another. All wall-mounted dimmers shall be of the same manufacturer and of a “slide” type. Dimming ballast shall be provided for each lamp or pair of lamps. Dimmers shall have adequate capacity for the load served and the environment in which installed.

### **2.03 WALL PLATES**

- A. Wall plates for switches and receptacles shall be ~~[type 302 stainless steel] [nylon] [thermo-plastic] [plated steel:chrome/brass].~~
- B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.
- C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.
- D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.
- E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas all receptacles shall be dust proof and or waterproof where applicable.
- F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Switches installed in hazardous areas shall be explosion proof type in accordance with the CEC and as shown on the drawings.
- B. Installation shall be in accordance with the CEC, NECA “Standard of Installation”, and as shown as on the drawings.
- C. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.
- D. General: Devices shall be of the type specified herein. All devices shall be installed with “pigtailed” leads from the outlet box. No device shall be used in the “feed through” application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.
- E. Installation: Devices and plates shall be installed in a “plumb” condition and must be flush with the finish surface of the wall where boxes are recessed.
- F. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.
- G. Install switches with the off position down.
- H. Clean debris from outlet boxes.
- I. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.
- J. Test each receptacle device for proper polarity.

**END OF SECTION**

**SECTION 26 2816  
ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section Includes:
  - 1. Disconnect and safety switches where shown on the contract drawings and specified herein.

**1.03 SUBMITTALS**

- A. Submit in accordance with Section 26 0500, COMMON WORK RESULTS FOR ELECTRICAL.
- B. Related Work:
  - 1. Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

- A. Approved Manufacturers: Cutler Hammer, General Electric, ITE-Siemens and Square-D.
- B. Disconnect Switches: Provide with devices enabling the switch to be locked in the open or closed positions.
- C. Manual Motor Switches: Tumbler type rated 3HP, 240 Volts with or without overload heaters as required to protect equipment served.
- D. Externally Operable Safety Switches: To have quick-make, quick-break mechanism, capable of switching 10 times switch rating, with cover interlock to prevent opening with switch in ON position and defeat mechanism for maintenance.
- E. Switches: Shall be general duty (GD) for 240 volt and below and heavy duty (HD) for 277/480 volt type unless otherwise indicated. Provide NEMA 1 enclosures for interior locations and

NEMA 3R enclosures for exterior or wet locations. Provide with number of poles, ampacity, voltage and HP rating, fusible or nonfusible as indicated. Copper blades shall be visible in off position.

- F. Fusible Switches: Equip them with rejection clips for UL Class R fuses. Switches having a dual rating when used with dual element fuses shall have a rating so indicated and shall be confirmed by equipment vendor being connected.
- G. 600 Amperes or Less Fuses: UL Class RKI with a minimum interrupting rating of 200,000 Amperes, Bussmann "Low-Peak Type" or equal.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL INSTALLATION**

- A. Locations: Install switches, disconnects and safety where indicated on the Contract Drawings or as required by CEC.
- B. Fastenings: Securely fasten switches to structural members or unistrut support as directed by the manufacturer.
- C. Manual Motor Switches: Install flush mounted in finished areas.
- D. Manual Motor Switches: Install surface mounted in equipment rooms and non-finished areas. Where installed above inaccessible ceilings provide access panels.
- E. Label all disconnect switches in accordance with Section 26 0553, IDENTIFICATION OF ELECTRICAL SYSTEMS.
- F. Fuse: All fuses shall be as indicated on the plan or as required by the equipment. Verify fuse size with equipment manufacturer requirements, prior to installation. Use current limiting fuses as indicated on plan. Provide one spare fuse cabinet in each electrical room with one complete set of spare fuses for all sizes of main fuses, subpanel fuses, HVAC equipment fuses and fire alarm.
- G. Terminals shall be minimum 75 degree rated.

**END OF SECTION**





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# APPENDIX A EQUIPMENT CUT SHEETS

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# TECHNICAL HIGHLIGHTS

CEAST 9000 Series

## IMPACT TESTER



CEAST 9050 Manual



CEAST 9050 Motorized

|                                   |            |  |  |
|-----------------------------------|------------|--|--|
| Hammer Energy Range               | J<br>ft-lb | 0.5 - 50<br>0.37 - 36.9                                | 0.5 - 50<br>0.37 - 36.9                                |
| Hammer Release                    | -          | Manual (Pneumatic Optional)                            | Pneumatic  |
| Hammer Braking                    | -          | Manual   | Pneumatic  |
| Hammer Recovery                   | -          | Manual   | Motorized  |
| Hammer Identification             | -          | Automatic  | Automatic  |
| Electrical Supply                 | -          | 100 - 240 V<br>50 - 60 Hz                              | 100 - 240 V<br>50 - 60 Hz                              |
| Compressed Air Supply             | bar<br>psi | 5<br>72.5  | 5.5<br>79.8  |
| Machine Dimensions<br>(w × d × h) | mm<br>in   | 1035 × 430 × 880/1190<br>40.8 × 16.9 × 34.6/46.9       | 1035 × 510 × 1190<br>40.8 × 20.1 × 46.9                |
| Machine Weight                    | kg<br>lbs  | 220 (330 with 50 J Plate)<br>485 (725 with 50 J Plate) | 270 (380 with 50 J Plate)<br>595 (838 with 50 J Plate) |
| Safety Guards                     | -          | Standard<br>(Full Enclosure Optional)                  | Full Enclosure   |

# CEAST 9000 Series

Pendulum Impact Systems





**CEAST 9000 Series**  
Pendulum Impact Systems

# MAKE A SWING

Impact resilience is one of the most important properties and cost-effective evaluations for material producers, both with respect to product development and quality control. As components could fail at stress levels well below the critical fracture stress, accurate determination of impact damage propagation is necessary.

With the combined experience of CEAST, Instron® has more than 50 years experience in designing pendulum impact testing systems.

## 4 | What are you testing?

The CEAST 9000 Series is designed to perform your Charpy, Izod, Tensile Impact, and Dynstat tests on a wide range of samples, from bars/dumbbell to pipes, in accordance with specific standards.

## 6 | What is your expected resilience?

It's critical to determine the energy value necessary to break the specimen under certain conditions, such as specimen size, notch shape, and hammer impact energy.

## 8 | Notching your specimens

Accurate notching is key for pendulum impact testing. Instron® has solutions to meet your requirements

## 10 | Which model is right for you?

Our Pendulum series offers fully manual or pneumatic and motorized options. Choose the version that meets your needs.

## 14 | Will you perform tests at different temperatures?

When choosing a pendulum impact system, comprehensive impact characterization with tests at different temperatures can be important for a material application.

## 16 | Which result do you need?

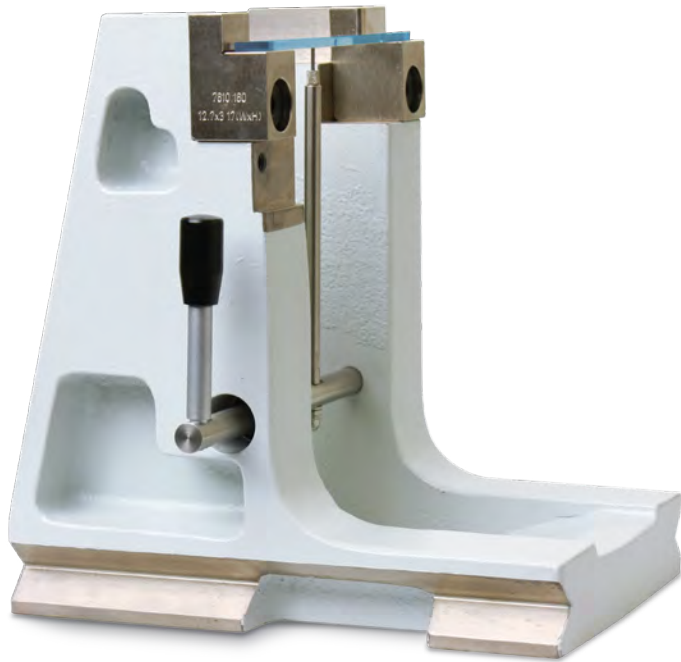
From quality control on resilience results to automated result calculation and visual curve displays, pendulum impact systems can be equipped with instrumentation to fit your needs.





## TEST TYPES

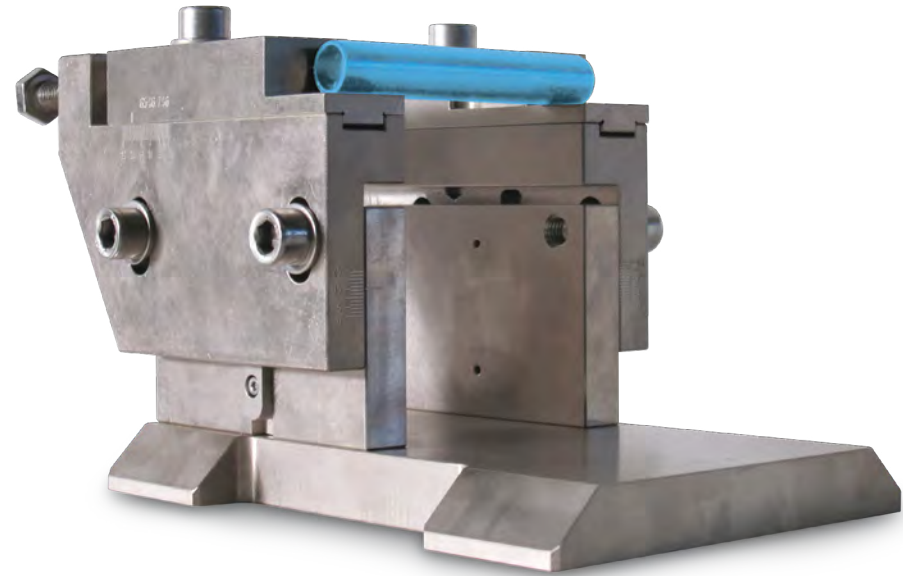
CEAST 9000 Series



### Charpy

This 3-point bend test that requires a standard notched or unnotched bar is impacted on either the wide or narrow face of its cross-section. The energy required to break the specimen is recorded and the subsequent impact strength is calculated. Specimen and fixture dimensions, impact speed, and hammer dimensions are all defined in the test standard being followed, including ISO 179, ASTM D6110, DIN 53453, DIN 53753, and BS 7413.

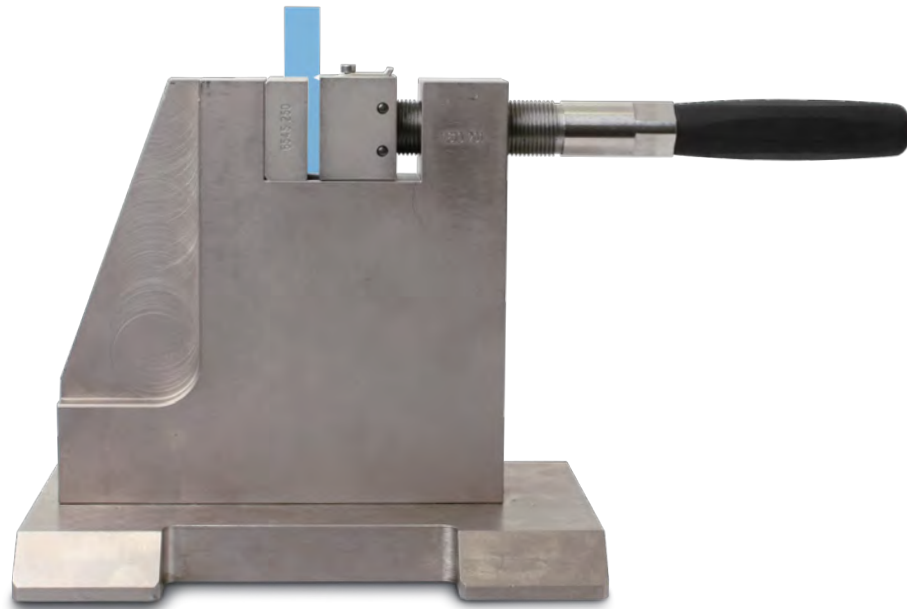
Metals can be tested according to DIN 50115 and ASTM E23 standards. Hammer energies are available from 0.5 - 50 J (0.37 - 36.9 ft-lbs). The Charpy vice can be fitted with alignment devices for notched, unnotched, and double notched specimens in either the edgewise or flatwise orientation.



