Beaverton School District
Aloha High School
Modular Roof Upgrades

18550 SW Kinnaman Rd.
Beaverton, Oregon 97078

Permit and Bid Documents
April 06, 2021

Owner Representative
Kurt Meeuwsen
503-964-2091

Architect
Oh Planning + Design
115 NW First Avenue, Suite 300
Portland, Oregon 97209
503-280-8000
Project Number 90065

00 01 02
PROJECT TEAM

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END OF SECTION

PROJECT:
Beaverton School District
Client Project Number: 90065
BSD Aloha High School Modular Reroof

Architect of Record:
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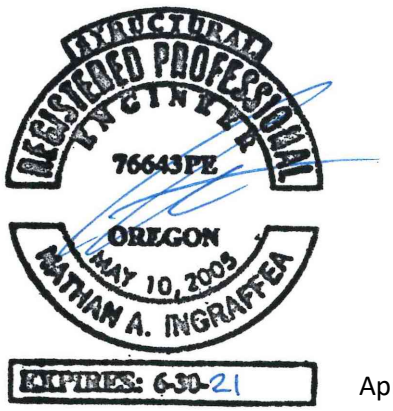
Architect of Record Date

PROJECT:
Beaverton School District
Client Project Number: 90065
BSD Aloha High School Modular Reroof



Structural Engineer:
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April 2, 2021

Engineer of Record Date

PROJECT:
Beaverton School District
Client Project Number: 90065
BSD Aloha High School Modular Reroof

EXPIRES: 12/31/21

4/1/2021

Engineer of Record Date

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PROJECT:
Beaverton School District
Client Project Number: 90065
BSD Aloha High School Modular Reroof

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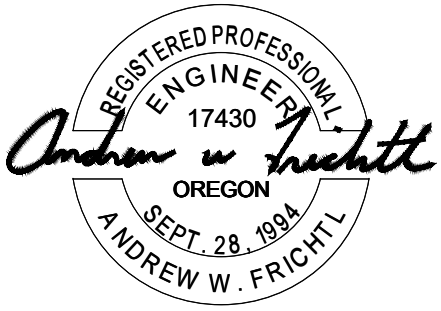
EXPIRES: 06/30/22 4/1/2021

Engineer of Record Date

PROJECT:
Beaverton School District
Client Project Number: 90065
BSD Aloha High School Modular Reroof



EXPIRES: 12/31/21

4/1/2021

Engineer of Record Date

Plumbing:
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SUMMARY OF WORK

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Related Requirements
B. Work Covered by Contract Documents.
C. Contract Method.
D. Permits and Fees
E. Work by the District or Others.
F. Contractor's Use and Site Premise.

1.02 RELATED REQUIREMENTS
A. General Conditions of the Contract for Construction.

1.03 WORK COVERED BY THE CONTRACT DOCUMENTS
A. All work shall be performed on the Beaverton School District – Aloha High School Modular Roof Project located at:

Aloha High School, 18550 SW Kinnaman Road, Beaverton, Oregon 97078

B. The Work shall include all supplies, tools, equipment, scaffolding, transportation, utilities, service, superintendence, labor, and the furnishing of all materials, items, and accessories needed for the Project.
   1. All on-site work, including demolition, installation, and final cleaning is required to be completed during the regularly scheduled hours. Contractor is to coordinate work to accommodate the continuous operation of the adjacent streets and utilities, without interruption or hindrance.
   2. The Contractor shall provide for all scheduling, coordination, cutting and patching and all other items required by the Contract Documents to complete the Work.
   3. The contractor will be required to learn and use Owners Project Management database (e-Builder) for this project.

C. Work of this Contract, as more completely detailed in the Contract Documents consists of one scope of work at one Beaverton School District school. The scope of work for the school includes, but is not limited to, the following elements:

REROOF
1. ARCHITECTURAL
   a. Re-roof with single-ply roofing materials and rigid insulation – full tear-off of existing roofing.
   b. Re-roof with single-ply roofing materials and rigid insulation – partial tear-off of existing roofing.
   c. Replace roof flashings and copings.
   d. Salvage and reinstall roof hatch.
   e. Salvage and reinstall scuppers & downspouts.
   f. Replace or reinstall roof ladders.

2. MECHANICAL
   a. Replace (4) packaged rooftop heat pumps with new packaged gas/electric rooftop units.
   b. Install gas piping to new rooftop units from existing meter.
   c. Replace (2) packaged gas/electric rooftop units with new, including adapter curbs to fit on existing curbs.
   d. Air balancing for (6) rooftop units.
   e. New controls and thermostats for (6) rooftop units.

3. PLUMBING
   a. Demolish, relocate or install related plumbing items within areas of work.
   b. Extend plumbing roof vents as required to accommodate new roof assembly & insulation.
   c. Extend gas line to new rooftop units.

4. ELECTRICAL

a. Disconnect electrical and reconnect to new HVAC as required and as indicated.
b. Demolish, relocate or install related electrical items within areas of work.

1.04 CONTRACT METHOD

A. Construct the work under the AIA Contract, furnished by the Owner.

1.05 PERMITS AND FEES

A. The Owner will reimburse the Contractor as a direct expense (no markup) for the building permit. All other permits will be the responsibility of the Contractor.

1.06 WORK BY THE DISTRICT OR OTHERS

A. If District-awarded contracts interfere with each other due to work being performed at the same time or at the same Site, the District will determine the sequence of work under all contracts. "Contractor's Use of Site and Premises" Articles in this Section outline the District's policies on use of site.
B. Coordinate Work with utilities of the District and public or private agencies.
C. The Contractor shall afford the District and the Owner's separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work.

1.07 OWNER FURNISHED PRODUCTS INSTALLED BY CONTRACTOR (OFCI)

A. There are no OFCI items on this project.

1.08 OWNER FURNISHED PRODUCTS INSTALLED BY OWNER (OFOI)

A. There are no OFOI items on this project.

1.09 HAZARDOUS MATERIALS PROCEDURES

A. The District will directly retain an accredited Asbestos Consultant to provide documentation regarding the finding of asbestos and mitigation measures as required by the Asbestos Hazard Emergency Response Act. The Contractor is responsible for the following procedures when encountering suspected hazardous materials:
    1. Immediately reporting to the District and its Asbestos Consultant the finding of suspected asbestos material.
    2. Following of any rapid response procedures to isolate District staff, students, visitors, and Contractor staff from the suspected material, while maintaining continued progress on the remainder of the project work.
    3. Sending a sample of the suspected material to a qualified testing laboratory, receiving test results, and informing the District and their Asbestos Consultant.
    4. If a material is confirmed to contain asbestos, considering any recommendations from the District and/or its Asbestos Consultant and then implementing asbestos remediation.
    5. Resuming full scale work activities on the project as soon as the remediation is complete.

1.10 CONTRACTOR'S USE OF SITE AND PREMISES

A. Construction operations are to be limited to areas indicated on contractor's logistics plan approved by the Owner
B. Use of the Site:
    1. Do not unreasonably encumber Site or facility with materials and equipment.
    2. Do not load structure with weight that will endanger structure.
    3. Confine operations at the site to the areas permitted. Portions of the site beyond areas in which work is indicated are not to be disturbed.
    4. Keep existing driveways and entrances serving the premises clear and available at all times. Do not use parking for storage of materials.

5. Move stored products which interfere with the District operations and other contractors.
6. Assume full responsibility for the protection and safekeeping of stored products.
7. Obtain and pay for use of additional storage land work areas needed for Contractor operations if necessary.
8. Provide resources for trash removal. Facility dumpsters and trash cans cannot be used for Contractor's trash disposal. Contractor shall not interfere with District waste facilities and scheduled trash pickup.
9. Lock automotive type vehicles and other mechanized or motorized construction equipment when parked and unattended. Do not leave vehicles or equipment unattended with the motor running or ignition key in place.
10. Areas of the site which will be occupied by the Contractor or impacted by construction shall be restored to existing conditions. Contractor is responsible for damage caused by construction activities to playgrounds and surfaces not rated for heavy traffic.
11. It is understood that the Contractor has the most knowledge about staging construction and the extent of restoration required. The Contract Documents therefore do not indicate new construction to replace existing.
12. Landscaping damaged by the Contractor or associated activities shall be repaired to original conditions. All newly seeded or planted areas will be maintained through a period of establishment as determined as reasonable but not less than one growing season. Contractor shall follow requirements as indicated below:
    a. The Contractor shall be responsible for protecting seeded areas from damage and maintaining seeded areas as necessary to establish a complete coverage of the specified vegetation in a healthy and growing condition for 365 days from the date of substantial completion of the project.
    b. Mowing: Mow all seeded areas as required to maintain in a healthy growing condition, and to control the germination and spread of noxious weeds. Mow a minimum of once per maintenance period. Line trimmers may be used where appropriate.
    c. Re-Seeding: Upon detection of damaged or failing areas and areas showing unsatisfactory growth and coverage, the Contractor shall restore the area as necessary to establish a complete cover crop. Reseed using the seed mixes specified.
    d. Provide necessary watering of seeded areas via temporary irrigation system or hand watering. Any irrigation system is subject to requirements for system use, such as approved backflow devices. Perform necessary site visits and observations to maintain the proper amounts of moisture in soils to promote healthy and vigorous plant growth. Correct conditions of over or under-watering as may be determined by weekly observations during the irrigation season.
13. Contractor is to protect existing trees in the vicinity of construction operations. No Work, staging, or vehicle traffic is to extend into the drip line of a tree. Contractor will be responsible for any and all penalties, fines, arborist reports, inspections, and required remediation steps for causing damage to a tree or its root system.

C. Contractor's Use of the Existing Building:
1. Maintain the existing building in a safe and weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect building during construction period.
2. Keep public areas such as hallways, stairs, elevator lobbies, and toilet rooms free from the accumulation of waste materials, rubbish, or construction debris.
3. Cleaning:
    a. Contractor to ensure that non-construction areas remain free of construction dust throughout the course of the project.
    b. Comply with progress cleaning requirements in section 01 52 00 – Construction Facilities.
    c. When school is in session, daily cleaning of all construction-related dust and debris is the responsibility of the Contractor. Contractor must remove dust that falls overnight from the previous night's work or over the weekend from weekend work prior to staff and students occupying the space. Required cleaning includes dust/debris on the floor, student desks, teacher desks, chairs, the top of light fixtures, the top of sprinkler piping

and other exposed pipes and/or ducts, all classroom accessories (animal cages, furniture, sinks, cabinets, etc.), cardboard and other storage boxes, and all items in classrooms and other spaces affected by construction. Contractor will be back charged full cost of cleaning by Owner if Owner is required to clean up dust and debris from Contractor's construction operations.

4. Area of exterior work will need to be secured with a construction fence.
5. In the event of a water intrusion incident, the Contractor shall follow the below procedures:
    a. Notify the District of the incident immediately.
    b. Investigate the source of the water intrusion and put measures in place to stop the infiltration of water or moisture into the building.
    c. Hire a professional remediation company that is pre-approved by the District to manage and remediate the damage within 24 hours of becoming aware of the event.
    d. If the areas impacted by the water intrusion are not sufficiently dried-out (as determined by moisture testing performed by a certified professional) within 48 hours to stop any potential mold growth, Contractor is to pay for a baseline mold test to be performed to establish whether any mold has started to grow. A final mold test will be required to clear the area after the remediation work is complete.
    e. In addition to returning the affected areas to their original condition, Contractor is also responsible for replacing any FF&E that is damaged, paying for the necessary relocation of school operations, and paying for the District's employees and agents involved in managing and/or remediating the damage.
6. All roof openings, and areas where any portion of the roofing has been removed shall be made temporarily waterproof using EPDM rubber roofing or an equivalent product that is a minimum of 40 mils thick. Visqueen, plastic tarps, and other similar products are not acceptable.
7. Shrouding of existing furnishings, fixtures, and equipment:
    a. Contractor is to gather and shroud all furnishings near the work zone to protect them from dust, debris, and liquids.
    b. Furnishings are to be replaced to their former position at the end of the Work.
    c. Maintain clearance for circulation and egress within the halls.
    d. Furniture and contents from each room shall be stored separately and cannot be mingled.
8. In addition to the above requirements, the contractor shall prepare a detailed temporary barrier plan that covers at a minimum procedures associated with:
    a. Separating the work zones from the non-work zones.
    b. Flooring protection from demolition and new construction damage.
    c. Cover mechanical grilles to protect from dust migration and damage.
    d. Light fixtures protection from dust migration and damage.
    e. Locker protection from dust migration and damage.
    f. Walk off mats at transitions from work zones to non-work zones to prevent dust migration.
    g. Temporary barriers shall be fully sealed and maintained so that they do not allow dust migration or passage of unauthorized personnel.
    h. All furniture, fixtures, and equipment exposed to dust hazard shall be covered with plastic.
    i. Contractor will be backcharged if Owner is required to clean-up dust and debris from their construction operations.

D. Contractor's Site Conduct:

1. Identifying name tags will be worn at all times.
2. No loitering in the school buildings.
3. The site is a tobacco-free site. This means no smoking or chewing on the property.
4. Keep the project free of pop cans, lunch wrappers, etc.
5. The supervisor will review the scheduling of any work that is excessively noisy.
6. Profanity is not acceptable.
7. The wearing of clothing with logos displaying alcohol, tobacco, illegal substances, or suggestive themes is not acceptable attire.

8. The Contractor, the Contractor's employees and all subcontractor's and subcontractor's employees who perform Work will be required to comply with the Owner's policies and procedures.
9. Beyond courtesy, there should be no interaction between Contractor and the District's staff.

E. Emergency Building Exits During Construction:
1. Maintain required access to existing emergency exits as required by governing jurisdiction. Any changes made to the egress plan by the Contractor shall be the Contractor's responsibility to get it professionally designed and approved by the governing jurisdiction.
2. Protect the public and the District's staff from construction hazards in the emergency egress pathways.
3. Protection barriers from falling material hazards shall be professionally designed and submitted to the District for approval.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

01 14 00
WORK RESTRICTIONS

PART 1 - GENERAL

1.01 Section includes
- A. Related Requirements
- B. Access to Site
- C. Coordination with Occupants
- D. Use of Site
- E. Standard Working Hours/Days
- F. Deviation from Standard Hours/Days

1.02 RELATED REQUIREMENTS
- A. General Conditions of the Contract for Construction

1.03 ACCESS TO SITE
- A. Contractor shall limit use of premises for Work and for construction operations.
- B. There shall be no access through or from adjacent residences.
- C. Coordinate use of premises under direction of the District.

1.04 COORDINATION WITH OCCUPANTS
- A. District staff will occupy portions of the building throughout the construction period. Contractor shall coordinate use of premises with owner.
- B. The District shall permit public closure of the areas of work within the building.
    1. Contractor shall limit access to authorized personnel only and shall not allow public access without prior authorization from the District.
    2. Contractor shall prepare and maintain a record of all site visitors and shall provide copies of this record to the District at Project progress meetings.