### Pipe Testing

Scientific research on the material of pipes or the examination of pipe sections and tubing impact strength are suitable to yield information on the fracture behavior under service conditions. According to the ISO 7628 and ISO 9854, either complete segments or small sections of pipes tested on a pendulum in a 3-point bend configuration similar to the Charpy tests.

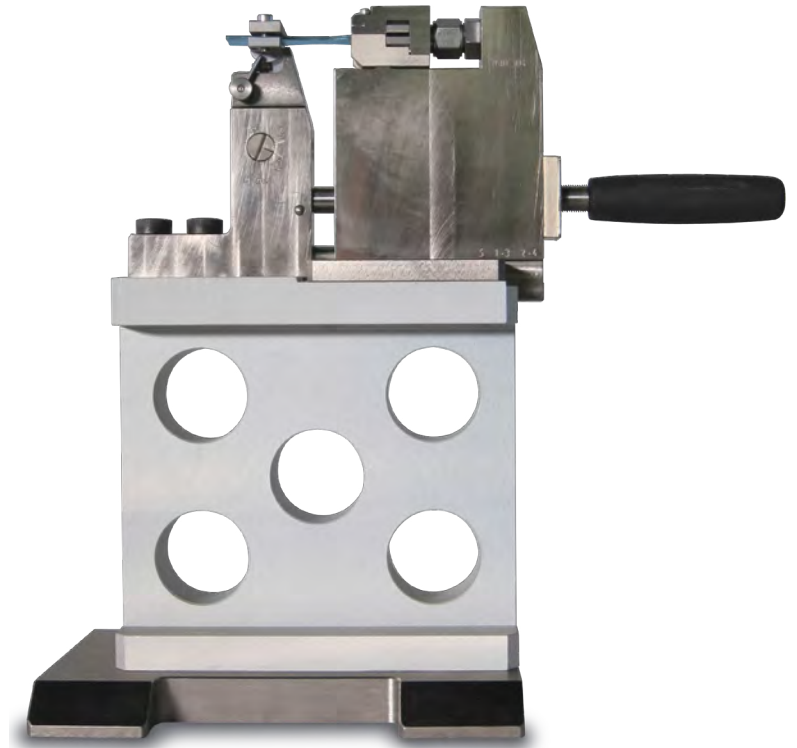
Sample diameter dimensions up to 25 mm (0.98 in) can be tested with hammer energies of 7.5 - 15 J (5.6 - 11.1 ft-lbs) or 50 J (36.9 ft-lbs), as defined in the ISO standards.



## Izod

For the Izod test, the specimen is impacted in a cantilevered position with the fixed end clamped into the vice. This testing method generates a more severe stress test than the Charpy mode. Energy required to break the specimen is recorded and the subsequent impact strength calculated. Specimen dimensions, hammer geometry, and impact speed are defined by the test standards, the most common of which are ISO 180, ASTM D256, and ASTM D4812.

To more accurately adjust and control the clamping force, the Izod vice can be used with a torque wrench or fitted with a foot-operated pneumatic clamping system. It may be necessary to control the clamping force.



## Tensile Impact

Tensile impact tests are conducted on materials that are either too thin or exhibit a high elongation before fracture. Hammer geometry, impact energy, specimen shapes, and dimensions are defined in test standards such as ISO 8256 Method A, ISO 8256 Method B, and ASTM D1822.

The specimen is either held in the stationary anvil (ISO 8256 Method A) or attached directly to the pendulum hammer (ISO 8256 Method B and ASTM D1822). Hammer energies are available from 0.5 - 50 J (0.37 - 36.9 ft-lbs) depending on the type of the test. The Tensile Impact vice can be fitted in the crosshead with an optional device to ensure specimen alignment.





# IMPACT TESTING IS ALL ABOUT ENERGY

## CEAST 9000 Series

How much energy does it take to fully break a specimen?  
How little energy does it take to begin a failure mode in the specimen?  
How much energy did the specimen absorb during impact?

The CEAST 9000 Series tabletop pendulums offer impact energies up to 50 J with a range of options available from basic manual testers to semi-automatic systems that include pneumatic release of the hammer and motorized hammer re-positioning.

### CEAST 9050 | Manual Model

**Energy Range:** 0.5 - 50 J (0.37 - 36.9 ft-lb)

**Hammer Positioning:** Manual

**Hammer Release:** Manual (pneumatic optional)

**Braking Mechanism:** Manual



$$E = m \cdot g \cdot L (\cos \alpha_1 - \cos \alpha_0)$$

Energy is equivalent to the hammer's momentum per difference between impact and starting angle

The greater the mass the higher the impact energy. The lighter the mass the lower the impact energy. Our pendulum systems use hammer energies ranging from 0.5 - 50 J (0.37 - 36.9 ft-lbs) and velocities from 1 - 3.80 m/s (3.2 - 12.4 ft/s).

Regardless of your energy requirements, we have the system that meets your needs.

## CEAST 9050 | Motorized Model

**Energy Range:** 0.5 - 50 J (0.37 - 36.9 ft-lb)

**Hammer Positioning:** Motorized

**Hammer Release:** Pneumatic

**Braking Mechanism:** Pneumatic





# NOTCHING YOUR SPECIMENS

CEAST 9000 Series

Proper preparation of the specimen is a critical process for accurate material characterization. An appropriate preparation of the specimen, as well as an adequate notching procedure affects the final test results, generating reliable outcomes in the finish product performances.

This is accomplished by several specimen preparation techniques, making them particularly suitable to select the most appropriate material and failure results analysis.

## WHY IS THE NOTCH REQUIRED?

- Notching of the specimen drastically reduces the energy loss due to the deformation
- It provides a stress concentration area which promotes a brittle rather than a ductile failure.

## WHY IS ACCURATE NOTCH PREPARATION IMPORTANT?

The notch properties are effected by:

- A slight variation in the radius and depth affects the impact strength results
- Cutting speed, sharpness of the knife, pass depth, quality of notching machine

## KNIVES

The notching machines use interchangeable knives and are available to meet the following standards:

|             |            |
|-------------|------------|
| ISO 179     | ASTM D256  |
| ISO 180     | ASTM D6110 |
| ISO 8256    | DIN 53435  |
| BS 2782-359 | DIN 53453  |

## MANUAL AND MOTORIZED NOTCHING MACHINES

- The manual and motorized Notching Machines are designed to notch thermoplastic and reinforced thermo plastic specimens
- A notch, with dimension according to the requirement of the main international standards, is obtained by means of a constant profile knife with an alternating linear movement
- Choice of analog or digital depth measurement

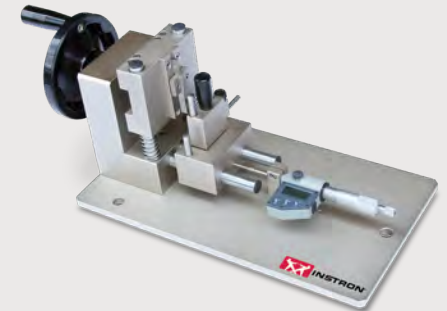
### Manual Model

Manual knife movement, speed and cutting depth

**Up to 18 m/min** cutting speed

Analog or digital feed measurement

**Up to 4 specimens** notched simultaneously



### Motorized Model

Motorized knife movement and speed

Manual cutting depth

**Up to 12-42 m/min** cutting speed

Analog or digital feed measurement

**Up to 10 specimens** notched simultaneously



## CEAST AN50 – AUTOMATIC NOTCHING MACHINE

The CEAST AN50 is designed for laboratories which need to perform a large number of impact tests. Up to 50 specimens can be notched in a single cycle with the key parameters stored for later use. The optional knife cooling system, double notch loader and an adjustable cutting speed allow for consistent time saving and accurate notching operations at the same time.



## FEATURES

Programmable motorized knife movement and speed from 1 to 21m/min

Single pass depth, programmable from 0.01 to 0.25mm



Up to 50 specimens notched simultaneously



Optional slicing device for cutting dumb-bell specimens to a rectangular shape



Optional knife cooling system



Option to double notch specimens for Charpy or Tensile Impact applications



# CEAST 9050

CEAST 9000 Series

The CEAST 9050 is an advanced pendulum tester that performs uninstrumented to semi-automatic instrumented tests. Hammer energies range from 0.5 - 50 J (0.37 - 36.9 ft-lbs) and are available for Charpy, Izod, Tensile Impact, Dynstat, and Pipe testing standards.

### STANDARD FEATURES INCLUDE:

- Monolithic cast iron frame
- Intuitive touch panel operation
- Automatic hammer identification and verification
- Angular encoder measuring to 0.05° resolution
- Quick-change hammers and specimen supports
- Hammer disc brake system

### OPTIONAL FEATURES INCLUDE:

- Increased height safety enclosure for Manual Model
- Slip ring and Trigger for instrumented hammer data acquisition
- Accessories to facilitate operations

|          |            |           |
|----------|------------|-----------|
| ISO 179  | ASTM D6110 | DIN 53453 |
| ISO 180  | ASTM D256  | DIN 53753 |
| ISO 8256 | ASTM D1822 | DIN 50115 |
| ISO 9854 | ASTM E23*  |           |
| ISO 7628 | BS 7413    |           |

\*For indirect verification to ASTM E23 only low energy reference specimens may be used.



## Manual Model

The CEAST 9050 manual model has manual hammer repositioning and disc braking. The hammer release has a two-handed operation that is standard but can be specified as pneumatic.

### FEATURES



#### Standard Safety Guards

A fully protective safety guard on both sides of any pendulum version allows safe operation according to the compulsory CE directive.



#### Hammer Brake System

The hammer disk brake is characterized by a double braking surface that assures high-braking torque with low effort and smooth operation, even for the heaviest hammers. The brake is manually operated on the Manual Model or pneumatically operated in the Motorized Model.



#### Hammer Angle Measurement

Using a non-contacting magnetic encoder allows for virtually zero friction and a resolution of 0.05°.



#### Hammer Identification System

This system automatically recognizes the mounted hammer and retrieves all the relevant data (code, test standard, nominal energy, and impact speed) from the internal database. Repetitive data input and the risk of error is completely eliminated.



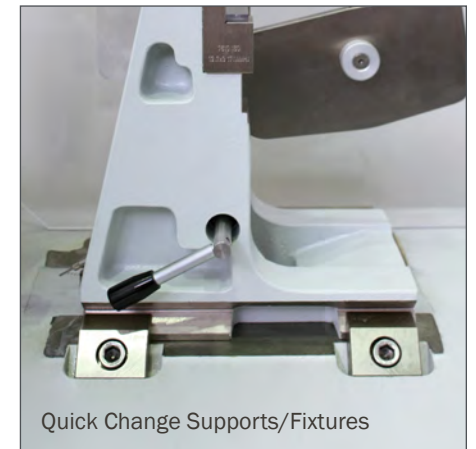


## Motorized Model

The CEAST 9050 motorized model is equipped with a pneumatically operated hammer release and disc braking system that is standard. The hammer repositioning eases use and increase the output in tests. A data acquisition trigger is included.



Complete range of Hammers



Quick Change Supports/Fixtures



### Touch Panel

A high-resolution 6.5-inch color display with touch-screen technology allows the most flexible and intuitive use of the instrument.



### Embedded-PC Technology

Allows an Ethernet connection to PC Networks (LAN), data exchange through a removable USB stick, and direct printing on standard USB printers.



### Quick Change Hammers

Equipped with an ergonomic quick-change mechanism, the hammers can be easily changed without the use of tools or screws and the innovative wedge system assures a firm fixing.



### Quick Change Supports and Fixtures

Through an ergonomic fixing system, vices for all test types, can be easily and quickly changed and positioned.



Monolithic Cast Iron Frame



# HAMMERS

CEAST 9000 Series

This innovative hammer line evolved from two primary needs: accuracy and rigidity. The patented\* hammer structure, machined from one piece of metal alloy plates, ensures incomparable rigidity, a solid connection to the encoder shaft, and negligible vibrations. Furthermore, the flattened shape minimizes energy lost due to wind friction.

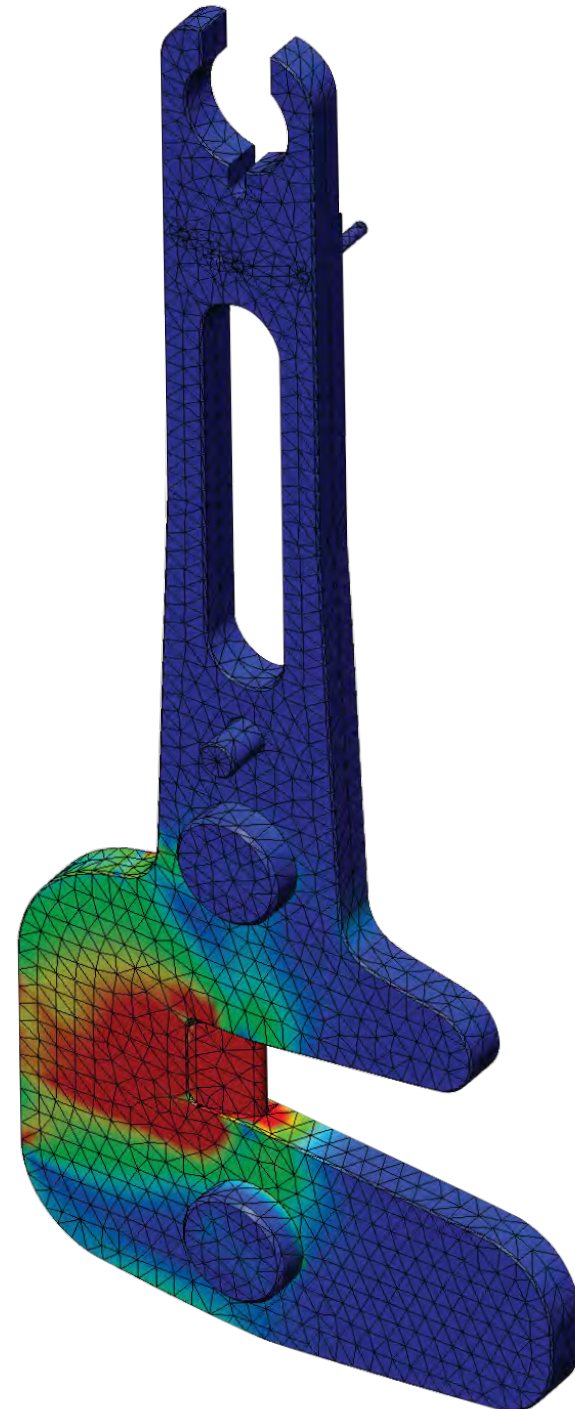
3D CAD design and Finite Element Modeling (FEM) calculations have been employed for the optimal arrangement of mass, position of the center of gravity, and reduced length. Due to this solid design the manufacturing accuracy is by far the best with respect to traditional hammers made of several assembled parts.

Each hammer is equipped with a system that allows fine adjustments of the reduced length, of its weight at 90°, and of its vertical position during the calibration process.

The auto-recognition is the most innovative feature of the hammer and ensures no operator error. This system consists of three pins that are positioned on the hammer and are read by the photocell system of the instrument. The hammer is recognized during calibration and throughout the test.

To view our range of accessories please visit:

[www.instron.com/accessories](http://www.instron.com/accessories)



\*Covered by US Pat. No. 7726173, owned by Illinois Tool Works Inc.



# TOUCH-SCREEN INTERFACE

WINDOWS® BASED

The instrument is equipped with an advanced interface, based on a powerful embedded-PC with a high-resolution, 6.5-inch color display.

The touch-screen technology allows the most flexible and intuitive use of the instrument, while the embedded-PC technology provides an open architecture, allowing Ethernet connection to PC Networks (LAN), data exchange through a removable USB and direct printing on standard USB printers. Through the LAN connection hundreds of results can be stored and easily exported to LIMS systems.

| N         | Brk | Width [mm] | Abs.en. [%] | Re [kJ/m <sup>2</sup> ] | Energy [J] |
|-----------|-----|------------|-------------|-------------------------|------------|
| 1         | N   | 8.00       | 51.71       | 177.50                  | 5.680      |
| 2         | P   | 8.00       | 43.91       | 151.11                  | 4.836      |
| 3         | C   | 8.00       | 48.26       | 166.07                  | 5.314      |
| 4         | H   | 8.00       | 45.04       | 154.97                  | 4.959      |
| 5         | H   | 8.00       | 45.46       | 156.42                  | 5.005      |
| $\bar{X}$ |     | 8.00       | 46.88       | 161.21                  | 5.159      |
| $\sigma$  |     | 0.00       | 2.81        | 9.52                    | 0.305      |

Options ▶

| Parameter     | Value   |
|---------------|---------|
| Laboratory    | CEAST   |
| Operator      | AC      |
| Temperature   | 023 °C  |
| Material code | PP 284  |
| Supplier      | CEAST   |
| Conditioning  | No cond |
| Comment       | None    |

Please hook the hammer at 150° and press Start

Hammer  
Code: 7600.004  
Desor: Charpy ISO  
Energy: 4 J  
Lost energy max: 0.020 J

Angle: 150.0 °      Lost energy: 0.007 J







# TESTING AT NON-AMBIENT TEMPERATURES

CEAST 9000 Series

Impact properties are dramatically influenced by temperature. Plastic materials usually show a brittle behavior at low temperatures and a more ductile behavior as the temperature increases. Finding a brittle-ductile transition temperature can be of critical interest for many polymer applications.

Comprehensive impact characterization with tests at different temperatures becomes possible with a series of options for the CEAST 9050 pendulum.

## Cryobox

**Cooling system:** Liquid Nitrogen

**Temperature range:** Ambient to  $-60^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$ )

The Cryobox is a thermal conditioning cell mounted directly onto the CEAST 9050 and positioned to enclose the specimen vice. This optional system is able to condition up to 11 specimens for below-zero tests. Izod, Charpy, or Tensile Impact vice and clamped specimens are jointly conditioned. Through a separate electrical cabinet for temperature control, it's possible to set the cryobox inside temperature before impact.





Suitable for cooling specimens to the following standards:

|          |            |           |
|----------|------------|-----------|
| ISO 179  | ASTM D6110 | DIN 53453 |
| ISO 180  | ASTM D256  | DIN 53753 |
| ISO 8256 | ASTM D1822 | DIN 50115 |
| ISO 9854 | ASTM E23   |           |
| ISO 7628 |            |           |

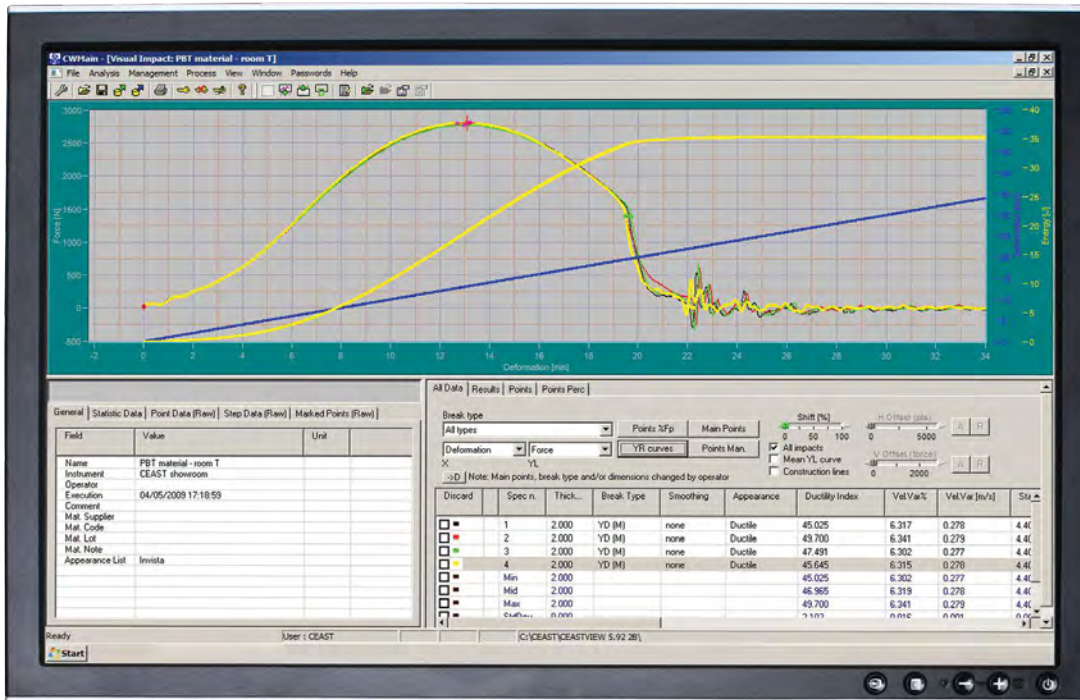
To view our range of accessories please visit:  
[www.instron.com/accessories](http://www.instron.com/accessories)



# THE RESULTS ARE IN

CEAST 9000 Series

Do you need to know more than the absorbed energy for your pendulum test?  
Would seeing the load-time curve help understand your results?



## UNINSTRUMENTED

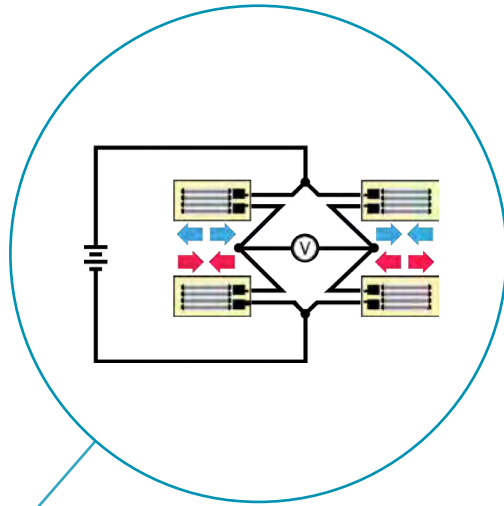
Uninstrumented pendulum tests provide the energy taken to break the specimen and allow the impact resistance to be calculated.

Different materials may have the same absorbed energy while failing in different ways. This information can only be collected by instrumenting your test.