1.05 SECURITY REQUIREMENTS
- A. All personnel under the employment of the Contractor and its Subcontractors who spend time at the project site are to wear photo ID badges while on the work site. Individuals not wearing badges will be removed from the project work site. ID badges are to contain:
    1. Individual's full name (no nicknames).
    2. Individual's company affiliation.
    3. Recent photograph of the individual; taken within the last 4 years.
- B. Badges must be carried by workers in a visible location at all times.
- C. All personnel under the employment of the Contractor and its Subcontractors that spend time at the project site must pass a formal background screening review before being allowed on the work site. Background screening is to be done by a professional screening firm meeting the following qualifications:
    1. Must have a minimum of five years of screening experience specifically for construction industry clients,
    2. Must have a minimum of fifteen employees.
    3. Must be able to provide access to an internet-based screening management software system which has a feature to allow access by the District to view the pass-no pass result for each screened Contractor/Subcontractor employee working on a District project.
    4. Must be accredited by the National Association of Professional Background Screeners (NAPBS)
- D. Each individual will be screened for having committed any crime as listed in ORS 342.143, most recent edition.

1.06 USE OF SITE

A. Contractor shall have full access to the Site during construction, but shall coordinate and limit locations as required for the operations of other construction projects and owner use. Contractor to indicate locations and schedule to owner in advance for approval.

B. Contractor shall direct all construction vehicle and delivery traffic along an access route as approved by the Owner.

C. Contractor shall professionally prepare a site logistics plan defining Contractor areas for work, access, staging and storage utilizing CAD, Bluebeam, Adobe Acrobat, or other similar software.

D. Provide staging and logistics plan delineated on Project Site Plan. Include crane operations plan, material lay-down area plan, job office location, fence locations, gate locations, and fence locking plan. Project Site Plan shall be on 11x17 paper and shall be professionally prepared.

1. Provide field office trailer during construction. Coordination with owner is required.

E. Contractor shall submit staging and logistics plan to District and governing authorities for review and approval prior to commencement of Work.

F. Contractor shall limit his use of the premises for Work and for storage to allow for:

1. District occupancy and operations.
2. Coordinated use of premises under direction of Owner.
3. Full responsibility for protection and safekeeping of products under this Contract stored at Site.
4. Moving stored products, under Contractor's control, which interfere with operations of District or a separate Contractor.
5. Obtaining and paying for use of additional storage or work areas needed for operations.
6. Conformance to fire / life safety requirements and fire equipment access.
7. Worker vehicle parking on-site.

G. The existing fire alarm system and fire sprinkler system shall remain operational twenty four (24) hours/day, seven (7) days/week. If at any time during the Project the existing system is not fully operational the Contractor, at its own expense, shall provide a “Fire Watch” acceptable to the Owner until the existing system is made fully operational.

H. Work on weekends, evenings or holidays may be required to meet the project phasing schedules. Provide 72 hours notification to the Owner to ensure necessary inspections, monitoring, testing, etc. are provided during these work hours.

I. Temporary hard barriers as necessary shall be constructed prior to the start of work in accordance with Section 01 11 00 – Summary of Work.

J. On a site plan indicate lay down areas, pedestrian walkways, and contractor parking areas Snow fencing is not acceptable as hard fencing.

K. The Contractor shall submit a diagram one week prior to start of construction indicating the construction zone, and barricades and access for students and School Personnel, for approval by the Owner.

L. The Contractor must provide and maintain access and code compliant egress to and from all occupied spaces.

M. Contractor shall post temporary signage (appropriate and secure) to redirect students and staff for emergency exiting.

N. The Contractor shall diligently maintain all construction zone barricades and fencing.

1. Fence panels shall be secured with two fence clamps per joint.
2. The Contractor shall secure end panels in a manner acceptable to the Owner.
3. The use of tie wire will not be an acceptable method for securing fence panels.
4. Construction zone gates shall be secured with chains and District provided padlocks.

1.07 STANDARD WORKING HOURS/DAYS

A. The project schedule assumes a 6-day work week, working Saturday. It is up to the contractor to determine their required work week needed to meet the required substantial completion dates for each phase. Contractor is required to provide onsite management on days that they are working including Saturdays.

B. Exterior work and interior work that generates noise shall be performed in accordance with local codes.
C. For work occurring during the school year between Monday and Friday, before beginning work, contractor shall check in daily with the Project Manager to review the previous day's work and discuss upcoming work for that day/evening. This check-in will take place on every school day, Monday through Friday, so District staff members can be made aware of current construction activity.

1.08 DEVIATION FROM STANDARD HOURS/DAYS

A. For any deviation from the above stated working days/times, Contractor shall submit a request in writing to the District at least 48 hours prior to the date in question. While the District cannot assure approval in every instance, efforts shall be made to accommodate such requests.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 CONTRACT TIME / MILESTONE SCHEDULE AND DESCRIPTION OF PHASES

A. Contract Time and Milestone Schedule:
   1. Notice of intent to award: May 13, 2021
   2. Construction Phase Summer 2021
      a. Contractor may begin work on site: June 21, 2021
      b. All work shall be substantially complete on September 7, 2021.
   3. Final Completion shall occur no later than September 30th, 2021.
B. Description of General Construction Requirements:
   1. These descriptions of the construction requirements are general in nature and in no way offer the complete and concise description of all the work required by the Contract Documents.
   2. The start dates represented in the milestone schedule are preliminary and the District reserves the right to modify these dates based on when the Notice to Proceed is issued.
   3. The Contractor is responsible for providing the manpower and scheduling the shifts necessary to complete the work in accordance with the Contract Time and Milestone Schedule.
   4. The School will remain open during the academic year and will be partially occupied during summer construction periods. The Work of this project must take into account that the site will be occupied by students and staff and will be phased as generally described above and in other contract documents. Provide additional cleaning when school is in session as indicated in Section 01 10 00 – Summary of Work.
   5. Non-School hours are defined as hours before 7:00 AM, and after 3:30 PM on days when school is in session.
   6. Follow Washington County Noise Ordinance.
   7. Work that is hazardous, noisy, or that causes vibration may not be performed in the buildings or on the site during school hours, without written approval from the Owner. This includes but is not limited to the following work activities:
      a. Hazardous materials abatement.
      b. Concrete bushing, chipping, grinding, jack hammering.
      c. The use of Powder-Actuated (PAT's) fasteners.
      d. Floor grinding to remove adhesive.
      e. Chemicals used in quantities that cause excessive odor, such as hot tar, and cannot be effectively ventilated. As determined by the Owners Representative.
      f. Wall tile removal. Hand scraping or chipping may be acceptable as approved by the Owners Representative.
      g. Large impact drills for use in concrete.
      h. Smaller Bulldog type impact drills for ¼" holes or less.
      i. Operation of cranes in occupied areas, including drilling rigs, and concrete pump trucks unless the occupants can be sufficiently isolated from the swing zone.

j. Chop Saws for metal studs or other metal cutting. These may be used if isolated in a temporary sound deadening room constructed by the Contractor as approved by the Owner's representative.
k. Earthwork compaction, including the operation of vibratory compaction equipment.

3.02 ACTUAL DAMAGES

A. Substantial Completion: The delayed Substantial Completion of any phase of the Work will result in the assessment and withholding of Actual Damages for each day of delayed Substantial Completion. See Section 01 77 00 "Closeout Procedures" for requirements by phase of the project.
B. Final Completion: The delayed Final Completion of the Work will result in the assessment and withholding of Actual Damages for each day beyond the Contract Time until all punch list items are completed. Actual damages include but are not limited to: The District's project team labor (including the CM), additional time spent re-inspecting work that was completed incorrectly, and attorney's fees related to the delay in completing the work.

END OF SECTION

01 18 00
PROJECT UTILITY SOURCES

PART 1 – GENERAL

1.01 SECTION INCLUDES
- A. Related Sections
- B. Access and Start-Up/Termination
- C. Shut-Off Procedures
- D. System Survey
- E. Emergency Shut-Off Survey
- F. Payment Provisions

1.02 RELATED REQUIREMENTS
- A. General Conditions of the Contract for Construction.

1.03 RELATED SECTIONS
- B. Section 01 73 00 – Execution and Closeout Procedures.

1.04 ACCESS AND START-UP/TERMINATION
- A. Contractor shall contact and make arrangements with utility providers to ensure proper access to temporary power, water and other utilities as needed to conduct the work. Contractor shall not disconnect any existing breakers to use for temporary power without approval from the District, and shall not install new breakers for temporary power without first confirming that the panel has adequate capacity for the new breakers.
- B. Upon completion of the Work, Contractor shall ensure that all utility services have been appropriately terminated in accordance with the Contract Documents and utility purveyor requirements.
- C. Refer to Section 01 73 00.

1.05 SHUT-OFF PROCEDURES
- A. Contractor shall be responsible for demolition of utility systems including cutting, capping and system shut down in accordance with local utility service purveyor requirements.
- B. Contractor shall notify District a minimum of three working days prior to any proposed shut-down and shall provide written documentation of shut-down procedures as well as requirements for future system restart.
- C. Domestic water main valves cannot be turned-off without a District representative being present. Any damage caused to the auto-flush valves, water filters, or any other plumbing fixture due to unauthorized shut-down of the system will be repaired at the Contractor's expense.
- D. Fire alarm systems must be 100% operational at all times during construction.
- E. No Fire sprinkler work is in the scope. Fire sprinkler systems are not to be modified without approved submittals clearly defining the work to be performed, a fire sprinkler permit in-hand, and a District representative present at the time the system depressurized and drained. If the system is not 100% operational at the end of every work day, then Contractor is to notify the District and by-pass the tamper flow switches on the fire alarm system.
- F. Power to breaker panels and the District's equipment is not to be turned-off without approval from an authorized District representative. Any costs incurred by the District for having to re-start or re-program any of the mechanical or electrical systems due to unauthorized shut-down of any power supply will be the Contractor's responsibility.
- G. All HVAC fans are to be shut-down before construction begins to keep the ducts from getting contaminated with construction dust. If Contractor does not shut down the units and adequately protect the grills, then Contractor will be required to clean the ducts before Substantial Completion.

1.06 SYSTEM SURVEY

A. Perform pre-construction balancing of the air system per Specification 23 05 93 – Testing, Adjusting and Balancing for HVAC for the buildings in the scope.
B. In the presence of the District Representative the contractor will perform a survey of all the fire alarm, phone, data, power outlets, P/A system (public address system) clocks/bells, thermostats, building management system controls (DDC controls), and security systems in each room within the scope buildings/modular prior to the start
C. Any testing that might affect other portions of the school must be completed during non-school hours.
D. Each outlet and/or device is to be checked and tested to verify that they are working.
E. The survey will be submitted and reviewed by the District Representative prior to the start of demolition
F. Any device not tested will be assumed to be functioning properly and shall be returned to the District in that condition.

1.07 EMERGENCY SHUT-OFF SURVEY

A. Before construction begins Contractor shall field survey the building/buildings and site and contact the appropriate BSD personnel to develop an Emergency Shut-off Plan.
B. The plan will show graphically all shut-off locations for utilities clearly identified along with any special instructions and contact procedures.
C. The plan will include an emergency contact list for the Contractor, BSD Project Manager, Construction Manager, Fire Department, Power and Water District.
D. The Contractor shall assemble any specialty tools required and keys for any locked areas.
E. The Emergency Shut-off Plan shall be posted in Contractor's construction office with a copy of all items to be located in the front office.

1.08 PAYMENT PROVISIONS

A. District shall pay for permanent and temporary utility services.
B. Contractor shall use due diligence to observe sustainable and conservational utility use practices.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Requirements
B. Substitution Procedures (During Construction)
C. Product Substitution Procedures (During Construction)
D. Substitution Request Timing (During Construction)

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract for Construction

1.03 SUBSTITUTION PROCEDURES (DURING CONSTRUCTION)

A. All substitution requests shall be submitted as a Request for Information (RFI). In the RFI it must clearly state that this is a substitution request.
B. Contractor shall submit the substitution request, along with all associated cost adjustments using the District approved form.
C. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals without first being approved through the RFI process.
D. In making request for substitution, Contractor represents that:
    1. It has personally investigated proposed product or method, and have included a side-by-side comparison in the substitution request.
    2. It will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects at no additional cost to District once the substitution and related cost impacts have been accepted.
    3. It waives all claims for additional costs or time extensions related to substitution which consequently become apparent after the substitution is approved.
    4. It will reimburse District for review or redesign services associated with re-approval by authorities.
    5. Should any proposed product substitution require any redesign work to accommodate the substitute product, costs for such re-design work shall be included in the proposal amount and shall be paid to the District consultants for the required re-design work.
E. District shall notify Contractor in writing of decision to accept or reject request via the RFI process.
F. Upon receiving the District's decision to proceed with the substitution, Contractor is to initiate a Change Request to modify the contract and submit any additional submittals required as a result of changing products.

1.04 PRODUCT SUBSTITUTION PROCEDURES (DURING CONSTRUCTION)

A. Include in each request complete a side-by-side analysis of the following items:
    1. Product identification, including manufacturer's name and address.
    2. Manufacturer's literature.
    3. Product description.
    4. Performance and test data.
    5. Reference standards.
    6. Samples, when appropriate.
    7. Name and address of similar projects on which product was used and date of installation.
    8. Product availability and lead-time for delivery.
    9. Detailed description of proposed method and drawings illustrating methods.
    10. Itemized comparison of proposed substitutions with products and/or methods specified.
    11. Data relating to changes in Project schedule.

12. Accurate cost data on proposed substitution in comparison with product or method specified.

1.05 SUBSTITUTION REQUEST TIMING (DURING CONSTRUCTION)

A. Substitution may be considered for one or more of the following conditions:
   1. Product unavailability beyond control of Contractor, such as strikes, lockouts, and discontinuance by the manufacturer or his authorized supplier.
   2. Requirements for compliance with final interpretation of code requirements or insurance regulations.
   3. District or consultant requested substitution.
   4. If it can be shown that specified product or system is not well suited for proposed application, or that another is superior and less costly. Attach detailed documentation including cost savings.
   5. Subsequent information or data discloses inability of specified product to perform properly in the application and/or for the purpose for which it was intended.
   6. Manufacturer's or fabricator's refusal to certify or guarantee performance of specified product as required.
   7. Subsequent information that a long delivery date will not be compatible with the Contract construction period.
   8. Proof for any of the above set forth conditions shall be submitted to the District representative in writing with all pertinent data in the form of a Change Order Request.

B. District reserves the right to reject any and all substitution requests for any reason, without obligation or liability.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Requirements
B. Requests for Information (RFI)
C. Architectural Supplemental Instructions (ASI)
D. Construction Change Directives (CCD)
E. Change Order Requests (COR)
F. Change Orders

1.02 RELATED REQUIREMENTS

A. Section 01 31 23 Project Management Database

1.03 REQUESTS FOR INFORMATION

A. Initiating the Request for Information (RFI).
    1. Where the Contractor requires additional information to assist in interpreting the documents or understanding how to apply the provisions of the Contract Documents, the Contractor shall submit an RFI to the Architect to distribute as appropriate to the Project team.
    2. Upon submitting an RFI, Contractor is to determine if there are portions of the ongoing Work that are directly affected by the issue described in the RFI that need to be stopped until further direction is received, and they are to notify the Architect and Owner of this in writing. The Architect and/or Owner will direct Contractor as to whether or not they are to stop working in those areas.