## INSTRUMENTED

The addition of an instrumented hammer and Data Acquisition System (DAS) allow the engineer to “see” types of information that were previously unknown, including failure type and ductile-brittle behavior.

With instrumentation, the load on the specimen is continuously recorded as a function of time and gives a more complete representation of the test than a single energy value collected during uninstrumented tests.



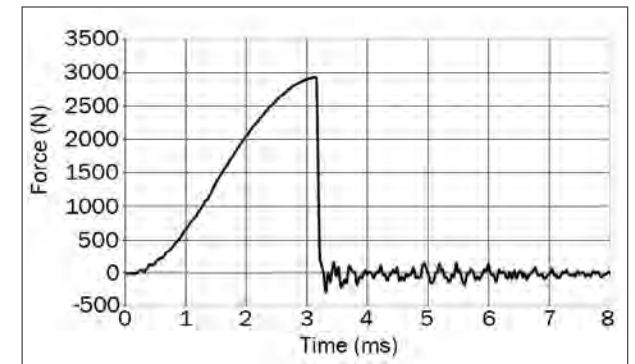
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## Instrumentation

To acquire the force signal during impact, a strain-gauge sensor bridge is placed inside the striker body. The deformation acting on the striker during impact will be acquired by a separate Data Acquisition System (DAS) as an electric signal, which is directly transformed into a force value. The instrument can be equipped with a miniaturized slip ring to transmit the electric signal with the lowest friction and easiest connection.







# GLOBAL PRESENCE, LOCAL TO YOU

CEAST 9000 Series



## When You Need Us, We're There

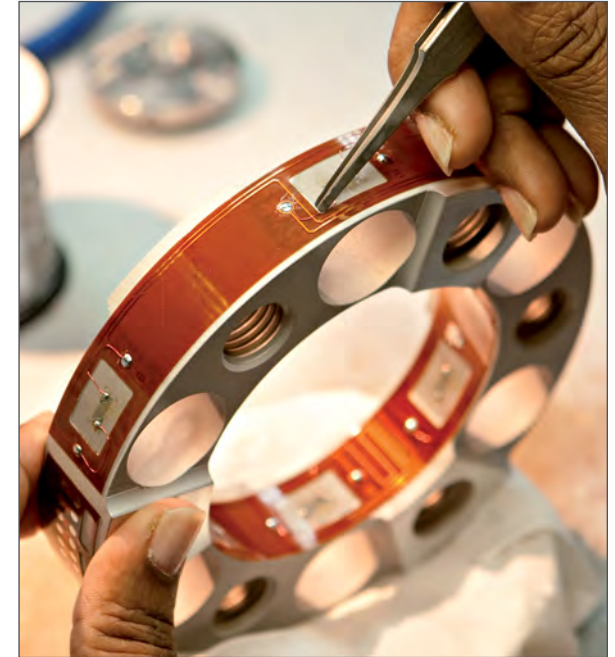
Founded in 1946, Instron® has established itself as a leading supplier of materials testing equipment and solutions. Operating with 25 offices in 18 countries and more than 1200 employees, we have a global infrastructure that is local to you and remain committed to advancing materials and components testing techniques.



## Maximize Uptime

The Instron world-class service organization is committed to deliver high-quality installation, calibration, training, maintenance, and technical support throughout the life of your system.

We help ensure that your systems are there when you need them.



## Quality Standards You Can Trust

Operating under ISO 9001 quality standards and with an extensive list of accreditations, Instron employs a product design philosophy where our customers' data integrity, safety, and protection of investment are paramount. We strive to ensure that our customer satisfaction is second to none.



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## THE WORLD STANDARD

We stake our reputation on the integrity of data. From the measurement of primary test data to result generation, we design and manufacture the full data integrity chain (e.g. load cells, sensor conditioning, and software). Additionally, we calibrate more than 90,000 of these sensors annually with the lowest accumulated uncertainty.

**30,000+**

We service and calibrate more than 30,000 Instron systems in active use worldwide every year.

**96%**

96% of the Fortune 100 list of the world's largest manufacturing companies use Instron test systems.

**18,000+**

Instron systems have been cited in more than 18,000 patents since 1975.

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**GO**                    **Type 2, Heat and Condensate Hood**

| Model | Hood Length (in.) | Width (in.) | Height (in.) | Exhaust Volume (CFM) | Exhaust SP (in. w.g.) | Condensate Baffle | Gutter |
|-------|-------------------|-------------|--------------|----------------------|-----------------------|-------------------|--------|
| GO    | 60                | 42          | 24           | 600                  | 0.307                 | No Baffle         | No     |

**Selected Options & Accessories:**

| Option or Accessory | Description               |
|---------------------|---------------------------|
| Mounting Height     | 80 in. off Finished Floor |

**Material:** 430 SS 100% Construction  
(Hanger brackets - galvanized steel)

**Features:**  
Stainless Steel Finish for Higher Corrosion Resistance

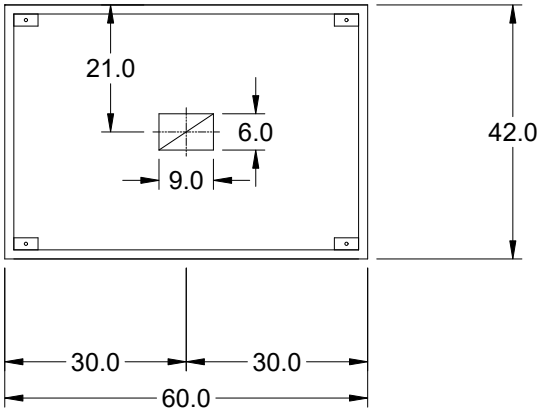
**Section Data:**

| Section Num. | Length (in.) | Weight (LBS) | Volume (CFM) | SP(in. w.g.) | Drain | Light Qty | Light Type | Foot Candles |
|--------------|--------------|--------------|--------------|--------------|-------|-----------|------------|--------------|
| 1            | 60.00        | 104.000      | 600.0        | 0.307        | None  | 0         |            | na           |

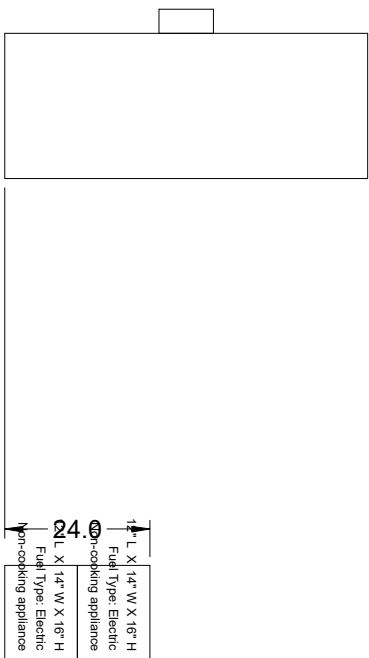
**Exhaust Collar Data:**

| Section Num. | Collar Num. | Collar Size (LxW) in. or Diameter (in.) | Pos. Off Left (in.) | Pos. Off Back (in.) | Velocity (fpm) | Mounting Option                   |
|--------------|-------------|---|---------------------|---------------------|----------------|-----------------------------------|
| 1            | 1           | 9 x 6                                   | 30                  | 21                  | 1600           | Factory Mounted Exhaust Collar(s) |

**EXHAUST HOOD**



MARK: H-1 - SECTION 1  
PLAN VIEW



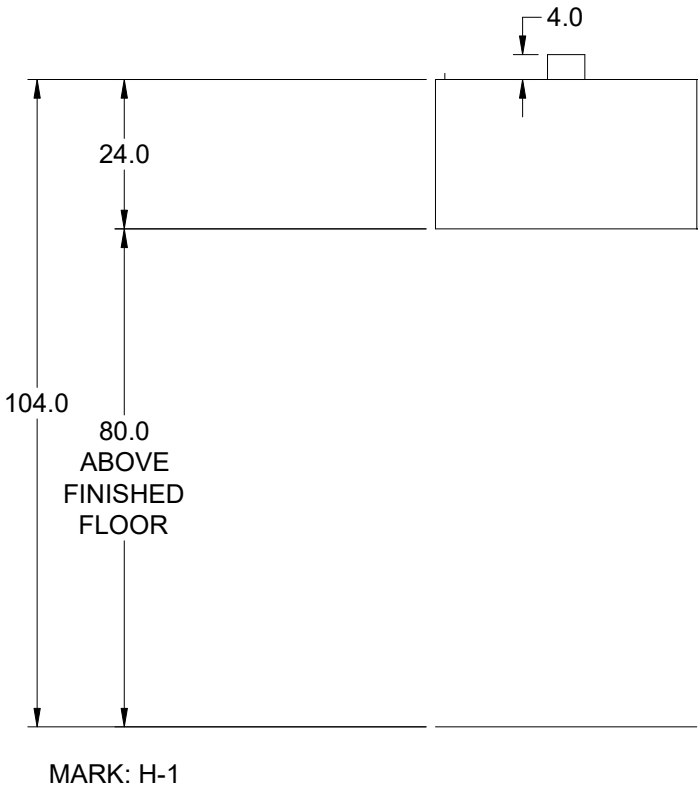
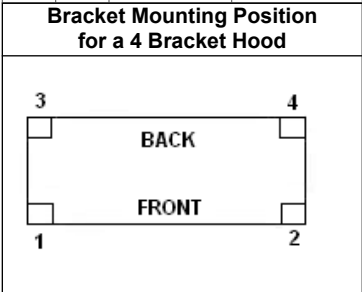
MARK: H-1 - SECTION 1  
ELEVATION VIEW

NOTE: All dimensions are in units of in.





| Hanger Bracket Locations |        |                        |                         |
|--------------------------|--------|------------------------|-------------------------|
| Sec #                    | Brkt # | Distance Off Left (in) | Distance Off Front (in) |
| 1                        | 1      | 3.50                   | 2.50                    |
| 1                        | 2      | 56.50                  | 2.50                    |
| 1                        | 3      | 3.50                   | 39.50                   |
| 1                        | 4      | 56.50                  | 39.50                   |



NOTE: All dimensions are in units of in.