B. All requests shall include the following:
    1. RFI number (assign sequential numbers to RFIs).
    2. Specific reference to the drawings, specifications or field conditions that initiated the need for interpretation, including drawing number(s), detail number(s), and specification section numbers(s).
    3. List of subcontractors involved.
    4. Date of request.
    5. Date that response is needed.
    6. Background: State purpose of Request. Provide concise information necessary for the Architect's understanding of the Request.
    7. State Contractor's interpretation of the requirements of the Contract Documents.
    8. Provide statements in condensed and precise question format, and where appropriate, compose in such a way that "yes" or "no" would be acceptable response.
    9. If the statement of the question for which interpretation is requested is ambiguous or unclear, the Request shall be considered incomplete.
    10. Use additional forms, diagrams or marked-up Contract Drawings where necessary.
    11. Reason for need for information (unanticipated field condition, conflict in documents, change in requirements of third party such as code entity).

C. Suggested options for resolution.
D. Indication of whether or not the issue appears to have potential impact on the Contract Sum or Contract Time.
E. Space for Architect's response.
F. Limit Requests for Information to not more than one issue or question.
    1. Avoid questions that may include multiple sub-issues.

2. If Architect determines that a Request contains more than one issue, Contractor will be required to resubmit.

A. Architect's Review
   1. After receipt of an RFI, Architect will determine whether the Request is complete.
   2. If Request is determined to be incomplete, Architect will notify Contractor in writing of the deficiencies. Architect will take no further action on incomplete RFI until deficiencies are remedied.
   3. Allow 5 working days for review by Architect.
      a. If a longer review time is deemed necessary, Architect will notify Contractor of the anticipated response time, within 5 working days of receipt of the complete RFI.
      b. Indicate "URGENT" on RFIs which may impact the Project Schedule to notify Architect of priority.
      c. Urgent RFIs will take precedence and be answered as soon as possible.

B. Architect's Response
   1. Responses issued by Architect will be to explain and clarify the intent of the Contract Documents.
   2. Responses of the Architect shall be consistent with the intent of the Contract.

C. Distribution and Notification
   1. Upon receipt of the Architect's response, Contractor shall distribute copies to the initiator of the request and to all affected parties.
   2. Contractor is responsible for immediately implementing the changes to the Contract Documents in accordance with the Architect's response. Contractor shall be responsible for costs incurred due to continuing with Work that is contrary to the direction given in the Architect's response.
   3. Contractor is to notify the Owner within 48 hours of receiving the Architect's response of any cost or schedule impacts due to the changes made to the Contract Documents by the Architect's response.
   4. If there is a cost impact or a schedule impact due to the Architect's response, Contractor shall process a Change Order Request and obtain Owner's approval before proceeding with the changes. While waiting for the Owner's approval, Contractor shall not proceed with Work that will need to be redone if/when the cost or schedule impacts are approved.

G. Coordination with Contractor Submittals
   1. Contractor shall take special care to ensure that RFI responses are included and coordinated with all trades and required project Submittals and Shop Drawings.
   2. Submittals and Shop Drawings that do not incorporate all RFI responses shall be returned to Contractor without review as incomplete.

H. Administrative Costs
   1. Requests for Information (RFIs) for information that is already contained or provided for in the Contract Documents may result in additional administrative costs to the Owner, which the Owner may charge to the Contractor.
   2. Requests for Information (RFIs) for solutions to Contractor's errors may result in additional administrative costs to the Owner, which the Owner may charge to the Contractor.
   3. Requests for Information (RFIs) for Substitution Requests may result in additional administrative costs to the Owner, which the Owner may charge to the Contractor.

1.04 ARCHITECTURAL SUPPLEMENTAL INSTRUCTIONS

A. The District, without invalidating the Contract, may issue Architectural Supplemental Instructions (ASI) authorizing changes in the Work.

B. Distribution and Notification

1. Upon receipt of the ASI, Contractor shall distribute copies to all affected parties.
2. Contractor is responsible for immediately implementing the changes to the Contract Documents in accordance with the ASI. Contractor shall be responsible for costs incurred due to continuing with Work that is contrary to the direction given in the ASI.
3. Contractor is to notify the Owner within 48 hours of receiving the ASI of any cost or schedule impacts due to the changes made to the Contract Documents by the ASI.
4. If there is a cost impact or a schedule impact due to the ASI, Contractor shall process a Change Order Request and obtain Owner's approval before proceeding with the changes. While waiting for the Owner's approval, Contractor shall not proceed with Work that will need to be redone if/when the cost or schedule impacts are approved.

C. Coordination With Contractor Submittals

1. Contractor shall take special care to ensure that ASI's are included and coordinated with all trades and required project Submittals and Shop Drawings.
2. Submittals and Shop Drawings that do not incorporate all ASI's shall be returned to Contractor without review as incomplete.

1.05 CONSTRUCTION CHANGE DIRECTIVES

A. Where the District has requested a change to the Work and the District and Contractor cannot agree to the terms of adjustment to the Contract Sum or Contract Time, the District shall issue a Construction Change Directive compelling to the Contractor to commence with the change, tracking both the time and cost of the work until such time as the Contractor and District can come to an agreement.

B. Construction Change Directives shall contain a complete description of the changes in the work and shall designate the method to be followed to determine changes in the Contract Sum or Contract Time.

C. Contractor shall maintain detailed records on a time and materials basis of the Work required.

D. Upon completion of the change in the Work, the Contractor shall submit an itemized account and supporting data necessary to substantiate the cost and time adjustments to the Contract for preparation of a Change Order by the District's Representative.

E. Payment to the Contractor shall not be made on basis of a Construction Change Directive until it is made into a Change Order approved by the District, its Representative, the Contractor and the Architect/Engineer. Portions of a Construction Change Directive shall not be eligible to be made into a Change Order for partial payment.

1.06 CHANGE ORDER REQUESTS

A. Contractor shall process a Change Order Request (COR) for changes to the Contract Documents that result in revisions in the Contract Sum or Contract Time.

B. A separate COR shall be created for each issue.

C. Contractor is to submit the COR to the Architect for review via eBuilder (per Section 01 31 23).

D. The Architect shall review the COR's scope and pricing, and may request additional information or clarification from the Contractor.

E. After completing their review, the Architect will forward the COR to the Construction Manager with their comments.

F. The Construction Manager will review the COR's scope and pricing, and may request additional information or clarification from the Contractor or the Architect.

G. After completing their review, the Construction Manager will forward the COR to the District's Representative with their recommendation.

H. The District's Representative will review the COR's scope and pricing along with the Architect's comments and the Construction Manager's recommendations, and may request additional information or clarification from the Contractor, Architect, or Construction Manager.
I. Upon approval of the COR by the District's Representative, the Contractor can officially proceed with the changes.
J. Approved COR's will be rolled-up into a Change Order on a monthly basis.
K. Change Order Request must be received within 30 calendar days after the work related to the change order request has been performed and must have been identified within an RFI prior to the work being performed in order to be considered.

1.07 CHANGE ORDERS

A. Change Orders shall be recorded as a revision to the Contract for Construction and Contractor shall immediately upon execution add their content and value to both the Construction Schedule and the Schedule of Values.
B. Applications for Payment shall include all executed change orders in order to be considered complete and acceptable for payment processing.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 29 00
PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Requirements
B. Schedule of Values
C. Progress Payment Procedures
D. Payment for Stored Materials
E. Payment for Deposits on Ordered Materials
F. Payment Procedures for Testing Laboratory Services

1.02 RELATED REQUIREMENTS

A. The General Conditions to the Contract

1.03 SCHEDULE OF VALUES

A. Within 10 days of the Contract Award, the Contractor shall submit to the District for review and approval, the Schedule of Values.
B. The Schedule of Values shall allocate the entire Contract Sum among the various portions of the Work and shall be prepared in such form as approved by the District and supported by such data to substantiate its accuracy.
C. The Schedule of Values shall be itemized to the following level of detail:
    1. Separate the costs into Specification Sections (PVC Roofing, Sheet Metal Flashing, etc.).
    2. Separate costs for each Specification Section into Demo, Install Labor, and Install Materials.
    3. No one line item shall be more than 5% of the Contract Sum.
D. District shall review and approve the Schedule of Values for use in the preparation of Applications for Payment.

1.04 PROGRESS PAYMENT PROCEDURES

A. Each Application for Payment shall be submitted based on the procedures outlined in the Contract.
B. Applications for Payment that have an inflated % complete for any give line item shall be rejected. Contractor shall revise and resubmit the Application for Payment with the corrected % complete. The Contractor shall be responsible for hardships due to delays in the approval of the Application for Payments that are caused by errors in the Applications.
C. General Conditions shall be billed monthly at the same % complete as the total % complete for that Application for Payment.

1.05 PAYMENT FOR STORED MATERIALS

A. Contractor may be entitled to receive payment for stored materials provided the following conditions have been met:
    1. A valid off-site stored materials insurance certificate is to be provided to the District. The policy needs to reference the project that the materials are for, and the value of the policy needs to meet or exceed the value of stored materials. The District is to be listed as additional insured on the policy.
    2. Materials shall be clearly labeled as District property and specific to the project, and shall be stored separately from other materials.

3. The District shall obtain verification from an independent third party that all items are present within the warehouse. The cost of the initial verification process will be the responsibility of the Contractor to pay for.
4. Keys and alarm codes are to be provided to the District representative for unfettered access to the warehouse until the stored materials are delivered to the project site. Periodic unannounced inspection visits to the warehouse may be made a District representative. If the materials are removed without permission from the District, Contractor shall immediately reimburse the District for the entire payment made for the stored materials.
5. Digital photos of the off-site stored materials labeled for the project are to be submitted with the Application for Payment.
6. Contractor is to provide an executed bill of sale as proof of payment for stored materials.
7. Verification of stored materials and partial payment for such materials do not constitute acceptance on the part of the District. In the event that materials stored are found to be unsuitable for installation or incorporation into the Work for any reason, Contractor shall bear full responsibility for any and all corrections needed.
8. District shall not be responsible for any additional costs incurred for the storage of materials unless such storage is the result of and a part of an approved Change Order where the District is found to be responsible for such costs.

1.06 PAYMENT FOR DEPOSITS ON ORDERED MATERIALS

A. Where the Contractor has placed an order for materials or services and an initial deposit is required, the Contractor shall have the right to submit invoices for deposits as a part of the Application for Payment with supporting documentation indicating why such deposits are necessary.
B. The District shall review submitted invoices and shall have the right to approve or reject the payment for the deposit. The District is not obligated to pay for any deposits required for materials not present at the project site.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Related Requirements
B. Project Coordination
C. Construction Organization and Start-up
D. Construction Coordination
E. Coordinating Subcontractors' Work
F. Project Meetings

1.02 RELATED REQUIREMENTS
A. General Conditions of the Contract for Construction

1.03 PROJECT COORDINATION
A. Before submitting the Bid to the District, and continuously after the execution of this Contract, the Contractor shall carefully study and compare the Contract Documents and shall at once report to the District, any error, inconsistency or omission it may discover including any requirement which may be contrary to any law, ordinance, rule, regulation or order of any public authority bearing on the performance of the Work.
B. By submitting bid for this Contract and the Work under it, the Contractor agrees that the Contract Documents, along with any addendums or other supplementary written instructions issued that have become a part of the Contract Documents, appear accurate, consistent, and complete insofar as can reasonably be determined. If the Contractor has reported in writing an error, inconsistency or omission and has promptly stopped the affected Work until instructed, and otherwise followed the instructions of the District, the Contractor shall not be liable to the District for any damage resulting from any such errors, inconsistencies or omissions in the Contract Documents. The Contractor shall do no Work without Contract Documents and, when required, reviewed Shop Drawings, Product Data or samples for such portions of the Work.

1.04 CONSTRUCTION ORGANIZATION AND START-UP
A. Establish on-site lines of authority and communications by attending Pre-construction Meeting and Progress Meetings as required by the Architect, Engineer, District and District's Representatives.
B. Comply with procedures for intra-project communications including but not limited to:
    1. Submittals
    2. Reports and records
    3. Recommendations
    4. Coordination drawings
    5. Schedules
    6. Resolution of conflicts
C. Communication and transmitted documents are to flow from subcontractors to the GC (prime Contractor) and then in parallel to the Architect and the Owner. Communication and document transmission from the Architect and the Owner to the subcontractors is to occur in the same manner, except that the flow will be the reverse of that noted above.

1.05 CONSTRUCTION COORDINATION
A. General Coordination:
    1. Coordinate various elements of the work and entities engaged to perform work.
    2. Coordinate the work with existing facilities/conditions, and with work by separate contractors and by the Owner.
B. Mechanical and electrical drawings:
    1. Mechanical and Electrical Contract Drawings are diagrammatic. Additional offsets and bends may be required.

2. Install additional offsets and bends in the systems where required by field conditions.
3. The Architect may make minor adjustments in fixture, outlet, grille, louver, or ventilator locations prior to rough-in work with no additional cost.

C. Clearances:
1. Provide adequate clearance between Architectural, Structural, Mechanical, and Electrical Systems. Verify physical dimensions of equipment and its available space. Check access routes through concealed or existing spaces for installation of systems or equipment.
2. Review the Construction Documents for possible conflicts prior to rough-in. Contractor is responsible for verification that equipment will fit in the space provided. Resolve conflicts with the Architect prior to rough-in work.

1.06 COORDINATING SUBCONTRACTORS' WORK

A. Coordinate the Work of all Subcontractors and make certain that, where the Work of one trade is dependent upon the Work of another trade, the Work first installed is properly placed, installed, aligned, and finished as specified or required to properly receive subsequent materials applied or attached thereto.
B. Direct Subcontractors to correct defects in their workmanship when subcontractors of subsequent materials have a reasonable and justifiable objection to conditions of work.
C. Do not force Subcontractors to apply or install products to improperly finished product.
D. Coordinate changes to assure that:
1. Requirements of Contract Documents are fulfilled.
2. Changes in Contract requirements of all affected trades are reflected in executed Change Orders.

E. Scheduling and Installation Sequence:
1. Coordinate scheduling, submittals, and Work of various sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
2. Schedule work in accordance with current Project Construction Schedule.
a. Coordinate schedules of all trades.
b. Verify timely deliveries of products for installation by other trades.
c. Verify that labor and equipment are adequate for Work and schedule.
d. Verify that material deliveries are adequate to maintain schedule.

1.07 PROJECT MEETINGS

A. Preconstruction Meetings:
1. Owner and the Construction Manager will manage the preconstruction meeting for execution of Owner-Contractor Contract and exchange of preliminary submittals.

B. Site Mobilization Meetings
1. Owner will administer site mobilization conference at Project site for clarification of Owner and Contractor responsibilities in use of site and for review of administrative procedures.

C. Progress Meetings
1. Contractor shall attend the weekly project site meetings throughout the course of the Work. Contractor shall make physical arrangements for the meetings, prepare agenda with copies of the meeting minutes from the previous meeting and all necessary logs and schedules for the participants.
2. The Owner or the Construction Manager shall preside at the weekly meetings.
3. The Construction Manager will provide meeting minute’s format/template. The Construction Manager shall record the minutes at the meetings which shall be distributed by the Contractor Manager within two days to Owner, Architect,

Engineer, subcontractors, participants at the meetings, and those affected by decisions made at the meetings.