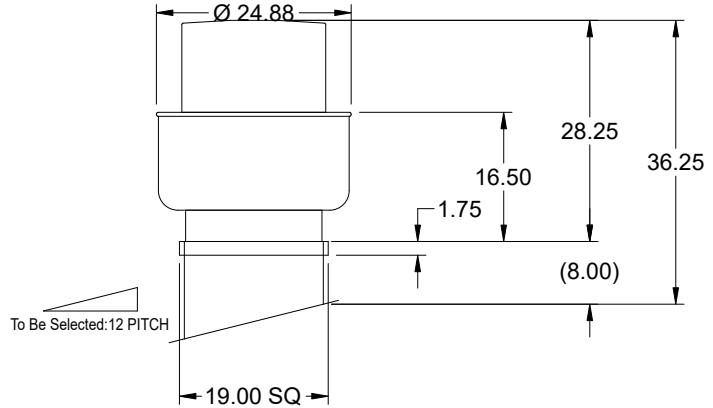


# Model: CUE-100HP-VG

Direct Drive Upblast Centrifugal Roof Exhaust Fan

Previously: CUE-101HP-VG

| Dimensional                   |             |
|-------------------------------|-------------|
| Quantity                      | 1           |
| Weight w/o Acc's (lb)         | 50          |
| Weight w/ Acc's (lb)          | 56          |
| Weight w/ Acc's and Curb (lb) | 80          |
| Standard Curb Cap Size (in.)  | 19 x 19     |
| Optional Damper (in.)         | 12 x 12     |
| Roof Opening (in.)            | 15.5 x 15.5 |

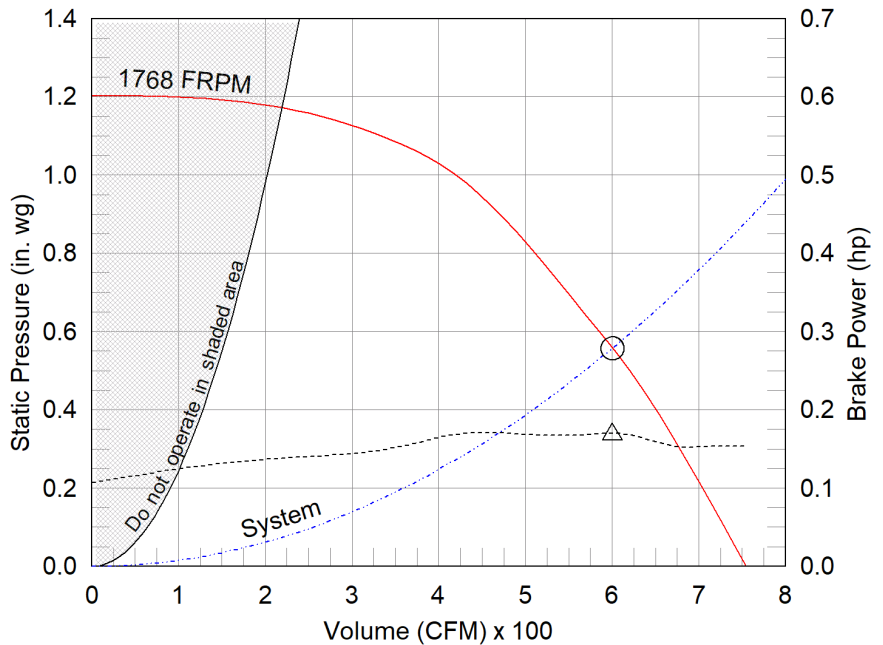


OVERALL HEIGHT MAY BE GREATER DEPENDING ON MOTOR, ADAPTER, AND/OR HINGE BASE.

| Performance                |       |
|----------------------------|-------|
| Requested Volume (CFM)     | 600   |
| Actual Volume (CFM)        | 600   |
| Total External SP (in. wg) | 0.557 |
| Fan RPM                    | 1768  |
| Operating Power (hp)       | 0.17  |
| Elevation (ft)             | 75    |
| Airstream Temp.(F)         | 70    |
| Air Density (lb/ft3)       | 0.075 |
| Tip Speed (ft/min)         | 5,149 |
| Static Eff. (%)            | 31    |

| Misc Fan Data            |     |
|--------------------------|-----|
| Fan Eff. Index (FEI)     | -   |
| Outlet Velocity (ft/min) | 469 |

| Motor                             |          |
|-----------------------------------|----------|
| Motor Mounted                     | Yes      |
| Size (hp)                         | 1/2      |
| Voltage/Cycle/Phase               | 115/60/1 |
| Enclosure                         | ODP      |
| Motor RPM                         | 2500     |
| Efficiency Rating                 | High     |
| Windings                          | 1        |
| FLA (Amps)                        | 6.6      |
| Min. Circuit Ampacity (MCA)       | 8        |
| Max. Overcurrent Protection (MOP) | 15       |
| Short Circuit Current Rtg (SCCR)  | 5 kA     |



- △ Operating Bhp point
- Operating point at Total External SP
- Fan curve
- - - System curve
- - - Brake horsepower curve

## EXHAUST FAN

### Notes:

All dimensions shown are in units of in.  
\*NEC FLA, MCA and MOP are for reference only – based on tables 430.248 or 430.25 of National Electric Code 2020. Actual motor FLA may vary, for sizing thermal overload, consult factory. MCA and MOP values shown only account for the motor, not accessories (damper actuator, field supplied VFD, etc).  
LwA - A weighted sound power level, based on ANSI S1.4 dBA - A weighted sound pressure level, based on 11.5 dB attenuation per Octave band at 5 ft - dBA levels are not licensed by AMCA International  
Sones - calculated using ANSI/AMCA 301 at 5 ft

### Sound Power by Octave Band

| Sound Data | 62.5 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | LwA | dBA | Sones |
|------------|------|-----|-----|-----|------|------|------|------|-----|-----|-------|
| Inlet      | 82   | 76  | 69  | 68  | 65   | 61   | 57   | 53   | 71  | 59  | 10.0  |



## Model: CUE-100HP-VG

Direct Drive Upblast Centrifugal Roof Exhaust Fan

### Standard Construction Features:

- Aluminum housing - Backward inclined aluminum wheel - Aluminum curb cap with prepunched mounting holes - Drain trough - Ball bearing motors (sizes 85-300 and all Vari Green), sleeve bearing motors (sizes 60-80) - Motor isolated on shock mounts - Corrosion resistant fasteners

### Selected Options & Accessories:

Motor - Vari-Green EC motor  
Control - Dial for balancing  
Standard Curb Cap Size - 19 Square  
Switch, NEMA-3R, Toggle,  
Junction Box Mounted & Wired  
High Temp Curb Seal Rated for Continuous Duty at 1500 F (Factory Attached)  
High Temperature Construction-Continuous Duty up to 425 F  
Conduit Chase Qty 1  
Unit Warranty: 1 Yr (Standard)  
Damper Shipped Loose, BD-100-PB-12X12, Gravity Operated, Not Coated,  
Nominal Size

### Selected Sub Marks

See individual submittals for full details  
GFPF-19-G8

***The Vari-Green Motor included in this order has a 'Multi-Voltage' ability. The red wire on the motor is called a 'Voltage Doubler', and when it is connected the motor can be powered by 115V.***

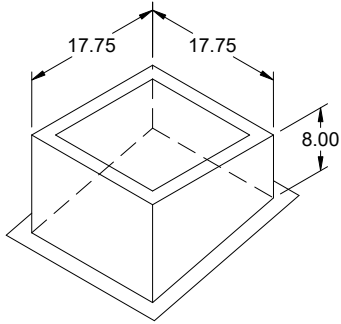
***If the Red wire is disconnected, then the motor can be powered with 208-230/277V. The motor will leave the factory with the voltage doubler wired per the order.***

## AMCA



AMCA Licensed for Sound and Air Performance. Power rating (BHP/kW) does not include transmission losses.

Greenheck Fan Corporation certifies that the model shown herein is licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program. Performance certified is for installation type A: Free inlet, Free outlet. Power rating (BHP/kW) does not include transmission losses. Performance ratings do not include the effects of appurtenances (accessories). The sound ratings shown are loudness values in fan sones at 5 ft. (1.5 m) in a hemispherical free field calculated per ANSI/AMCA Standard 301. Values shown are for installation type A: free inlet hemispherical sone levels. dBA levels are not licensed by AMCA International. The AMCA Certified Ratings Seal applies to sone ratings only.



## Model: GPFP

### Pitched Roof Curb

#### Standard Construction Features:

- Roof Curb fits between the building roof and the fan mounted directly to the roof support structure - Constructed of either 18 ga galvanized steel or 0.064 in. aluminum - Designed for pitched roofs - Straight sided without a cant - 2 in. or 5 in. mounting flange - 1 in. thick 3 lb density insulation - Height - Available from 8 in. to 24 in. as specified in 0.5 in. increments Notes: - The maximum roof opening dimension should not be greater than the "Actual" top outside dimension minus 2 in.. - The minimum roof opening dimension should be at least 2.5 in. more than the damper dimension or recommended duct size. - The Roof Opening Dimension may or may not be the same as the Structural Opening Dimension.

#### General

| Tag | Qty | Model   | Sizing Method | Undersizing (in.) | Pitch (in.) | Pitch Run | Weight (lb) | Shipped Assembled | Union Label   |
|-----|-----|---------|---------------|-------------------|-------------|-----------|-------------|-------------------|---------------|
|     | 1   | GPFP-19 | Nominal       | 1.25              | ???         | Long Side | 24          | Yes               | No Preference |

#### Dimensions

| Curb Height (in.) | Nominal Outside Width (in.) | Nominal Outside Length (in.) | Actual Outside Width (in.) | Actual Outside Length (in.) | Actual Inside Width (in.) | Actual Inside Length (in.) | Flange Width (in.) | Flange Length (in.) | Hinge Base Width* (in.) | Hinge Base Length* (in.) |
|-------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|----------------------------|--------------------|---------------------|-------------------------|--------------------------|
| 8                 | 19                          | 19                           | 17.75                      | 17.75                       | 14.25                     | 14.25                      | 18                 | 18                  |                         |                          |

\*May not be applicable

#### Accessories

| Material   | Security Bars | Liner | Insulation (in.) | Insulation R Value |
|------------|---------------|-------|------------------|--------------------|
| Galvanized | No            | No    | 1                | R4.3               |



# Wilson® Rockwell® 574

Regular, Superficial, and Twin Scale Testing

The Rockwell 574 Testers are proven, durable, and reliable performers meeting a range of Rockwell testing applications. Available in Regular, Superficial or Twin Scale models, the 574 provides a rugged industrial design, an all-new, easy-to-use control panel, and a built-in USB for easy data transfer to Microsoft® Excel® or other applications. Designed with the best repeatability in its class, the 574 is an affordable, high-precision depth measurement system with proven performance.



## Durable & Accurate

- Inline depth transducer for absolute accuracy
- Loading system out of stainless steel components
- Best in class GR&R performance

## Interface

- USB port for data transfer
- Crisp, intuitive LCD display with test status, hardness values, statistics, and six languages

## Brake

- Automatic minor load braking system

## Specimen Illumination

- Specimen lighting with adjustable illumination levels

## Applications

- Hardness from castings and forgings
- For flat and cylindrical work pieces
- Wide application within the automotive and aerospace industry
- Laboratory and workshop testing
- Sample testing or quality control testing
- Steels, non-ferrous metals
- Cemented carbide, ceramics, stainless steel

## HARDNESS TESTER



**BUEHLER**

Solutions for Materials Preparation, Testing and Analysis

## Specifications

|                          | 574R Regular  | 574S Superficial  | 574T Twin  |
|--------------------------|---|---|--|
| Pre-load                 | 10kgf   | 3kgf  | 3, 10kgf   |
| Main-load                | 60, 100, 150kgf   | 15, 30, 45kgf   | 15, 30, 45, 60, 100, 150kgf  |
| Hardness scales          | HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV | 15N, 30N, 45N, 15T, 30T, 45T, 15W, 30W, 45W, 15X, 30X, 45X, 15Y, 30Y, 45Y | HRA, HRB, HRC, HRD, HRE, HRF, HRG, HRH, HRK, HRL, HRM, HRP, HRR, HRS, HRV, 15N, 30N, 45N, 15T, 30T, 45T, 15W, 30W, 45W, 15X, 30X, 45X, 15Y, 30Y, 45Y |
| Test load type           | Calibrated Spring (Minor Load), Dead weight stack (Major load)            |   |  |
| Test cycle type          | Motorized with automatic pre-load brake                                   |   |  |
| Vertical test capacity   | 11.43in [289mm] <i>accessories may decrease available capacity</i>        |   |  |
| Horizontal test capacity | 6.93in [175mm] at the top, 6.13in [155mm] at the bottom                   |   |  |
| Indenters (optional)     | 120° Diamond cone, 1/16in, 1/8in, 1/4in, 1/2in Ball                       |   |  |
| Data-out                 | USB and RS232   |   |  |
| Standards Compliant      | ASTM E18, ASTM D785, ASTM B294, ISO 6508, JIS Z 2245, GB/T 230            |   |  |
| Power                    | 100 - 240VAC, 60/50Hz   |   |  |



### Test Blocks and Indenters

High quality Wilson® hardness standardized test blocks from Buehler® are calibrated in compliance with ASTM E384, ASTM E18, ASTM E10, ISO 6507, ISO 6508, or ISO 6506 where appropriate. Rockwell C standardized test blocks are directly NIST traceable. All calibrations and certifications are performed in an ISO/IEC 17025 compliant facility.