4. Attendees shall include Contractor's project manager and superintendent, Owner, Construction Manager, and Architect/Engineer as appropriate to the topics for each meeting.
5. Suggested agenda topics: informational items, safety, schedule review, RFI & ASI review, submittal review, Contractor issues, design issues, owner issues, change order requests and pay applications, and closeout.

D. Pre-Installation Meeting

1. Prior to commencement of critical new activities on site, Contractor shall conduct a Pre-Installation Meeting. Contractor shall ensure that all relevant subcontractors are present inclusive of those performing work immediately prior and subsequent to the subject activity as well as those who are impacted by the Work.
2. The purpose of the meeting is to review field conditions to confirm that the site and all previous work is ready for the commencement of the new activity, confirm clear understanding of the intention of the plans and specifications and to identify potential risks and resolutions to those risks related to the proposed work.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 31 23
PROJECT MANAGEMENT DATABASE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Requirements
B. Summary
C. General Requirements
D. System Requirements
E. System Access
F. System Use

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract for Construction

1.03 SUMMARY

A. Project Management Communications: The Owner, Contractor and Architect shall use the Internet web-based project management communications tool, E-Builder® ASP software and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
B. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses and to reduce the number of paper documents while providing improved record keeping by creation of electronic document files.

1.04 GENERAL REQUIREMENTS

A. Project management communications is available through E-Builder® as provided by "E-Builder®" in the form and manner required by the Owner.
B. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant.
C. Support: E-Builder® will provide on-going support through on-line help files.
D. Training: The District will provide a minimum 2-hour e-Builder Training Session for awarded Contractor's project manager or lead member of Contractor's project staff for the specific E-Builder modules required on this project.
E. Authorized Users: Access to the web site will be by individuals who are licensed users as required by the Owner.
F. Licenses Granted by Owner: Owner shall pay for and provide licenses for the following members of the project team:
    1. Lead member of Architect's design team responsible.
    2. Contractor's project manager or lead member of Contractor's project staff.
    3. Owner's project manager or representative.
    4. Others as deemed appropriate by Owner.

1.05 SYSTEM REQUIREMENTS

A. System Configuration:
   1. Operating System: Windows 7 or later, or OS X v10.8 or later.
   2. Display capable of SVGA (1024 x 768 pixels) 256 colors display.
   3. 101 key Keyboard.
   4. Mouse or other pointing device.

B. Operating system and software configuration:
   1. All software shall be properly licensed with vendors or developers. Use of “E-Builder” does not convey any rights or licensure for use of any software, hardware or internet service provider.
   2. Software Configuration:
      a. The most current version of Microsoft Internet Explorer, Google Chrome, or Safari. This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
      b. The most current version of Adobe Acrobat Reader (current version is a free distribution for download).
      c. Other plug-ins specified by E-Builder® as applicable to the system (current versions are a free distribution for download from www.e-builder.net).
      d. Users are recommended to have properly licensed versions of the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

1.06 SYSTEM ACCESS

A. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Contractor shall be responsible for providing suitable computer systems for each licensed user at the user’s normal work location with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.

B. Authorized users will be contacted directly by the web site provider, E-Builder®, who will assign the temporary user password.

C. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

1.07 SYSTEM USE

A. Owner's Administrative Users: Owner administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE ITEMS OR YOUR COMPANY’S CONFIDENTIAL ITEMS IN THE DATABASE!

B. Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s). Costs incurred or associated with such issues shall be the financial responsibility of the party responsible for the transgression.

C. Communications: Communication for this project for the items listed below shall be solely through E-Builder®:

1. Submission of Contractor shop drawings and submittals, and receiving processed shop drawings and submittals.
2. Submission of Requests for Information (RFI) and receiving RFI responses from the Owner and Architect.
3. Receiving Architect's Supplemental Instructions.
4. Submission of invoices and approval or rejection of same.
5. Distribution of meeting minutes.
6. Submission of as-built record drawings (electronic format).
7. Submission of test results and Operation and Maintenance (O&M) manuals (electronic format).
8. Submission of Change Orders (COs) and contract amendments and approval or rejection of same.
9. Transmission of formal letters and notices between the District and the Contractor.
10. All other communication shall be conducted in an industry standard manner.

D. In the event of occasional operational problems with e-Builder, transmission of the above documents may be done for a temporary period of time by hand carrying, email, normal mail or express mail. Prior approval must be obtained from the District before utilizing this backup communication system and a resumption of e-Builder use is to initiate as soon as the operational problems are corrected.

E. Communications shall be labeled in a manner that is site- and Contractor-specific and references projects in a coded sequential method. The Owner and Architects will refer to RFIs, Submittals, ASIs, and all other eBuilder tracked communications with the eBuilder assigned number. It is the Contractor's responsibility to coordinate their numbering system with the eBuilder assigned numbers.

F. Project Documentation: The following project documentation will be prepared by Contractor, converted to PDF electronic format, and shall be uploaded to E-Builder® on a weekly basis or as project record documents:
1. Project Schedule (See Requirements in the Contract General Conditions).
2. Contractor's Health and Safety Evaluation (See Requirements in Section 01 32 00).
3. Contractor's Daily Construction Progress Reports (See Requirements in Section 01 32 00).
4. Photographic Documentation (See Requirements in Section 01 32 00).
5. Other project supporting documentation as required by District.
6. Close-Out Submittals (See Requirements in Section 01 77 00).

G. Document Integrity and Revisions:
1. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
2. The system shall identify revised or superseded documents and their predecessors.
3. Server or Client side software enhancements during the life of the project shall not alter or restrict the content data published by the system. System upgrades shall not affect access to older documents or software.

H. Document Security: The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties' communication except for Administrative Users.
I. Document Integration: Documents of various types shall be logically related to one another and discoverable.
J. Notifications and Distribution: Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
K. Ownership of Documents and Information: All documents, files or other information posted on the system shall become the property of the Owner.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Related Requirements
B. Scheduling of Work
C. Construction Progress Schedule
D. Three Week Look Ahead
E. Recovery Schedule
F. Submittals Schedule
G. Deferred Submittals
H. Site Specific Safety Plans
I. Site Specific Staging and Logistics Plan
J. Contractor Health and Safety Evaluation
K. Construction Progress Reporting
L. Periodic Work Observation
M. Photographic Documentation

1.02 RELATED REQUIREMENTS
A. General Conditions of the Contract for Construction.

1.03 SCHEDULING OF WORK
A. The primary objectives of the project scheduling program are as follows:
    1. To ensure the adequate planning, scheduling, and execution of the construction activities so they may be prosecuted in an orderly and expeditious manner within the Contract Time and the Milestones stipulated by the Contract.
    2. To provide optimum coordination between Subcontractors.
    3. To establish the basis for measuring and monitoring individual Contractor progress and overall project progress.
    4. To detect problems for the purpose of taking corrective action to maintain the scheduled program and to provide a mechanism or tool for determining and monitoring such corrective actions.
B. If the Contractor should desire or intend to complete the Work earlier than any required Milestone or Completion date, the District, Architect/Engineer or the District's Representative shall not be liable to the Contractor for any costs or other damages should the Contractor be unable to complete the Work before this earlier date. The duties, obligations and warranties of the District to the Contractor shall be consistent with and applicable only to the completion of the Work on the Milestone and Completion dates required in the Contract, unless the District, the District's Representative and the Contractor otherwise agree in writing.

1.04 CONSTRUCTION PROGRESS SCHEDULE
A. Pursuant to the General Conditions of this Contract, the following additional scheduling requirements are a part of this Contract.
B. The Construction Progress Schedule shall be created using the current version of MS Project or approved equal.
C. Work under this Section shall consist of completing a Construction Progress Schedule showing in detail how the Contractor plans to execute and coordinate the Work.
D. Each work item on the Construction Progress Schedule, as well as being correlated to the payment document, shall be broken into feasible work segments/activities (where practicable) with individual starting and stopping dates.
E. Work shall be segmented to demonstrate its relationship to the various Milestone Dates. Activity titles shall be self-explanatory and abbreviations shall be shown in the legend.

1.05 THREE WEEK LOOK AHEAD SCHEDULE

A. Each week the Contractor shall prepare and present an update schedule showing the planned activities for the next three weeks and 1 week prior. The schedule shall be coordinated with the master schedule and accurately portray activities completed and activities planned for the upcoming weeks. Unless otherwise directed by the Owner, the Contractor shall present this schedule at the weekly meeting.
B. Provide copies to the participants at the time of the weekly Progress Meeting.
C. Format shall be 11" by 17" or as necessary to be easily legible.

1.06 RECOVERY SCHEDULE

A. Should any conditions exist, such that certain activities shown on the Contractor's Construction Progress Schedule fall behind schedule to the extent that any of the critical path Milestones or Completion Dates are in jeopardy, the Contractor shall be required to, at no cost to the District, prepare and submit a supplementary Recovery Schedule. The Recovery Schedule shall be in a written form with appropriate details including an explanation and display on how he/she intends to reschedule those activities to regain compliance with the Construction Progress Schedule during the immediate subsequent pay period.
B. The Contractor and District's Representative shall do the following after determination of the requirement for a Recovery Schedule:
    1. Within three (3) calendar days, the Contractor shall present to the District's Representative the Recovery Schedule.
    2. The Recovery Schedule shall represent the Contractor's best judgment regarding how to reorganize and accelerate the Work to get back on schedule within the immediate subsequent pay period. The Recovery Schedule shall be prepared to a similar level of detail as the Construction Progress Schedule.
C. Five (5) calendar days prior to the expiration of the Recovery Schedule, the District's Representative and the Contractor will meet at the job site to determine whether the Contractor has regained compliance with the Construction Schedule. At the direction of the District's Representative, one of the following will happen:
    1. If, in the opinion of the District's Representative, the Contractor is still behind schedule, the Contractor in conjunction with the District's Representative will prepare another Recovery Schedule, at the Contractor's expense to take effect during the immediate subsequent pay period.
    2. If, in the opinion of the District's Representative, the Contractor has sufficiently regained compliance with the Construction Schedule, the use of the Construction Schedule will be resumed.

1.07 SUBMITTALS SCHEDULE

A. In conjunction with the preparation of the Construction Progress Schedule, the Contractor shall prepare a Submittals Schedule that shall outline all required submittals and when they are required to be approved based on ordering lead times and the incorporation of products into the Work in conformance with the Construction Progress Schedule.
B. Contractor shall then reverse engineer the Submittals Schedule to determine when submittals need to be provided to the District and design team, noting latest approval dates and factoring in time for the re-submittal of items if necessary.
C. The Submittals Schedule shall be clearly identified within Construction Progress Schedule and shall be updated and reviewed at each Project Progress Meeting.
D. Contractor shall fill out submittal log that will include all dates associated with submittals. The log will be updated accordingly and submitted weekly for approval.

1.08 DEFERRED SUBMITTALS

A. Certain components of the Work under this project are Delegated Design. It is the Contractor's responsibility to coordinate and assume or assign to subcontractors the complete responsibility for the design, calculation, submittals, fabrication, transportation and installation of the Delegated Design portions or components as required. Delegated Design components of the Work are defined as complete operational systems, provided for their intended use.

B. Submit deferred submittals for Delegated Design elements to the governing agency for the separate approval of each Delegated Design item. Where required, provide design and calculations stamped by a professional engineer licensed in the State of Oregon.

C. Owner shall not be responsible to pay for any delays, additional products, additional hours of work or overtime, restocking or rework required due to failure by the Contractor or the subcontractor to coordinate their work with the work of the other trades on the project or to provide the Delegated Design portion or component in a timely manner to meet the schedule of the project.

1.09 **SITE SPECIFIC SAFETY PLAN**

A. In an effort to reduce accidents and maintain a safe work site, the Contractor, prior to any work on site, shall submit to the Owner a detailed site-specific safety plan which outlines, at a minimum, a detailed description of the following:

1. Facility Safety and Security
2. Construction Safety and Security
3. Disaster Response
4. Emergency Procedures and Protection
5. Safety and Health Procedures and Work Practices pertaining to;
   a. Demolition
   b. Electrical
   c. Excavations
   d. Fall Protection
   e. Fire Prevention
   f. Hazard Communications
   g. Heavy Equipment
   h. Housekeeping
   i. Mobile Cranes
   j. Scaffolding
   k. Signs – Barricades – Fencing

1.10 SITE SPECIFIC STAGING AND LOGISTICS PLAN

A. The Contractor, prior to any work on site, shall submit to the Owner a detailed site specific staging and logistics plan

1.11 CONTRACTOR HEALTH AND SAFETY EVALUATION FORM

A. The Contractor, prior to any work on site, shall fill out the Owner’s required Contractor Health and Safety Evaluation form, and participate in the completion of a Hazard and Potential Exposure Evaluation Checklist.

B. The Owner will provide the Contractor with these forms.

1.12 CONSTRUCTION PROGRESS REPORTING

A. The Contractor shall review the progress and quality of the Work on a daily basis and shall report on that progress daily and upload the reports to e-Builder.

B. Written progress reports shall include, at a minimum:
   1. Project name.
   2. Date.
   3. Author of report.
   4. Weather conditions including wind, precipitation and temperature.
   5. Trades present through the reporting period and count.
   6. A summary of the Work performed that day.
   7. Materials and equipment delivered, utilized and/or stored on site.
   8. Conformance with Contract Documents and/or any observed deviations.
   9. Conformance with or deviation from Construction Progress Schedule.
   10. Tests and/or inspections performed inclusive of results
   11. List of site visitors including regulatory agencies and/or testing and inspection entities.
   12. Notes from any safety meetings.

1.13 PHOTOGRAPHIC DOCUMENTATION

A. Contractor shall provide ground-level, color digital progress photos weekly for a permanent record of the Project. Photos should be dated and include a description of the picture and the camera location. Contractor shall upload all photos to e-Builder.

B. Contractor shall determine at least six interior locations for different views. Stand in the same chosen locations week after week until no further progress can be seen from that location.

C. Contractor shall arrange for professional digital color aerial photographs from at least (6) angles of the entire construction site including adjacent streets. Photos shall be taken prior to the start of construction and at 30-day intervals until no further progress can be seen and at the conclusion of the Project.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Related Requirements
B. Certificates
C. Electronic Submittals
D. Shop Drawings, Product Data, and Samples

1.02 RELATED REQUIREMENTS
A. Section 01 31 23 - Project Management Database
B. General Conditions of the Contract for Construction.

1.03 CERTIFICATES
A. When specified in an individual specification Section, submit a manufacturers' certificate to the Architect/Engineer for review, in quantities specified for Product Data.
B. Indicate how material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
C. Certificates must be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.04 ELECTRONIC SUBMITTALS
A. All documents transmitted for purposes of administration of the contract submittals and product data, are to be in electronic (PDF) format and submitted through e-Builder. (See Section 01 31 23 - Project Management Database)
    1. Contractor and Architect are required to use this electronic submittal service unless otherwise directed by the Owner.
    2. It is the Contractor's responsibility to submit all submittal and product data documents in the following format:
        a. Submittals shall be submitted by project and separated by specification divisions.
        b. All electronic submissions shall be in a format compatible with the e-Builder database; such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com.
        c. Limit PDF size to 10MB, unless otherwise authorized by Architect.
        d. Naming convention for a PDF for product submittals is to be approved by Architect.
    3. Subcontractors, suppliers, Architect, and Architect's consultants will be permitted to use certain modules available at no extra charge.
    4. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
    5. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
B. Cost: The cost of the e-Builder service will be paid by Owner.
C. Submittal Service: The selected service is e- Builder. Refer to Section 01 31 23 - Project Management Database for additional information.
D. Training: One, training session will be arranged for all participants with representatives of Architect, Architect's Consultants, and Contractor participating. Further training is the responsibility of the user of the service.

E. Project Closeout: Submit a Closeout Submittal Log prior to the first payment application. Coordinate with Architect and Owner to verify that archive documents have been saved and remain accessible to Architect and Owner prior to terminating the service for the project.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Shop Drawings are drawings, diagrams, schedules and other data specially prepared by the Contractor or any Subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work. Electronic pdf documents are required and shall be submitted through e-Builder.

B. Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor which illustrates material, product or system for some portion of the Work. Electronic pdf documents are required and shall be submitted through e-Builder.

C. Samples are physical examples which illustrate materials, equipment or workmanship including color, texture, and pattern. Approved samples will establish standards by which the Work will be judged. All samples must be tracked with an accompanying electronic submission through e-Builder.

D. The Contractor shall review, approve and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the work of the Owner or any separate contractor; all Shop Drawings, Product Data and Samples required by the Contract Documents.

E. If the Owner Directs the Contractor to submit hard copies of shop drawings and submittal documents, the following format will apply:

1. For standard manufactured items not requiring special Shop Drawings for manufacture, submit the number the Contractor requires plus four (4) copies of manufacturer's catalog sheets showing illustrated cuts of item to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams and controls, and all other pertinent information. Mark each copy to indicate actual product to be provided. Four (4) copies of reviewed submissions will be retained by the Owner, its Representatives and Architect/Engineer. Hard copies are to be logged and tracked on e-Builder.
2. For all other Shop Drawings, submit three (3) legible, unfolded, reproducible print(s) for each drawing. Hard copies to be logged and tracked on e-Builder. Drawings are to show connections, details, dimensions, finishes, fasteners, and any other pertinent information drawn to an accurate scale. Each drawing shall have a clear space for stamps. When phrase "by others" appears on Shop Drawings, the Contractor shall indicate on the drawing whom is to furnish material or operations so marked before submittal. When Shop Drawings are checked "revise and resubmit", the Contractor shall correct original tracing and submit a new transparency and opaque prints for review.

F. Samples: Submit (4) sets of samples unless indicated otherwise. Two sets will be returned. Maintain one returned set at the project site for purposes of quality control comparisons.

G. For use of all trades, the Contractor shall provide a number of prints required for field distribution.

H. By submitting Shop Drawings, Product Data and Samples, the Contractor represents that he/she has determined and verified all materials, field measurements, and field construction criteria related thereto, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Contractor shall adhere to any supplementary processing and scheduling instruction, pertaining to Shop Drawings, as may be issued by the Owner’s Representative.

I. Architect will review submittals for design concept and conformance with the Contract Documents, and return submittals to the Contractor for distribution with corrections noted thereon.

J. The Contractor is advised that every Submittal returned to the Contractor, regardless of how marked, may not have been reviewed in every aspect, and that in no event should the Contractor assume that the review stamp certifies total compliance with the Contract Documents.

K. Stamp: The Architect will stamp each submittal to be returned with a uniform, self-explanatory action stamp, appropriately marked and executed to indicate the status of the submittal. The stamp indicates and requires the follow action:
    1. No Exception Taken: No further action is required.
    2. Make Corrections Noted: Make the corrections upon fabrication of the material only.
    3. Rejected: The material submitted is not acceptable and another material submission is required.
    4. Revise and Resubmit: The material submittal is not acceptable and it is to be elaborated upon or corrected and resubmitted prior to material fabrication.
    5. Submit Specified Item: Submittal is rejected and the material specified is to be submitted.
    6. 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 and correlated at the job site, fabrication processes and techniques of construction, coordination of his work with that of all other trades and the satisfactory performance of his work.

L. The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Architect or Engineer's review of Shop Drawings, Product Data or Samples unless the Contractor has received a Change Order. Contractor shall not be relieved from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples by the Architect or Engineer's review thereof.

M. The Contractor shall make any corrections required by the Architect and shall resubmit in electronic format, or if applicable, the required number of corrected hard copies of Shop Drawings, Product Data, or new Samples. Resubmittal of Shop Drawings necessitated by required corrections shall not be a cause for extension of time. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings, Product Data or Samples, to revisions other than the corrections requested on previous submittals.

N. No portion of the Work requiring submission of a Shop Drawing, Product Data or Sample shall be commenced until the submittal has been reviewed by the Architect or Engineer. All such portions of the Work shall be in accordance with approved submittals.

O. Schedule of Submittals:
    1. Schedule of Submittals to be provided within 10 days of contract signing.
    2. Prepare and keep current, for Architect’s approval, a Schedule of Submittals which is coordinated with the Contractor’s Construction Schedule and allows Architect reasonable time to review Submittals and in such sequence as to cause no delay in the Work.
    3. List Submittals sequentially by date of transmittal.
    4. Group Submittals pertaining to a single product or assembly, showing that they will be submitted together.
    5. Schedule of Submittals shall include the following and per the Owner submittal form:
        a. Submittal number.
        b. Description of item.
        c. Name of party responsible for preparing Submittal.
        d. Reference to Contract Documents, Specifications and/or Drawings.
        e. Date of anticipated transmittal to Architect.
        f. Date of anticipated return to Contractor.
        g. Scheduled date for commencement of fabrication.
        h. Estimated shipping date
        i. Scheduled date for installation.

6. Submit initial Schedule of Submittals within 14 calendar days after date established in Notice to Proceed for Architect and Contracting Officer review.

P. Time Schedule for Submittals:
1. Shop drawings: submit to the architect for review. The architect will review within 14 calendar days.
2. Schedule submissions to allow ample time for ordering and delivery of materials after review.
3. It is the responsibility of the Contractor to Order long-lead items in an expedited manner so as not to cause any delay in construction schedule.
4. The District will not be responsible for expedited shipping costs or schedule delays resulting from late submission of long-lead item submittals.
5. Product data: submit to the architect for review. The architect will review within 14 calendar days. Schedule submissions to allow ample time for ordering and delivery of materials after review.
6. Samples: submit to the architect for review. The architect will review within 14 calendar days. Schedule submissions to allow ample time for ordering and delivery of materials after review.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Related Requirements
B. Quality Control
C. Tolerances
D. References
E. Labeling
F. Mockup Requirements
G. Testing and Inspection Services
H. Manufacturers' Field Services

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract for Construction.

1.03 QUALITY CONTROL

A. Monitor quality control over suppliers, manufacturers, products, services, Site conditions, and workmanship, to produce Work of specified quality.
B. Comply with specified standards as the minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
C. Perform Work using persons qualified to produce required and specified quality.
D. Products, materials, and equipment may be subject to inspection by Architect/Engineer and the Owner at place of manufacture or fabrication. Such inspections shall not relieve Contractor of complying with requirements of Contract Documents.
E. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

1.04 TOLERANCES

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

1.05 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, complies with requirements of standard except when more rigid requirements are specified or are required by applicable codes.
B. Conform to reference standard by date of issue current as of date of Contract Documents except where specific date is established by code.
C. Obtain copies of standards and maintain on Site when required by product Specification Sections.
D. When requirements of indicated reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
E. Contract Documents by mention or inference in reference documents shall not be altered by contractual relationships, duties, or responsibilities of parties in Contract, nor those of Architect/Engineer.

1.06 LABELING

A. Attach label from agency approved by authorities having jurisdiction for products, assemblies, and systems required to be labeled by applicable code.

B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label:
    1. Model number.
    2. Serial number.
    3. Performance characteristics.
C. Manufacturer's nameplates, trademarks, logos, and other identifying marks on products are not allowed on surfaces exposed to view in public areas, interior or exterior.

1.07 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this Section and identified in individual product Specification Sections.
B. Assemble and erect specified or indicated items with specified or indicated attachment and anchorage devices, flashings, seals, and finishes.
C. Accepted mockups shall be comparison standard for remaining Work.
D. Where mockup has been accepted by Architect/Engineer and is specified in product Specification Sections to be removed, remove mockup and clear area when directed to do so by Architect / Engineer.

1.08 TESTING AND INSPECTION SERVICES

A. The Owner will select, employ, and pay for specified services of an independent firm to perform testing and inspection. Independent firm will perform tests, inspections, and other services specified in individual Specification Sections and as required by Architect/Engineer and authorities having jurisdiction.
    1. Laboratory: Authorized to operate in State of Oregon.
    2. Laboratory Staff: Maintain full-time specialist on staff to review services.
    3. Testing Equipment: Calibrated at reasonable intervals with devices that are accurate and traceable to the National Bureau of Standards or accepted values of natural physical constants.
B. Testing may be required for, but is not limited to, the following:
    1. Soils
    2. Concrete
    3. Structural steel
    4. Welding
    5. Brick and grout
C. Testing, inspections, and source quality control may occur on or off Project Site. Perform off-Site testing as required by Architect/Engineer or the Owner.
D. Reports shall be submitted by independent firm to the Owner, Architect/Engineer, Contractor, and authorities having jurisdiction, in duplicate when so directed, indicating observations and results of tests and compliance or noncompliance with Contract Documents Submit final report indicating correction of Work previously reported as noncompliant.
E. Contractor is to cooperate with independent firm and furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
    1. Notify independent firm 48 hours before expected time for operations requiring services.
    2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
F. Employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work according to requirements of Contract Documents.
G. Retesting or re-inspection required because of nonconformance with specified or indicated requirements shall be performed by same independent firm on instructions from Architect/Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.
H. Agency Responsibilities:
    1. Test samples of mixes submitted by Contractor.

2. Provide qualified personnel at Site. Cooperate with Architect/Engineer and Contractor in performance of services.
3. Perform indicated sampling and testing of products according to specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect/Engineer and Contractor of observed irregularities or nonconformance of Work or products.
6. Perform additional tests required by Architect/Engineer.
7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit electronic copies of report to the Owner, Construction Manager, Architect/Engineer, Contractor, and authorities having jurisdiction. Written inspection or test reports shall include:
1. Name of testing agency or test laboratory.
2. Date issued.
3. Project title and number.
4. Name of inspector and individuals present.
5. Date and time of sampling or inspection.
6. Identification of product and Specification Section.
7. Location in Project.
8. Type of inspection or test.
9. Date of test.
10. Complete inspection or test data.
11. Results of tests.
12. Interpretations.
13. Recommendations.
14. Conformance with Contract Documents.

J. Limits on Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency or laboratory may not approve or accept any portion of the Work.
3. Agency or laboratory may not assume duties of Contractor.
4. Agency or laboratory has no authority to stop the Work.

1.09 MANUFACTURER'S FIELD SERVICES

A. When specified in individual Specification Sections, required material or product suppliers or manufacturers to provide qualified staff personnel to observe Site conditions, conditions of surfaces and installation, quality of workmanship, startup of equipment, testing, adjusting, and balancing of equipment and commissioning as applicable, and to initiate instructions when necessary.
B. Fabricator: Company specializing in performing work associated with the project with documented experience, and proper certifications.
C. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer is subject to approval of Architect/Engineer. Observer is subject to approval by the Owner.
D. Report observations and Site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

01 52 00
CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Related Sections
B. Temporary Utilities
C. Temporary Controls
D. Construction Facilities
E. Removal of Utilities, Facilities and Controls

1.02 RELATED REQUIREMENTS
A. General Conditions of the Contract for Construction

1.03 RELATED SECTIONS
A. Section 01 10 00 – Summary of Work
B. Section 01 71 00 – Final Cleaning

1.03 TEMPORARY UTILITIES
A. Temporary Electricity:
1. Contractor shall use existing Owner provided power until such time as it becomes impractical to retain existing service feed due to progress of the Work.
2. Contractor shall secure temporary power service required from Utility source in Owner's name. Contractor shall perform a load test to verify load capacity.

B. Temporary Lighting:
1. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
2. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 10 foot candles.
3. Provide and maintain 2 foot candles lighting to exterior staging and storage areas after dark for security purposes.
4. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
5. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
6. Maintain lighting and provide routine repairs.

C. Temporary Heat:
1. Provide and pay for heat devices and heat as required to maintain specified conditions for construction operations.
2. Comply with codes, agencies, and regulations regarding usage of temporary space heaters.
3. Propane heaters are prohibited in interior areas.

D. Temporary Ventilation:
1. Ventilate enclosed areas to:
   a. Assist cure of materials.
   b. Dissipate humidity.
   c. Prevent accumulation of dust, fumes, vapors, or gases.
   d. Provide local exhaust ventilation to prevent harmful dispersal of hazardous substances into atmosphere at all times.

E. Temporary Telephone and Internet Service:
1. Telephone Land Lines: Install one telephone line for each field office.
2. At each telephone, post a list of important telephone numbers:
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect's office.
   e. Engineers' offices.

f. Owner's office.
g. Principal subcontractors' field and home offices.

3. Internet Connections: Minimum of one DSL modem or faster.

F. Temporary Water Service:
1. Contractor shall use existing Owner provided water service required for construction operations.

G. Temporary Sanitary Facilities:
1. Provide and maintain adequate number of required facilities and enclosures for use of all persons and trades employed on Work during construction period. Existing building toilet facilities will be off-limits at all times.
a. Toilet facilities.
b. Washing facilities.

H. Temporary First Aid Facilities: Provide adequate first aid facilities for construction personnel. Provide local hospital directions and phone number.

I. Temporary Fire Protection:
1. Take all precautions to prevent possibility of fire resulting from construction operations. Particularly avoid hazardous accumulations of rubbish and unsecured flammable materials.
2. Provide emergency fire extinguishing equipment of adequate type and quantity, readily available and properly maintained.
3. Keep local Fire Department's telephone number prominently displayed near telephone.

1.04 TEMPORARY CONTROLS

A. Barriers and Fencing
1. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
2. Provide barricades and covered walkways required by governing authorities for public rights of way.
3. Protect non owned vehicular traffic, stored materials, site and structures from damage.
4. Provide temporary commercial grade chain link fencing at the limits of construction for the duration of construction, until Work has been accepted or occupied by Owner. Maintain site fencing as needed and equip with vehicular gates with locks. Daisy chain BSD locks onto contractor locks.

B. Water Control:
1. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
2. Protect site from pooling or running water. Provide water barriers as required to protect site from soil erosion.
3. Exercise care in cleaning out equipment, etc., so as to prevent materials from clogging catch basins and yard drains.
4. Leave all drainage items clean and in proper working condition.

C. Dust Control:
1. Utilize water application or other methods approved by the Oregon Department of environmental Quality to control dust on access roads and the project site to the satisfaction of the Owner.
2. Contractor shall provide air barriers as required within the Contract Documents to address the airborne spread of hazardous materials during the course of the Work. Air barriers shall remain effective during construction and during non-working hours to prevent adverse distribution of materials due to wind or other non-construction related impacts to the site.
3. Maintain dust control operation to prevent flying dust from leaving the project site. Use power sweepers for street, parking lot, playground areas, staging areas and cleaning as necessary.