### Accessories

#### Standard

- 63 mm (2.5 in) flat anvil
- 1.5875 mm (1/16 in) carbide ball indenter with four extra carbide balls
- CD with operating instructions and CE certificates
- Certificate of calibration
- Power cord

#### Accessory options

- Indenters and blocks
- Regular, Superficial, Twin Scale kits
- Clamping Adapter
- Wide range of anvils, fixtures, and test tables

*For a complete listing of consumables, please refer to our Product Catalogue or contact your local Buehler Sales Engineer. Buehler continuously makes product improvements; therefore technical specifications are subject to change without notice.*

|  |                       |   |                               |                             |
|--|-----------------------|---|-------------------------------|-----------------------------|
| Sectioning<br>AbrasiMet • AbrasiMatic • IsoMet | Mounting<br>SimpliMet | Grinding & Polishing<br>EcoMet • AutoMet • MetaServ | Imaging & Analysis<br>OmniMet | Hardness Testing<br>Wilson® |
|--|-----------------------|---|-------------------------------|-----------------------------|



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**BUEHLER Asia-Pacific**  
info@buehler.com.hk

# Cable, Cord and Hose Reels

## Features and Benefits

### Commercial Cord Reels

- Durable steel construction for commercial and general purpose applications
- Compact size, flexible mounting options for ceiling, wall or bench
- Automatic ratchet lock holds cord at desired length and provides easy, smooth retraction of cord
- Attached plug for power cord requires no wiring



### Commercial Cord Reels

- Durable light weight non-metallic housing
- Removable bracket allows reel to be disengaged from mount providing portability
- 40 Ft. of #12/3 cord for greater current carrying capacity
- Triple tap outlet with supplemental over current protection

### Commercial Cord Reels

| Description                                       | Amps | Volts AC | Cable Length Feet (m) | Cable Type | Watts (Max) | Weight Lbs. (kg) | Catalog Number     |
|---|------|----------|-----------------------|------------|-------------|------------------|--------------------|
| Black Reel with triple tap outlet.                | 15   | 125      | 40 (12.2)             | #12/3 SJTW | 1,875       | 13.8 (6.3)       | <b>HBLC40123TT</b> |
| Black Reel with wire leads.                       | 15   | 125      | 40 (12.2)             | #12/3 SJTW | 1,875       | 13.8 (6.3)       | <b>HBLC40123</b>   |
| White Reel with triple tap outlet and white cord. | 10   | 125      | 30 (9.1)              | #16/3 SJT  | 1,250       | 8.5 (3.9)        | <b>HBLC30163TT</b> |
| White Reel with single connector and white cord.  | 15   | 125      | 20 (6.1)              | #14/3 SJT  | 1,875       | 8.5 (3.9)        | <b>HBLC20143C</b>  |
| Yellow Reel with Hubbell HBL5969VBLK connector.   | 10   | 125      | 25 (7.6)              | #16/3 SJT  | 1,250       | 8.5 (3.9)        | <b>HBLC25163C</b>  |
| Yellow Reel with wire leads.                      | 10   | 125      | 25 (7.6)              | #16/3 SJT  | 1,250       | 8.5 (3.9)        | <b>HBLC25163**</b> |

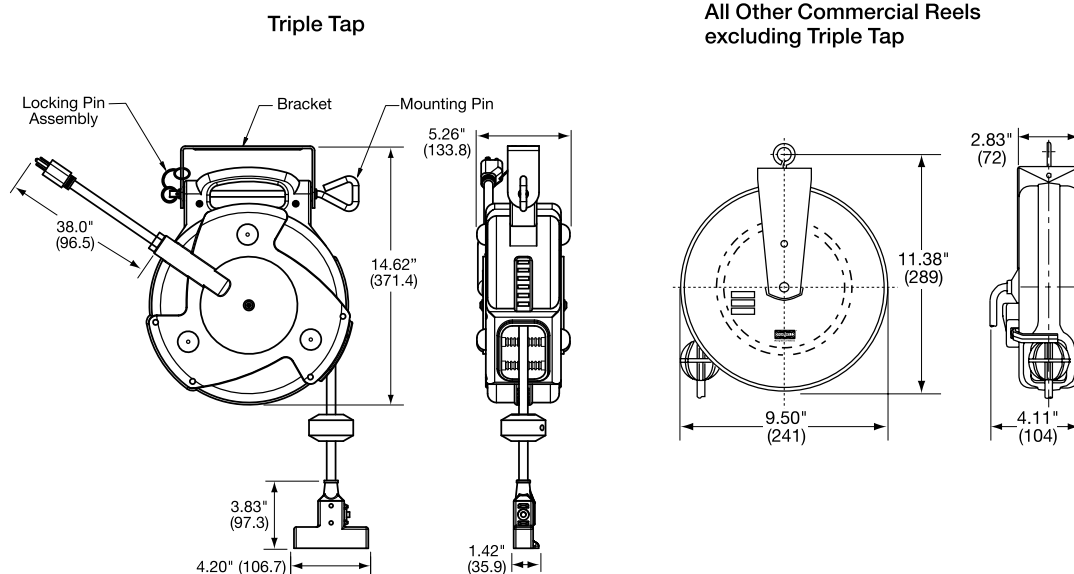
Note: Reels supplied with 2 ft. power supply cord and molded on straight blade 15A plug.

\*\*UL Listed only.

### Specifications

|                       |  |
|-----------------------|--|
| Listing/Certification | UL 355.  |
| Environment           | Dry, indoor, non-hazardous locations.  |
| Incandescent Lamp     | 75 watt max., auto switch, no receptacle; 100 watt max. bulb, with receptacle. |
| Fluorescent Lamp      | 10A/1200W max. with in-line receptacle; 13 watt without receptacle.            |

### Dimensions



HBLC40123TT



HBLC30163TT



HBLC20143C



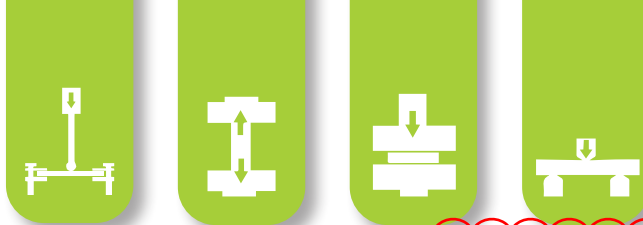
HBLC25163C

Dimensions in Inches (mm)



# TENSILE TESTER

## SPECIFICATIONS

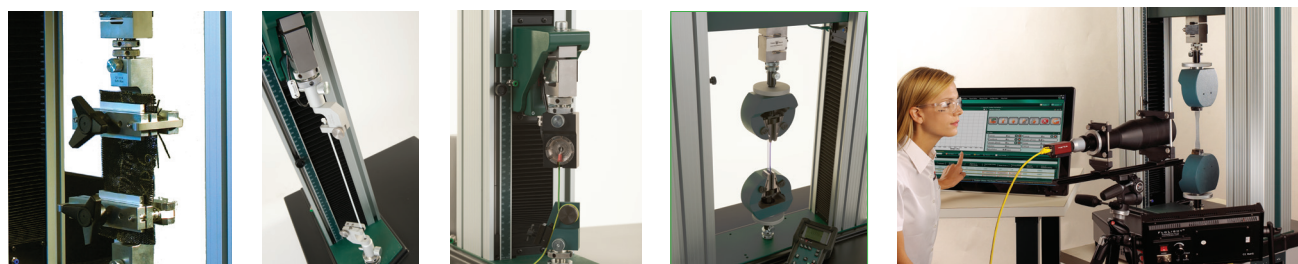


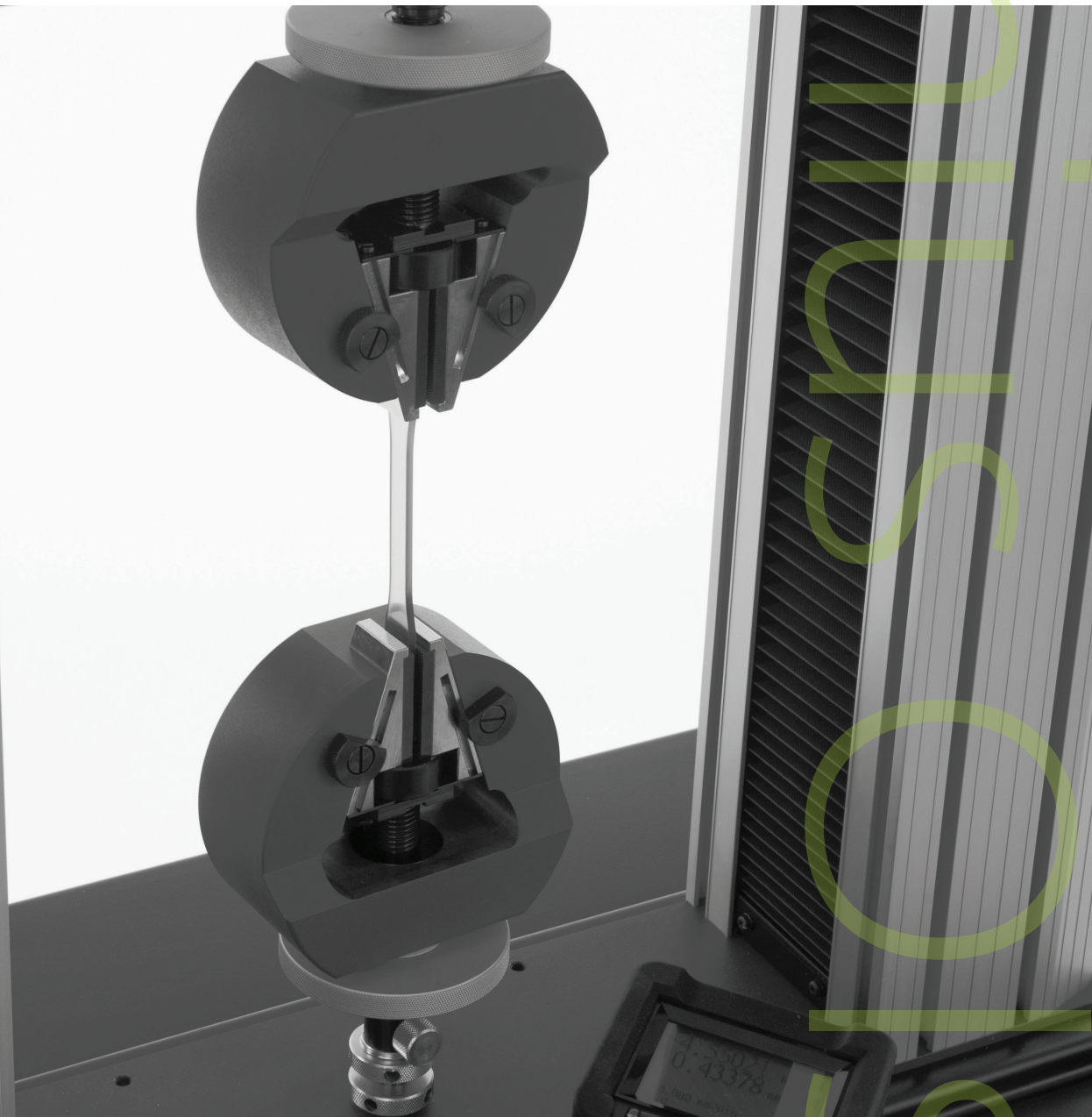
| MODEL                     |        | 1ST              | 5ST              | 10ST             | 25ST             | 50ST             |
|---------------------------|--------|------------------|------------------|------------------|------------------|------------------|
| Capacity                  | kN     | 1                | 5                | 10               | 25               | 50               |
|                           | lbf    | 200              | 1,000            | 2,000            | 5,000            | 11,000           |
| Test speed range          | mm/min | 0.0001-1000      | 0.0001-1000      | 0.0001-1000      | 0.0001-1000      | 0.0001-500       |
|                           | in/min | 0.000004-40      | 0.000004-40      | 0.000004-40      | 0.000004-40      | 0.000004-20      |
| Clearance between columns | mm     | -                | -                | 410              | 410              | 410              |
|                           | in     | -                | -                | 16               | 16               | 16               |
| Throat depth              | mm     | 100              | 100              | -                | -                | -                |
|                           | in     | 4                | 4                | -                | -                | -                |
| Max crosshead travel      | mm     | 755              | 755              | 1090             | 1090             | 1065             |
|                           | in     | 30               | 30               | 43               | 43               | 42               |
| Dimensions (HxWxD)        | mm     | 1168 x 511 x 467 | 1168 x 511 x 467 | 1625 x 729 x 506 | 1625 x 729 x 506 | 1655 x 729 x 506 |
|                           | in     | 46 x 20 x 18     | 46 x 20 x 18     | 64 x 29 x 20     | 64 x 29 x 20     | 65 x 29 x 20     |
| Weight                    | kg     | 58               | 58               | 129              | 129              | 192              |
|                           | lb     | 128              | 128              | 284              | 284              | 423              |

| MODEL                     |        | 100ST             | 150ST             | 300ST             |
|---------------------------|--------|-------------------|-------------------|-------------------|
| Capacity                  | kN     | 100               | 150               | 300               |
|                           | lbf    | 20,000            | 30,000            | 60,000            |
| Test speed range          | mm/min | 0.001-500         | 0.001-500         | 0.001-500         |
|                           | in/min | 0.0004-20         | 0.0004-20         | 0.0004-20         |
| Clearance between columns | mm     | 656               | 656               | 656               |
|                           | in     | 26                | 26                | 26                |
| Max crosshead travel      | mm     | 1198              | 1173              | 1173              |
|                           | in     | 47                | 46                | 46                |
| Dimensions (HxWxD)        | mm     | 2323 x 1205 x 700 | 2323 x 1205 x 700 | 2323 x 1205 x 700 |
|                           | in     | 91 x 47 x 28      | 91 x 47 x 28      | 91 x 47 x 28      |
| Weight                    | kg     | 750               | 970               | 1050              |
|                           | lb     | 1653              | 2138              | 2315              |

### NOTES

- Load weighing system meets or exceeds the requirements of the following standards: ASTM E4, ISO 7500-1, and EN 10002-2. Tinius Olsen recommends that systems are verified at installation in accordance with ASTM E4 and ISO 75001.
- Strain measurement system meets or exceeds the requirements of the following standards: ASTM E83, ISO 9513 and EN 10002-4.
- Specifications are subject to change without notice.





# ST Series

Electromechanical  
Universal Testing Machines

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# ST Series

The ST Series of electromechanical testing machines from Tinius Olsen is designed to test a wide range of materials including, but not limited to: plastics, films, paper, packaging materials, filter material, adhesives, foils, food, toys, medical devices and components, in tension, compression, flexure, shear and peel.

All ST series machines can be used with selection of handheld interfaces or a virtual machine interface running on a connected PC. Powerful data analysis and machine control software (our Horizon Materials Testing software) can be added to your system to provide a library of standardized test routines, generate a complete graphical result of your test, and perform sophisticated powerful analyses on the test data to produce the test report you need.

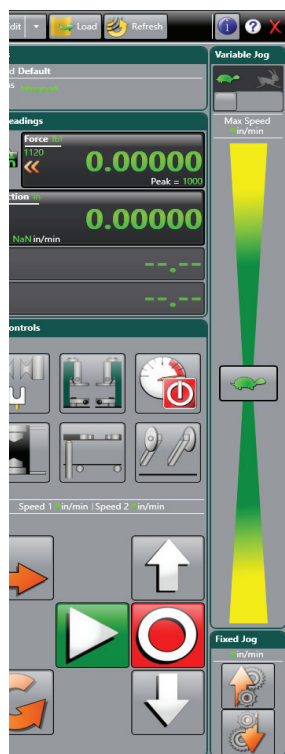
A comprehensive selection of self-identifying load cells, grips and fixtures hold the simplest to most complex specimen profiles, strain measurement instruments employ different technologies, temperature

chambers and more can be used in conjunction with these test frames and Horizon software to ensure you

have one of the best, most accurate repeatable, flexible and easy-to-use systems on the market today.

## HORIZON SOFTWARE

Our Horizon software sets new standards of data analysis by adding a host of report writing and data manipulation capabilities that will make easy work of your materials testing programs, whether they're designed for the demanding rigors of R&D or the charting and analysis functions of QC testing. In addition, Horizon Materials Testing software is networkable and scalable so operators and managers can operate equipment and review test results from multiple sources and locations.



## CONTROLLER INTERFACES

ST systems can be operated by a choice of different interface panels. Choose from tethered, wireless or a virtual interface running on a connected PC.

This **virtual interface** runs on a connected PC and can be used to set up and run a test to provide a quick numerical result. The addition of Horizon software with any of these interfaces allows complex tests to be created and recalled, along with sophisticated data analysis of all graphical data.

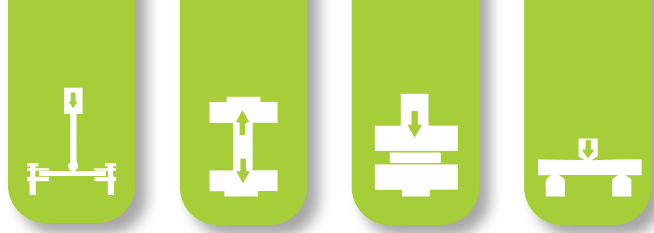


The **Bluetooth connected interface** features easy to operate tactile buttons and a high resolution touchscreen to set up and monitor tests where parameters and results are shown numerically. The interface also features an 8MP camera and has WiFi connectivity.



The **tethered interface** option features larger tactile feedback buttons to operate the testing frame; these are ideal for users who need to wear protective gloves while operating the machine. The display provides simple numerical display of individual channels used on the testing machine.

# KEY FEATURES



## T SLOTS

To keep the testing area as open, uncluttered and flexible as possible, each test system features T slots in the columns. These T slots can be used to attach the handheld interface, a video camera stand, automatic extensometer support and strain gage or LVDT extensometer support and swing-away guards and shields etc, using vibration-free articulating arms. By keeping the test area as uncluttered as possible, unrestricted access to chambers and test tanks is maintained.

## ACCURACY

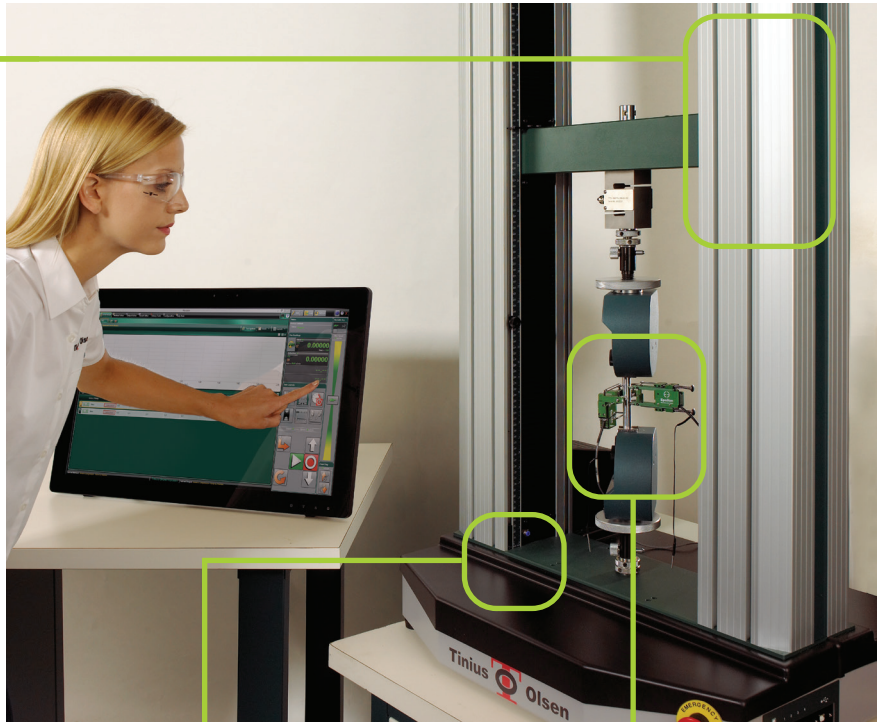
We have the most robust, reliable and accurate load measuring systems available in the machine. This system allows us to achieve an accuracy of better than 0.2% of the reading from 0.2-100% of the load cell capacity.

## DATA RATE

Internal sample and update frequency can be up to 2.73k samples per second per channel while the data transfer rate to a computer running Horizon software via USB2 connection is restricted to 1kHz to ensure data is free of noise and spikes and prevents erroneous results being reported.

## ACCESSORY CONNECTIVITY

Up to a maximum of four connections can be made with the test frame via a built-in accessory connection panel on the machine.



## BUILT-IN PNEUMATIC SUPPLY

Connections for compressed air built into the machine (a compressed air inlet is supplied on the rear of the machine). This allows operation of pneumatic grips without long air supply lines obstructing the test area.

## EXTENSOMETERS

Full complement of video, automatic, encoder, laser, strain gage and LVDT extensometers are available for the determination of specimen strain.





# BENCH MACHINE OPTIONS

The Tinius Olsen benchtop range of ST models features both single and dual column frames. The single column models have frame capacities of 1kN (100kgf/200lbf) and 5kN (500kgf/1,100lbf), while dual column models are available in capacities of 10kN (1,000kgf/2,200lbf), 25kN (2,500kgf/5,000lbf) and 50kN (5,000kgf/11,000lbf), and are designed to test a vast range of materials and finished products for strength properties in tension, compression, flexure, shear, tear and peel.

They provide the ultimate in durability, speed, accuracy and convenience and feature high precision, interchangeable strain gage load cells for capturing applied load data. This design allows rapid change of machine capacity from as little as 0.2% of the capacity of the smallest load cell (exception in 5N&10N) to the maximum frame capacity in a very simple process.

The construction of the machine frame, leadscrews and drive system make them unique. Even at full capacity, these frames have excellent rigidity with negligible frame deflection.

The machines can be operated at speeds ranging from a minimum of 0.0001mm/min (0.004 thousandths of an inch per minute) to a maximum of up to 1000mm/min (40 inches per minute), depending on frame size, which accommodates a wide range of materials and specimens.

Frame flexibility is further extended by a wide array of accessories including various optical and electronic extensometers, compressometers and deflectometers, hot and cold temperature test chambers for sample conditioning and testing, high temperature furnaces (with high temperature-capable extensometers), as well as grips, holders, jigs and platens for holding the test specimens.