4. Continue vacuum cleaning on as-needed basis until building is ready for Substantial Completion or Occupancy.
5. Utilize sticky mats at all construction transition areas, replace frequently and install by competent person.
6. Contractor shall use sweeping compound during sweeping activities to mitigate dust migration.

D. Pollution Control:
1. Burning or burying of rubbish and waste materials on Site is prohibited. Provide covered dump box for collection of waste materials.
2. Disposal of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems is prohibited.
3. Keep Site and surrounding areas clear of accumulations of waste material and rubbish resulting from operations on a daily basis under this Contract. Remove waste from Site immediately upon completion of Work.

E. Protection of Installed Work:
1. Protect installed Work and provide special protection where specified in individual specification Sections.
2. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.
3. Provide and maintain temporary shoring and lateral bracing of structure during erection to resist all loads including:
    a. Wind
    b. Seismic
    c. Construction
    d. Materials
    e. Moving equipment
4. Do not remove temporary bracing and shoring until adequate permanent connections or structural elements are in final position and positively anchored.
5. Provide protective coverings at walls, projections, jambs, sills and soffits of openings.
6. Protect finished floors, stairs and other surfaces from traffic, dirt, wear, damage or movement of heavy objects, by protecting with durable sheet materials such as Tyvek.
7. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
8. Prohibit traffic from landscaped areas.

F. Tree and Plant Protection:
1. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
2. Provide barricades or fencing and maintain same around all trees, shrubs or other landscaped areas adjacent to work of this Contract to protect such areas from damage of any nature caused by construction operations.
3. Replace any plantings damaged or destroyed with plants of equivalent size, type and nature as approved by Architect.

G. Exterior Enclosures:
1. See Specification Section 01 10 00, Summary of Work, for additional requirements for protecting existing structure.
2. Provide temporary weather tight closure of exterior work areas to accommodate acceptable working conditions and protection of Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification Sections, and to prevent entry of unauthorized persons.
3. Provide access doors with self-closing hardware and locks.
4. Provide temporary roofing as required.

5. Provide scaffolding enclosures.

H. Interior Enclosures:
1. Provide temporary partitions and ceilings as required to separate work areas from owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.
2. Construction: Framed walls and rigid sheet materials reinforced with closed joints and sealed edges at intersections with existing structure. Provide doors at access points with sealing gaskets to prevent dust migration.

I. Security:
1. Provide security and facilities to protect Work from unauthorized entry, vandalism or theft.
2. Keep exterior doors locked to prevent unauthorized access to the buildings.
3. Coordinate with Owner's Security program.

J. Pest Control:
1. The Contractor is required to create a pest control plan that is intended to mitigate both the presence of pests on site at the outset of and during the construction process as well as impede their migration to offsite locations.
2. Pest control may include both mechanical and chemical measures for eradication. Contractor shall maintain site to remove pests following termination with consideration to mitigating the possibility of humans or domestic pets coming in contact with exterminated animals.
3. Prior to the commencement of work, Contractor shall enlist the services of a Pest Control Professional to provide a comprehensive pest control plan for the Project throughout the course of the work.

1.05 CONSTRUCTION FACILITIES

A. Access Roads
1. Construct and maintain temporary access to public roads to serve construction area.
2. Relocate access roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets. Any dirt, mud or other debris tracked onto streets must be removed immediately.

D. Provide barricades, warning signs, flagmen or other traffic regulators which may become necessary for protection of public, construction personnel and property.

E. Parking: Arrange for temporary parking areas to accommodate construction personnel, project visitors and Owner's Employees.

F. When site space is not adequate, provide additional off-site parking as allowed by the City.

G. Progress Cleaning:
1. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
3. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations. Utilize containers intended for holding waste materials of type to be stored.
5. Daily cleaning shall include magnetic sweep of jobsite to pick up all nails and metallic debris.

6. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces and other closed or remote spaces prior to enclosing the space.
7. Broom and vacuum clean interior areas prior to the start of surface finishing and continue cleaning to maintain a dust-free space during the finishing operations.
8. Remove waste materials, debris, and rubbish from site periodically and dispose offsite.

H. Project Identification:
1. Provide one 4 x 8 foot project sign of MDO exterior grade plywood and wood frame construction, painted with exhibit lettering by professional sign painter to District-approved graphic design and colors. Design supports, framing and surfaces to resist a minimum of 50 mph wind velocity.
2. List title of project and logo, names of Owner, Architect/Engineer, and Contractor.
3. Erect on the site at location established by the Owner.
4. Comply with requirements of authorities having jurisdiction.
5. Obtain and pay for any required permits.
6. No other signs will be allowed without the Owner’s permission except those signs required by law.

I. Field Offices and Sheds:
1. Furnish and install field office building(s) adequate in size and accommodation for all Contractor's offices, job site meetings, superintendent's office, supply room and tool room. Alternatively, a room within Aloha High School may be used as a field office during construction when school is not in session. Coordination with owner is required. Once school is in session if the project has not meet substantial completion the contractor will be required to supply at contractors cost a field office for the remainder of the project until the contractor has meet substantial completion.
2. For the duration of the project construction (until Substantial Completion), provide this office and conference space with:
   a. Adequate light, heating, air conditioning, and ventilation.
   b. A conference room with a conference room table with 12 chairs, a plan rack (wall mounted) and one 4' x 8' white marker board.
   c. Weekly janitorial services.
   d. Copy machine.
3. The above referenced facilities shall be completed in total and fully operational for use not later than ten (10) days after mobilization by the Contractor.
4. Sheds: Provide the following facilities in temporary buildings used for material and equipment storage:
   a. Ventilation: Where required for materials being stored.
   b. Fire Extinguisher: One ABC type portable fire extinguisher.
   c. Temperature Control: As required for materials being stored.

1.06 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
B. Clean and repair damage caused by installation or use of temporary work.
C. Restore Owner property, and adjacent private and public property damaged or used during construction, to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

01 60 00
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General Requirements
B. Products
C. Material and Equipment Selection.
D. Product delivery requirements.
E. Manufacturer’s Instructions.
F. Product storage and handling requirements.
G. Product options.

1.02 GENERAL REQUIREMENTS

A. General conditions of the Contract for Construction.

1.03 PRODUCTS

A. At minimum, comply with specified requirements and reference standards.
B. Specified products define standard of quality, type, function, dimension, appearance, and performance required.
C. Furnish products of qualified manufacturers that are suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise. Confirm that manufacturer's production capacity can provide sufficient product, on time, to meet Project requirements.
D. Do not use materials and equipment removed from existing premises except as specifically permitted by Contract Documents.
E. Furnish interchangeable components from same manufacturer for components being replaced.

1.04 MATERIAL AND EQUIPMENT SELECTION

A. Manufactured and fabricated products:
    1. Design, fabricate and assemble in accordance with the best engineering and shop practices.
    2. Manufacture like parts of duplicate units to standard sizes and gauges and to be interchangeable.
    3. Where two or more items of the same kind are indicated, provided items that are identical and by the same manufacturer.
    4. Provide products suitable for service conditions.
    5. Adhere to equipment capacities, sizes, and dimensions shown or specified unless variations are specifically approved in writing.
B. Do not use material or equipment for any purpose other than that for which it is designed or is specified.
C. Fabricate and install equipment to deliver its full rated capacity at the efficiency for which it was designed.
D. Select and install equipment to operate at full capacity without excessive noise or vibration.
E. Provide electrical products with Underwriter’s Laboratories Label or as approved by the local inspection authority.

1.05 PRODUCT DELIVERY REQUIREMENTS

A. Comply with delivery requirements in Section 01 74 00 – Construction Waste Management and Disposal: Construction Waste Management Plan.
B. Transport and handle products according to manufacturer's instructions.
C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.06 MANUFACTURER'S INSTRUCTIONS

A. Perform work in accordance with manufacturer's printed installation instructions. Obtain and distribute copies of such instructions to parties involved in the installation.

B. Maintain one set of complete instructions at the job site during installation and until completion.

C. Handle, install, connect, clean, condition, and adjust products in strict accordance with manufacturer's printed instructions and in conformity with specified requirements.

D. Consult with the Architect for further instructions should job conditions or specified requirements conflict with manufacturer's instructions.

E. Do not proceed with work without clear instructions.

F. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

1.07 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products according to manufacturer's instructions.

B. Store products with seals and labels intact and legible.

C. Store sensitive products in weather-tight, climate-controlled enclosures in an environment suitable to product.

D. For exterior storage of fabricated products, place products on sloped supports aboveground.

E. Provide off-Site storage and protection when Site does not permit on-Site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.08 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Products complying with specified reference standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of the manufacturers named and comply with Specifications; no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit Request for Substitution for any manufacturer not named, according to Section 01 25 00 - Substitution Procedures.

D. Or Approved Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved", comply with provisions Specification Section 01 25 00.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

01 73 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Related Requirements
B. Related Sections
C. Starting of Systems
D. Demonstration and Instructions
E. Testing, Adjusting, and Balancing
F. Project Record Documents
G. Operation and Maintenance Data
H. Spare Parts and Maintenance Products
I. Product Warranties and Product Bonds
J. Maintenance Service
K. Examination
L. Preparation
M. Execution
N. Protecting Installed Construction
O. Final Cleaning

1.02 RELATED REQUIREMENTS
A. General conditions of the Contract for Construction.

1.03 RELATED SECTIONS
A. Section 01 10 00 – Summary of Work
B. Section 01 33 00 – Submittal Procedures
C. Section 01 40 00 – Quality Requirements
D. Section 01 77 00 – Closeout Procedures

1.04 STARTING OF SYSTEMS
A. Coordinate schedule for startup of various equipment and systems.
B. Notify Architect/Engineer and Owner seven days prior to startup of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
D. Verify that tests, meter readings, and electrical characteristics agree with those required by equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute startup under supervision of manufacturer's representative or Contractors' personnel according to manufacturer's instructions.
G. When specified in individual Specification Sections, require manufacturer to provide authorized representative who will be present at Site to inspect, check and approve equipment or system installation prior to startup and supervise in placing equipment or system in operation.
H. Submit a written report according to Section 01 33 00 – Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.05 DEMONSTRATION AND INSTRUCTIONS
A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
B. Demonstrate Project equipment by qualified manufacturer’s representative who is knowledgeable about the Project.
C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Use operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
E. Demonstrate startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at designated location.
F. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instruction.

1.06 TESTING, ADJUSTING, AND BALANCING

A. Contractor will appoint and employ services of independent firm to perform testing, adjusting, and balancing of all mechanical systems impacted by construction activities per Section 23 05 93 – Testing, Adjusting, and Balancing.
B. Report submissions and additional requirements specified in Section 01 40 00 – Quality Requirements.

1.07 COMMISSIONING (BY OWNER)

A. The Owner may engage a Commissioning Agent through a direct contract. The Commissioning Agent will provide the following:
    1. A commissioning plan.
    2. Monitoring, recording, and reporting of commissioning test results.
    3. Adjustments to allow systems being commissioned to meet design performance criteria.
B. The Contractor is responsible for coordinating the Commissioning Agent’s work with the project schedule, setting up tests, operating equipment and systems, making adjustments to settings, and placing building systems in final operational mode.

1.08 PROJECT RECORD DOCUMENTS

A. Record documents are prepared by the Architect. As-built documents are prepared by the Contractor.
B. Maintain on Site one set of the following documents as a basis for as-built documents; record actual revisions to the Work:
    1. Drawings.
    2. Specifications.
    3. Addenda.
    4. Change Orders and other modifications to the Contract.
    5. Reviewed Shop Drawings, product data, and Samples.
    6. Manufacturer's instruction for assembly, installation, and adjusting.
C. Ensure entries are complete and accurate, enabling future reference by Owner.
D. Store as-built documents separate from documents used for construction.
E. Record information concurrent with construction progress, not less than weekly.
F. Specifications: Legibly mark and record, at each product Section, description of actual products installed, including the following:
    1. Manufacturer's name and product model and number.
    2. Product substitutions or alternates used.
    3. Changes made by Addenda and modifications.
G. As-Built Drawings and Shop Drawings: Legibly mark each item to record actual construction as follows:
    1. Include Contract modifications such as Addenda, supplementary instructions, change directives, field orders, minor changes in the Work, RFI’s, and change orders.
    2. Include locations of concealed elements of the Work.
    3. Identify depth of buried utility lines and provide dimensions showing distances from permanent facility components that are parallel to utilities.
    4. Dimension ends, corners, and junctions of buried utilities to permanent facility components using triangulation.
    5. Identify and locate existing buried or concealed items encountered during Project.

6. Measured depths of foundations in relation to finish main floor datum.
7. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
8. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
9. Field changes of dimension and detail.
10. Details not on original Drawings.

H. As-built document submittal requirements specified in Section 01 77 00 – Closeout Procedures: Closeout Requirements.

I. The contractor will be required to learn and use Owner Project Management database (e-Builder) for this project. Refer to Section 01 31 23 – Project Management Database.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit in PDF composite electronic indexed file.

B. Internally subdivide contents with pdf bookmarks, logically organized as described below;

C. Drawings: Provide hyperlinked electronic pdf drawings.

D. Contents: Prepare hyperlinked table of contents with each product or system description identified, in two parts as follows:

1. Part 1: PDF directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: PDF of the Operation and maintenance instructions arranged and by system and subdivided /hyperlinked by Specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Include the following:
    a. Significant design criteria.
    b. List of equipment. Include description of unit or system and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
    c. Parts list for each component. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
    d. Operating instructions. Include startup, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions. Include sequence of operation by controls manufacturer.
    e. Maintenance instructions for equipment and systems. Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
    f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
    g. Safety precautions to be taken when operating and maintaining or working near equipment.
    h. Piping Diagram: Include Contractor's coordination drawings with color-coded piping diagrams as installed. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
    i. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed. Include color-coded wiring diagrams as installed.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual Specification Sections.

B. Salvaged materials shall be palletized, shrink-wrapped, and delivered to a place and location as directed by Owner.
C. Deliver to Project Site or another location as directed by Owner; obtain receipt prior to final payment.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible Subcontractors suppliers, and manufacturers within ten days after completion on applicable item of Work.
B. Execute and assemble transferable warranty documents and bonds from Subcontractors, suppliers, and manufacturers.
C. Verify documents are in proper form, contain full information, and are notarized.
D. Co-execute submittals when required.
E. Time of Submittals:
    1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
    2. Make other submittals within ten days after date of Substantial Completion, prior to final Application for Payment.
    3. For items of Work for which acceptance is delayed beyond Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in Specification Sections for one (1) year from date of Substantial Completion during warranty period.
B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.
D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of District.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing Site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
C. Examine and verify specific conditions described in individual Specification Sections.
D. Verify that utility services are available with correct characteristics and in correct locations.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance according to manufacturer's instructions.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer-required or -recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

3.03 EXECUTION

A. Comply with manufacturer's installation instructions, performing each step in sequence. Maintain one set of manufacturer's installation instructions at Project Site during installation and until completion of construction.