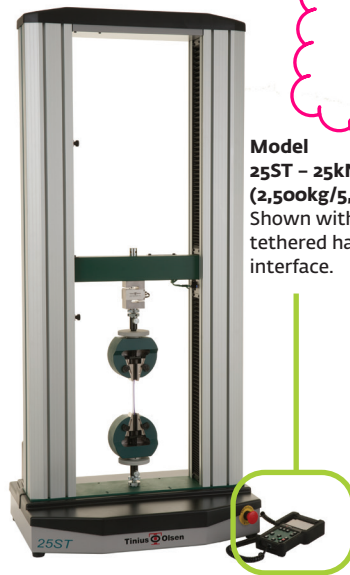
These test frames can be modified by adding extra height to the test area by up to an additional 400mm. Contact your sales representative for further details.



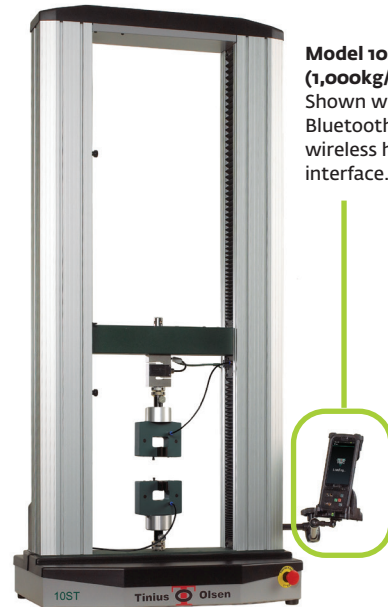
**Model 5ST – 5kN (500kg/1,000lbf)** Shown with Bluetooth-enabled handheld interface.



**Model 50ST – 50kN (5,000kg/11,000lbf)** Shown with Bluetooth-enabled, wireless handheld interface.



**Model 25ST – 25kN (2,500kg/5,000lbf)** Shown with tethered handheld interface.



**Model 10ST – 10kN (1,000kg/2,000lbf)** Shown with Bluetooth-enabled, wireless handheld interface.



**Model 1ST – 1kN (100kg/200lbf)** Shown with tethered handheld interface and Horizon software.

# FLOOR MACHINE OPTIONS

These Tinius Olsen floor standing ST models have frame capacities of 100kN, 150kN, and 300kN (20,000lbf, 30,000lbf, and 60,000lbf respectively) and are designed to test a vast range of materials including, but not limited to: rigid and reinforced plastics, composites, geotextiles, sheet metal, welded specimens, adhesives, and medical products and components, in tension, compression, flexure, shear, tear and peel.

These frames feature high precision, interchangeable strain gage load cells for capturing applied load data. This design allows rapid change of machine capacity from as little as 0.2% of the capacity of the smallest load cell to the maximum frame capacity in a very simple process.

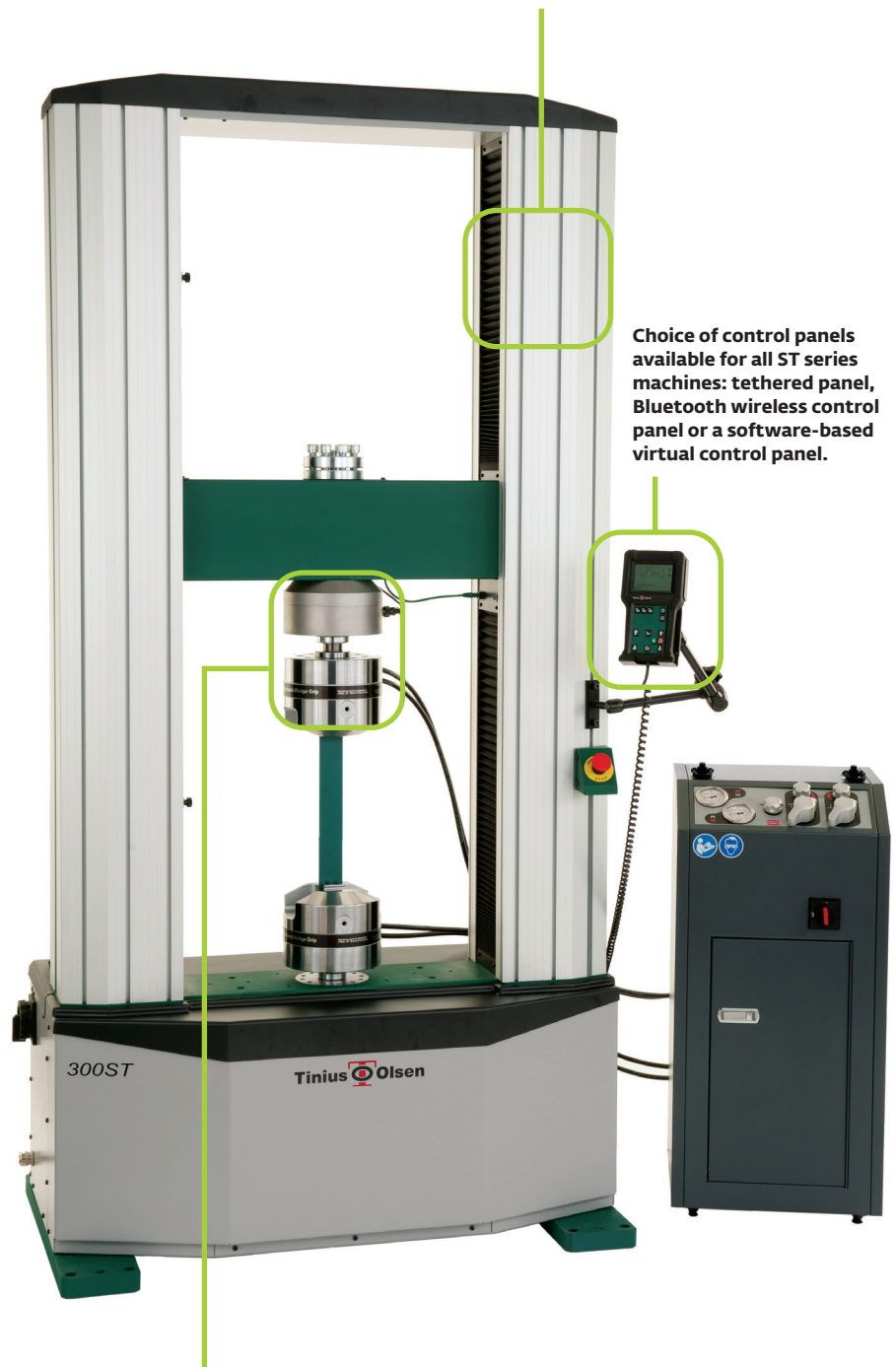
The construction of the machine frame and drive system make them unique. Even at full capacity, these frames have excellent rigidity with negligible frame deflection.

This design allows frame flexibility for both tension and compression tests. Users can load heavy specimens with minimal effort. This feature is further enhanced by a programmable switch mechanism that allows rapid setting of the upper and lower crosshead limits at any point within the frame's clearance.

The machines can be operated at speeds ranging from a minimum of 0.001mm/min (0.4 thousandths of an inch per minute) to a maximum of 500mm/min (20 inches per minute), which accommodates a wide range of materials and specimens.

Frame flexibility is further extended by a wide array of accessories including various optical and electronic extensometers, compressometers and deflectometers, hot and cold temperature test chambers for sample conditioning and testing, high temperature furnaces (with high temperature capable extensometers), as well as grips, holders, jigs, and platens for holding the test specimens.

To keep the testing area as open, uncluttered and flexible as possible, each test system features T slots in the columns. These T slots can be used to attach the handheld controller, a video camera stand, automatic extensometer support, a strain gage or LVDT extensometer support and swing-away guards and shields etc, using vibration-free articulating arms. By keeping the test area as uncluttered as possible, unrestricted access to chambers and test tanks is maintained.



Choice of control panels available for all ST series machines: tethered panel, Bluetooth wireless control panel or a software-based virtual control panel.

The ST Series accommodates a wide range of test accessories and facilitates changes in minutes.



# Software

Tinius Olsen has built upon its long history of providing solutions to an enormous variety of testing problems to develop Horizon, a comprehensive software program that makes testing simple, precise and efficient.

Whether the test sample is metal, paper, composite, polymer, rubber, textile, or a micro-component, Tinius Olsen's Horizon software goes far beyond data collection and presentation. It will help automate operations from R&D to the charting and analysis of QC testing.

Our Horizon software sets new standards of data analysis by adding a host of report writing and data manipulation capabilities that will make easy work of your materials testing programs. As with most features of Horizon, flexibility is key; reports can be customized by operators in any way they wish, as can all user screens, allowing operators to focus on features that are most important to them.

In addition to powerful reports, Horizon Materials Testing software is networkable and scalable so operators and managers can operate equipment and review test results from multiple sources and locations. Horizon provides a library of standard, specific and application-focused test routines that have been developed in close co-operation with customers around the world and to the standards they are using.

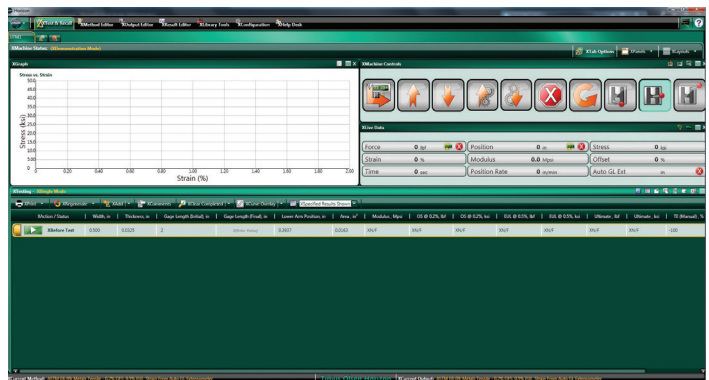
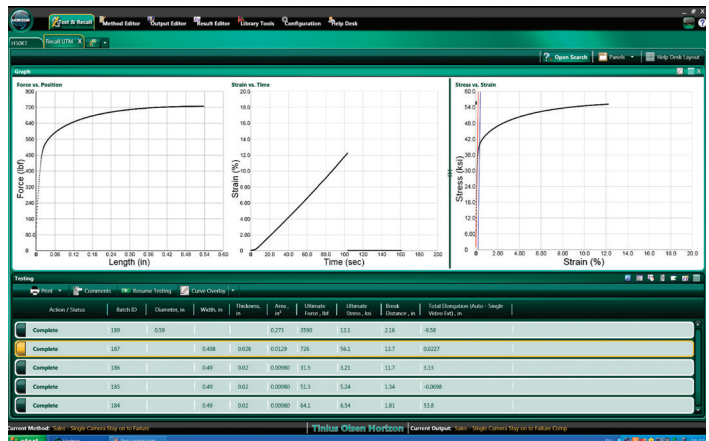
Among the many valuable features offered by Horizon are: a test routine library; simultaneous multiple machine control; test, output, method and result editors; and multilayered security. This software is designed for data acquisition, data analysis, and closed loop control of nearly all Tinius Olsen testing machines.

Horizon is rich with capabilities that improve productivity and enable you to build, access and use a modern, powerful materials testing database. It employs the latest Windows environments, running on

touchscreen-enabled monitors, to create an intuitive user experience. Built-in tutorials, online help, and help desk access provide additional user support.



“Horizon makes testing simple, precise and efficient”





# ST Series

Electromechanical  
Universal Testing Machines

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