B. When manufacturer's installation instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
C. Verify that field measurements are as indicated on approved Shop Drawings or as instructed by manufacturer.
D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
    1. Secure Work true to line and level and within specified tolerances, or if not specified, industry-recognized tolerances.
    2. Physically separate products in place, provide electrical insulation, or provide protective coatings to prevent galvanic action or corrosion between dissimilar metals.
    3. Exposed Joints: Provide uniform joint width and arrange to obtain best visual effect. Refer questionable visual-effect choices to Architect/Engineer for final decision.
E. Allow for expansion of materials and building movement.
F. Climatic Conditions and Project Status: Install each unit of Work under conditions to ensure best possible results in coordination with entire Project.
    1. Isolate each unit of Work from incompatible Work as necessary to prevent deterioration.
    2. Coordinate enclosure of Work with required inspections and tests to minimize necessity of uncovering Work for those purposes.
G. Mounting Heights: Where not indicated, mount individual units of Work at industry recognized standard mounting heights for particular application indicated.
    1. Refer questionable mounting heights choices to Architect/Engineer for final decision.
    2. Elements Identified as Accessible to Handicapped: Comply with applicable codes and regulations.
H. Adjust operating products and equipment to ensure smooth and unhindered operation.
I. Clean and perform maintenance on installed Work as frequently as necessary through remainder of construction period. Lubricate operable components as recommended by manufacturer.

3.04 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual Specification Sections.
B. Provide temporary and removable protection for installed products. Control activity in immediate Work area to prevent damage.
C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
D. Use durable sheet materials to protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.
E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
F. Prohibit traffic from landscaped areas.
G. Refer for Section 01 10 00 – Summary of Work for more information.

3.05 FINAL CLEANING

A. Execute final cleaning prior to final Project assessment.
B. Employ experienced personnel or professional cleaning firm.
C. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; and vacuum carpeted and soft surfaces.
D. Clean equipment and fixtures to sanitary condition with appropriate cleaning materials.
E. Clean permanent filters of operating equipment.
F. Clean debris from roofs, gutters, downspouts, and drainage systems.
G. Verify industry standard approach for addressing excess granular fines, so as not to void roof warranty. Vacuum loose granular fines from the cap sheet of new roofs so that they don’t wash down the roof drains.
H. Clean Site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste and surplus materials, rubbish, and construction facilities from Site.
J. Repair, patch, and touch up marred surfaces.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES
- A. Related Requirements
- B. Repair and Protection
- C. Submittals

1.02 RELATED REQUIREMENTS
- A. General Condition of the Contract
- B. Section 01 11 00 - Summary of Work
- C. Section 01 25 00 - Substitution Procedures
- D. Section 01 33 00 - Submittal Procedures
- E. Section 01 40 00 - Quality Requirements
- F. Section 01 60 00 - Product Requirements
- G. Section 01 73 00 - Execution and Closeout Requirements

1.03 REPAIR AND PROTECTION
- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
- B. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

1.04 SUBMITTALS
- A. See Section 01 33 00 – Submittal Procedures for additional requirements.
- B. Submit written request in advance of cutting or alteration which affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather-exposed or moisture-resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight-exposed elements.
    5. Work of Owner or separate contractor.
- C. Include in request:
    1. Identification of Project.
    2. Location and description of affected work.
    3. Necessity for cutting or alteration.
    4. Description of proposed work, and products to be used.
    5. Alternatives to cutting and patching.
    6. Effect on work of Owner or separate contractor.
    7. Written permission of affected separate contractor.
    8. Date and time work will be executed.

PART 2 - PRODUCTS

2.01 MATERIALS
- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 25 00 – Substitution Procedures.

PART 3 - EXECUTION

3.01 GENERAL
- A. Execute cutting, fitting, patching and finishing including excavation and fill, to complete Work, and to:
    1. Fit the several parts together, to integrate with other work.

2. Uncover work to install ill-timed work.
3. Match work that has been cut to adjacent work.
4. Repair areas adjacent to cuts to required condition.
5. Repair new work damaged by subsequent work.
6. Remove and replace defective and non-conforming work.
7. Remove samples of installed work for testing.
8. Provide openings in elements of Work for penetrations of mechanical and electrical work.
9. Provide finished appearance of surfaces and to match adjacent surfaces (unless otherwise noted) affected by the Work.

3.02 INSPECTION

A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
B. After uncovering, inspect conditions affecting performance of work.
C. Beginning of cutting or patching means acceptance of existing conditions.
D. Review District's Hazardous Material Abatement drawings, Management Plan, and Hazardous Materials Survey to become aware of any asbestos containing materials or lead containing painted surfaces that may be impacted prior to the execution of the Work.
    1. If suspected hazardous materials are encountered, do not disturb. Inform the District immediately and take corrective action as outlined in Section 01 10 00 – Summary of Work, before proceeding with the Work.

3.03 PREPARATION

A. Provide supports to assure structural integrity of surroundings; devices and methods to protect other portions of Project from damage.
B. 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. Maintain excavations free of water.
C. 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.

3.04 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.
B. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
C. 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 neatly to minimum size required, and with minimum disturbance of adjacent surfaces. When possible, remove existing materials back to joints or break points. Temporarily cover openings when not in use.
    2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
    3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
    4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
    5. Roofing: At locations where existing roofing must be removed to accommodate new construction, remove roofing, including insulation as necessary. Provide a

temporary cutoff in strict accordance with roofing manufacturer's recommendations, to provide a 100 percent watertight seal.

a. If any water is allowed to enter under the existing roofing, follow the procedures outlined in Section 01 10 00 – Summary of Work regarding water intrusion incidents.

D. 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 practicable as determined by Owner. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to the nearest intersection; for an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to the condition of substrate, Contractor shall repair substrate prior to repairing finish. Remove defective work to the limit of pre-existing joint or edge. Replacement of defective work will not create new seams or joint lines.
4. Restore work with new products in accordance with requirements of Contract Documents.
5. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
6. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated material, full thickness of the construction element.
7. For flooring adjacent to new partitions, impacted where removing walls or partitions extends one finished area into another, or damage by work, patch and repair floor surfaces in the new space. Provide an even surface of uniform color and appearance. For continuous sheet flooring areas where patching is not feasible, replace entire floor or to the nearest seam in a manner acceptable to Owner.
8. For painted surfaces affected by work, match paint of a uniform color and appearance and paint adjacent areas affected by work to the nearest natural seam or intersection.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements. Materials subject to testing and inspection in the specifications shall be retested after cutting and patching operations are completed.

END OF SECTION

01 74 00
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Plan Requirements
B. Submittals
C. Construction Waste Management Plan
D. Construction Waste Recycling
E. Construction Waste Adaptive Reuse
F. Construction Waste Collection
G. Construction Waste Disposal

1.02 RELATED REQUIREMENTS

A. General Conditions of the Contract for Construction.
B. Section 02 41 19 – Selective Structure Demolition

1.03 PLAN REQUIREMENTS

A. Develop and implement construction waste management plan as approved by Architect/Engineer and Owner.
B. Comply with Washington County requirements for managing and recycling construction waste.
C. Comply with Metro and State of Oregon rules and regulations pertaining to solid waste management.
D. Intent:
    1. Divert construction, demolition, and land-clearing debris from landfill disposal.
    2. Redirect recyclable material back to manufacturing process.
    3. Generate cost savings or incur minimal additional cost to Project for waste disposal.

1.04 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures contains requirements for submittals.
B. Construction Waste Management Plan: Submit construction waste management plan describing
C. Methods and procedures for implementation and monitoring compliance including the following:
    1. Transportation company hauling construction waste to waste processing facilities.
    2. Recycling and adaptive reuse processing facilities and waste type each facility will accept.
    3. Construction waste materials anticipated for recycling and adaptive reuse.
    4. On-Site sorting and Site storage methods.

1.05 CONSTRUCTION WASTE MANAGEMENT PLAN

A. Construction Waste Landfill Diversion: Minimize weight of construction waste materials for duration of Project through resale, recycling, or adaptive reuse.
B. Implement construction waste management plan at start of construction.
C. Review construction waste management plan at preconstruction meeting and progress meetings specified in Section 01 31 00 – Project Management and Coordination.
D. Distribute approved construction waste management plan to Subcontractors and others affected by plan requirements.
E. Oversee plan implementation, instruct construction personnel for plan compliance, and document plan results.
F. Purchase products to prevent waste by:
    1. Ensuring correct quantity of each material is delivered to Site.
    2. Choosing products with minimal or no packaging.

3. Requiring suppliers to use returnable pallets or containers.
4. Requiring suppliers to take or buy back rejected or unused items.

1.06 CONSTRUCTION WASTE RECYCLING

A. Use source separation method or comingling method suitable to sorting and processing method of selected recycling center. Despose nonrecyclable trash separately into landfill.
B. Source Separation Method: Recyclable materials separated from trash and sorted into separate bins or containers, identified by waste type, prior to transportation to recycling center.
C. Comingling Method: Recyclable materials separated from trash and placed in unsorted bins or container for sorting at recycling center.
D. Materials suggested for recycling include:
    1. Packing materials including paper, cardboard, foam plastic, and sheeting.
    2. Recyclable plastics.
    3. Organic plant debris.
    4. Earth materials.
    5. Native stone and granular fill.
    6. Asphalt and concrete paving.
    7. Wood with and without embedded nails and staples.
    8. Glass, clear type.
    9. Metals.
    10. Gypsum products.
    11. Acoustical ceiling tile.
    12. Carpet and carpet pad.
    13. Equipment oil.
    14. Rubble.
    15. Roofing with asbestos testing.
    16. Mixed-construction debris.

1.07 CONSTRUCTION WASTE ADAPTIVE REUSE

A. Arrange with processing facility for salvage of construction material and processing for reuse. Do not reuse construction materials on-Site except as allowed by Owner.
B. Materials suggested for adaptive reuse include:
    1. Concrete and crushed concrete.
    2. Masonry units.
    3. Lumber suitable for re-sawing or refinishing.
    4. Casework and millwork.
    5. Doors and door frames.
    6. Windows.
    7. Window glass and insulating glass units.
    8. Hardware.
    9. Acoustical ceiling tile.
    10. Equipment and appliances.
    11. Fluorescent light fixtures and lamps.
    12. Incandescent light fixtures and lamps.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE COLLECTION

A. Collect construction waste materials in marked bins or containers and arrange for transportation to recycling centers or adaptive salvage and reuse processing facilities.
B. Maintain recycling and adaptive reuse storage and collection area in orderly arrangement with materials separated to eliminate co-mingling of materials required to be delivered separately to waste processing facility.

C. Store construction waste materials to prevent environmental pollution, fire hazards, hazards to persons and property, and contamination of stored materials.
D. Cover construction waste materials subject to disintegration, evaporation, settling, or runoff to prevent polluting air, water, and soil.

3.02 CONSTRUCTION WASTE DISPOSAL

A. Deliver construction waste to waste processing facilities. Obtain receipt for deliveries.
B. Dispose of construction waste not capable of being recycled or adaptively reused by delivery to landfill, incinerator, or other legal disposal facility. Obtain receipt for deliveries.

END OF SECTION

01 77 00
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. Related Sections
B. Preliminary Closeout Reviews
C. Substantial Completion Documentation
D. Closeout Requirements

1.02 RELATED SECTIONS
A. Section 01 73 00 - Execution and Closeout Requirements

1.03 PRELIMINARY CLOSEOUT REVIEWS
A. Submit a closeout submittal log prior to the first payment application for review and approval by the District.
B. When Contractor considers Work Substantially Complete, submit written certification that:
    1. Contract Documents have been reviewed.
    2. Contractor has inspected Work for compliance with Contract Documents.
    3. Work has been completed in accordance with Contract Documents.
    4. The Project, properties, and streets are finally cleaned of debris and dirt caused by Contractor operations.
    5. Work is substantially complete and ready for final inspection.
    6. Provide preliminary punch list identifying any known corrective items
C. District Representative will coordinate inspection of the Work to verify completion status as soon as possible after receipt of Contractor's certification.
D. Should District Representative consider Work incomplete or defective:
    1. Representative will promptly notify Contractor in writing, through Construction Program Manager, listing incomplete or defective work.
    2. Contractor shall immediately remedy deficiencies and send second written certification that Work is complete.
    3. Representative will coordinate re-inspection of the Work.
E. When District, District Representative and Architect/Engineer find Work acceptable under Contract Documents, they will jointly request Contractor to make closeout submittals.
F. Re-inspection Fees: Should more than two Substantial inspections or one Final inspection be required due to Contractor's failure to correct specified deficiencies, the Contractor shall bear all costs (including compensation for the Construction Manager, Architect, and Engineer’s additional services) made necessary thereby.

1.04 SUBSTANTIAL COMPLETION DOCUMENTATION
A. General: Contractor shall submit documentation for Substantial Completion when it is evident that the Project can be occupied for its intended use and Final Completion can be achieved within thirty (30) days.
B. Complete the following before requesting review for certification of Substantial Completion, either for entire Work or for portions of Work.
    1. Create a list of items that are incomplete with the request. Include the value of incomplete Work, and reason for Work being incomplete.
    2. Include supporting documentation for completing as indicated in these Contract Documents.
    3. Submit statement showing accounting of changes to Contract Sum.

4. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
5. Deliver tools, spare parts, extra stock of material and similar physical items as directed by the Owner.
6. Complete final cleanup requirements.
7. Obtain Authorities Having Jurisdiction (AHJ) approvals as required and submit signed final permit in Closeout Documents.
8. Complete major punch list items.
9. Provide all certifications, reports and inspection records confirming that all work has been completed in accordance with the Contract Documents.

C. In the event that the Contractor is not able to achieve Final Completion within 30 days, the District shall notify the contractor in writing that it has 30 days to complete the balance of the Work. The Contractor shall respond within 7 days stating its intention to complete the work or reasons why the work cannot be completed within the allocated time frame. In the event that the Work is not completed within the stipulated 30-day time frame, the District reserves the right, without limitation to allocate values to the remaining punch list items and withhold up to 150% of the value of that work from the Contractor's final Application for Payment.

1.05 CLOSEOUT REQUIREMENTS

A. Subsequent to final punch list sign-off and prior to Application for Final Payment, submit all record documents to District that are required by governing or other authorities.
B. Deliver salvaged materials, extra stock materials, and maintenance supplies to Owner.
C. Perform onsite training for new mechanical and electrical systems as specified in Section 01 73 00 – Execution and Closeout Requirements.
D. Complete the testing and balancing requirements and confirm that all systems are functioning properly.
E. Coordinate necessary service contracts.
F. Remove all temporary services and contractor property from premises and affected areas restored.
G. Provide the following Closeout Documents. All documents are to be uploaded to e-Builder.
    1. Closeout pdf documentations;
        a. A Table of Contents, tab dividers for each item, and divider sheets describing the information to follow behind each tab divider.
        b. A list of subcontractors with contact information (including emergency phone number), and a summary description of their scope of work.
        c. A list of manufacturers with phone numbers and addresses of local distributers, service representatives and parts dealers. Include 24-hour service representatives when available.
        d. Warranties and guarantees from all subcontractors and suppliers including contact information for each warranty and a detailed description of their scope of work.
        e. The letter from the Contractor stating that the Work is Substantially Complete.
        f. The Architect's and Engineer's Substantial Completion Observation Reports and punch lists.
        g. The signed Substantial Completion Certificate.
        h. Record of the final punch list work being completed and accepted by Owner, Construction Manager, Architect, and Engineers.
        i. The final Application for Payment.
        j. Contractor's affidavit of payment of debts and claims.
        k. Certificate of consent of surety company to final payment.
        l. Contractor's certificate of completion and release of liens.
        m. Final permit(s) with all required signatures.

n. Temporary Certificate of Occupancy and/or Certificate of Occupancy.
o. Special inspector's final report.
p. Structural engineer's final sign-off.
q. Testing and balancing reports.
r. Signed transmittal for delivery of salvaged parts, extra stock materials, and maintenance supplies to BSD.
s. A summary of trainings completed and participants.

2. As-built Drawings (one electronic copy):
   a. Contractor shall submit a color scan of their fully-updated as-built drawings as defined in Section 01 73 00 - Execution and Closeout Requirements.
   b. Architect will use Contractor's as-built drawings as the basis for project Record Drawings.
3. As-built Specifications (one electronic copy):
   a. Contractor shall submit a color scan of their fully-updated Record Specifications as defined in Section 01 73 00 - Execution and Closeout Requirements.
   b. Architect will use Contractor's as-built specifications as the basis for project Record Specifications.
4. Operation and Maintenance Manuals (one electronic copy):
   a. Contractor shall submit O&M manuals as defined in Section 01 73 00 – Execution and Closeout Requirements.

B. Final Payment Documentation: The final payment for the remaining retained percentages shall not become due until the Contractor submits:
1. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might in any way be responsible, have been paid or will be paid or otherwise satisfied within thirty (30) days after receipt of final payment from the Owner.
2. Consent of surety to final payment.
3. Certificate of Completion and Release of Liens.
4. All Closeout Documents have been accepted by the Owner.
5. If any third party fails or refuses to provide a release of claim or waiver of lien as required by the Owner, the Contractor shall furnish a bond satisfactory to the Owner to indemnify the Owner from liability.

PART 2 – PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Shop-fabricated metal items.
   2. Roof ladders.
   3. Miscellaneous connectors.

B. Related Sections:
   1. Section 06 41 00 - Architectural Woodwork: Metal trim finishes.
   2. Section 09 96 00 - High-Performance Coatings: Field-applied finish.
   3. Section 10 11 00 - Visual Display Surfaces: Metal trim finishes.

1.02 REFERENCE STANDARDS

A. Aluminum Association:
   1. AA ADM 1 - Aluminum Design Manual.
   2. AA ASM 35 - Aluminum Sheet Metal Work in Building Construction.
   3. AA DAF-45 - Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association:
   1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American National Standards Institute:
   1. ANSI A117.1-2009 – American National Standard for Accessible and Usable Buildings.

D. ASTM International:
   1. ASTM A36 - Standard Specification for Carbon Structural Steel.
   2. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   4. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   5. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   7. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
   9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   10. ASTM A312 - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   11. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   12. ASTM A354 - Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.

13. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
14. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
15. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
16. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing.
17. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
18. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
19. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
20. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
21. ASTM A743 - Standard Specification for Castings, Iron Chromium, Iron Chromium Nickel, Corrosion Resistant, for General Application.
22. ASTM A992 - Standard Specification for Structural Steel Shapes.
23. ASTM B26 - Standard Specification for Aluminum-Alloy Sand Castings.
24. ASTM B85 - Standard Specification for Aluminum-Alloy Die Castings.
25. ASTM B177 - Standard Guide for Engineering Chromium Electroplating.
26. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
27. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
28. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire.
29. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
30. ASTM B241 - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
31. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
32. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
33. ASTM F436 - Standard Specification for Hardened Steel Washers.
34. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.

E. American Welding Society:
1. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.
2. AWS D1.1 - Structural Welding Code - Steel.
3. AWS D1.6 - Structural Welding Code - Stainless Steel.

F. Builders Hardware Manufacturers Association (BHMA):
1. ANSI/BHMA A156.20 - American National Standard for Strap and Tee Hinges, and Hasps.

G. California Department of Health Services:
1. CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

H. Green Seal:
1. GC-03 - Anti-Corrosive Paints.

I. National Association of Architectural Metal Manufacturers:
1. NAAMM Metal Finishes Manual.

J. National Ornamental & Miscellaneous Metals Association:
    1. NOMMA Guideline 1 - Joint Finishes.
K. SSPC: The Society for Protective Coatings:
    1. SSPC - Steel Structures Painting Manual.
    2. SSPC-SP 1 - Solvent Cleaning.
    3. SSPC-SP 3 – Power Tool Cleaning
    4. SSPC-SP 10 - Near-White Blast Cleaning.
    5. SSPC Paint 15 - Steel Joist Shop Primer/Metal Building Primer.
    6. SSPC Paint 20 - Zinc-Rich Coating (Type I - Inorganic and Type II - Organic).
L. State of Oregon, 2019 Oregon Structural Specialty Code.

1.03 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 - Project Management and Coordination: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Refer to structural drawings for additional submittal requirements.
C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
G. Qualifications Statements:
    1. Submit qualifications for fabricator and erector.
    2. Submit manufacturer's approval of fabricator and erector.
H. Product Data: Submit component descriptions, anchorage and fasteners, and finish options.

1.05 QUALITY ASSURANCE

A. Finish joints according to NOMMA Guideline 1.
B. Perform Work of this Section according to ASTM E985.

1.06 QUALIFICATIONS (LADDERS)

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' documented experience.
B. Erector: Company specializing in performing Work of this Section with minimum three years' documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Inspection: Accept metal fabrications on-Site in labeled shipments. Inspect for damage.
C. Protect metal fabrications from damage by exposure to weather or by ground contact.

1.08 WARRANTY

A. Section 01 73 00 – Execution and Closeout Requirements: Requirements for warranties.
B. Furnish 3-year manufacturer warranty against defects in materials and workmanship.

1.09 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 MISCELLANEOUS CONNECTORS

A. Includes miscellaneous brackets, clamps, connectors, plates, and related fasteners as detailed in drawings. Materials and finishes as indicated on drawings.

2.02 MATERIALS

A. Metals, General:
   1. Metal surfaces, General: For metal fabrications exposed to view upon completion of work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel:
   1. Structural Shapes: ASTM A36.
   2. Channels and Angles: ASTM A36.
   3. Steel Plate: ASTM A36.
   4. Hollow Structural Sections: ASTM A500, Grade B.
   5. Bearing Bars: ASTM A-1011 CS Type B.
   6. Steel Rods: ASTM A-510.
   7. Steel Pipe: ASTM A53, Grade B, Schedule 40.
   8. Sheet Steel: ASTM A653, Grade 33 Structural Quality.
   9. Bolts: Regular hexagon- head bolt, ASTM A307; Grade A
   10. Nuts: ASTM A563 heavy hex type.
   11. Washers: ASTM F436; Type 1.
   12. Welding Materials: AWS D1.1; type required for materials being welded.

C. Stainless Steel:
   1. Bars and Shapes: ASTM A276; Type 302 304; ASTM A582.
   2. Tubing: ASTM A269; Type 304.
   3. Pipe: ASTM A312 welded; Type 304.
   4. Plate, Sheet, and Strip: ASTM A240; Type 304.
   5. Bolts, Nuts, and Washers: ASTM A354.
   6. Welding Materials: AWS D1.6; type required for materials being welded.

D. Aluminum:
   1. Extruded Aluminum: ASTM B221 Alloy 6063, Temper T5, unless otherwise specified.
   2. Sheet Aluminum: ASTM B209 Alloy.
   3. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 Alloy 6063.
   4. Bolts, Nuts, and Washers: Steel, galvanized.
   5. Welding Materials: AWS D1.1; type required for materials being welded.

2.03 LADDERS

A. General: Ladders are to be custom-fabricated from steel according to the designs indicated on the drawings, or Contractor may provide a manufactured ladder system of similar design. Ladder designs deviating from the contract drawings must be approved by Architect, Structural

Engineer, and Owner, and engineered drawings and calculations signed and stamped by a structural engineer registered in the state of Oregon must be provided.

B. Manufacturers:
   1. Cotterman Company
   2. Substitutions: Section 01 25 00 – Substitution Procedures.
   3. Local fabricator at Contractor's option.

C. Exterior Roof Access Ladders
   1. Steel access ladder with platform and return as indicated.
      a. Rails: Provide eased edges. Refer to drawings for dimensions.
      b. Rungs: Premanufactured steel channel rung, channel depth 1.25 inches, tread width 1.625 inches, surface pattern to be circular perforation (3 rows), slip resistant. Basis of Design: McNICHOLS M8LR03499 Traction Tread.
      c. Mounting: Space centerline of rungs 7 inches from wall surface; with aluminum mounting brackets and attachments. Use manufacturer-recommended wall brackets for appropriate spans.
      d. Landing Platform: Premanufactured steel channel platform, channel depth 2 in, 24 in platform width, surface pattern grate to be diamond preformation and slip resistant. Basis of Design McNICHOLS M42450110 PERF-O GRIP grating.
      e. Finish: ladder rail, platform, and tread to be hot-dipped galvanized after fabrication.

2.04 FABRICATION

A. Fit and shop assemble items in largest practical sections for delivery to Site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small, uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located consistent with design of component, except where specifically noted otherwise.
F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
G. Fabrication Tolerances:
   1. Squareness: 1/8 in maximum difference in diagonal measurements.
   2. Maximum Offset between Faces: 1/16 in.
   3. Maximum Misalignment of Adjacent Members: 1/16 in.
   4. Maximum Bow: 1/8 inch in 48 in.
   5. Maximum Deviation from Plane: 1/16 inch in 48 in.

2.05 FINISHES

A. Finishes, General
   1. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Steel:
   1. Prepare surfaces to be primed according to SSPC-SP3 "Power Tool Cleaning".
   2. Do not prime surfaces in direct contact with concrete or where field welding is required.
   3. Prime paint items with one coat as specified in Section 09 90 00 except where galvanizing is specified.
      a. Painting: Spray apply specified primers in strict accordance with manufacturer's direction and rate of application.
   4. Galvanizing: ASTM A123; hot-dip galvanize after fabrication.
   5. Galvanized Steel Scheduled for High-Performance Coating:

a. Do not quench after galvanizing.
b. Ensure that any imperfections in galvanized coating are removed.

6. Galvanizing for Fasteners, Connectors, and Anchors:
   a. Hot-Dip Galvanizing: ASTM A153.
   b. Mechanical Galvanizing: ASTM B695; Class 50 minimum.
7. Sheet Steel: Galvanized with G (Z) coating class. G90, unless noted otherwise.
8. Bolts: Hot-dip galvanized.
9. Nuts: Hot-dip galvanized.
10. Washers: Hot-dip galvanized.
11. Shop Primer: SSPC Paint 15, Type 1, red oxide.
12. Touch-Up Primer: Match shop primer.
13. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type I Inorganic, SSPC Paint 20 Type II Organic.
14. Factory/Shop Finish: Provide where indicated.
    a. Fluoropolymer Coating: Multiple coat as specified for sheet metal system, thermally cured, conforming to AAMA 2605. Product: Kynar 500 manufactured by Arkema or approved equal.
    b. Manufacturers:
       1) Arkema.
       2) Solvay Solexis.
       3) Substitutions: Section 01 25 00 – Substitution Procedures.

C. Stainless Steel:
   1. Satin-Polished Finish: Number 4, satin directional polish parallel with long dimension of finished face.
D. Aluminum:
   1. Finish coatings to conform to AAMA 2604, AAMA 611. Comply with AA DAF-45.
   2. Aluminum Surfaces; Anodized.
      a. Exterior Two-step anodized to clear color, to 0.0007 in thickness.
   3. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify field conditions are acceptable and are ready to receive Work.
C. Verify that concealed blocking and reinforcement are installed and correctly located to receive wall-mounted handrails.
D. Verify adjoining materials are ready to receive Work of this section.

3.02 PREPARATION

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Clean and strip primed steel items to bare metal and aluminum where Site welding is required.
C. Supply items required to be cast into concrete, embedded in masonry or placed in partitions with setting templates to appropriate Sections.

3.03 INSTALLATION

A. Installation in accordance with manufacturer’s written recommendations.
B. Install items plumb and level, accurately fitted, and free from distortion or defects.
C. Make provisions for erection stresses. Install temporary bracing to maintain alignment until permanent bracing and attachments are installed.
D. Field weld components indicated on Shop Drawings.

E. Perform field welding according to AWS D1.1.
F. Obtain approval of Architect prior to Site cutting or making adjustments not scheduled.

3.04 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.
B. Maximum Variation from Plumb: 1/4 in per story or for every 12 ft. in height, whichever is greater, non-cumulative.
C. Maximum Variation from Level: 1/16 inch in 3 ft. and 1/4 inch in 10 ft.
D. Maximum Offset from Alignment: 1/4 in.
E. Maximum Out-of-Position: 1/4 in.

3.05 FIELD QUALITY CONTROL

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
B. Welding: Inspect welds according to AWS D1.1.
C. Replace damaged or improperly functioning hardware.
D. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.
E. Touch up factory-applied finishes according to manufacturer-recommended procedures.

3.06 ADJUSTING

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.
B. Adjust operating hardware and lubricate as necessary for smooth operation.

END OF SECTION

06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structural wall and roof framing.
   2. Wood structural panel sheathing.
   3. Composite sheathing panels.
   4. Preservative treatment of wood.
   5. Fire-retardant treatment of wood.
   6. Blocking, nailers, and furring.
   7. Miscellaneous framing and sheathing.

B. Related Sections:
   1. Section 06 41 00 – Architectural Woodwork: Non-exposed wood components.
   2. Section 09 29 00 – Gypsum Board.
   3. Section 10 11 00 – Visual Display Units.

1.02 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. American Wood Protection Association:
   1. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
   2. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. APA - The Engineered Wood Association:
   1. APA PS1 - Voluntary Product Standard for Construction and Industrial Plywood.
   2. APA - Plywood Design Specification, including supplements.

D. ASTM International:
   1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
   4. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
   5. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

E. California Department of Health Services: CA/DHS/EHLB/R-174 - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

F. Green Seal: GS-36 - Aerosol Adhesives.

G. National Lumber Grades Authority: NLGA - Standard Grading Rules for Canadian Lumber.

H. Northeastern Lumber Manufacturers Association: NELMA - Standard Grading Rules for Northeastern Lumber.

I. The Redwood Inspection Service: RIS - Standard Specifications for Grades of California Redwood Lumber.

J. South Coast Air Quality Management District: SCAQMD Rule 1168 - Adhesive and Sealant Applications.

K. Southern Pine Inspection Bureau: SPIB - Standard Grading Rules for Southern Pine Lumber.

L. U.S. Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

M. West Coast Lumber Inspection Bureau: WCLIB - Standard Grading Rules for West Coast Lumber.
N. Western Red Cedar Association: WRCA - Lumber Grades and Standards.
O. Western Wood Products Association: WWPA - 2011 Western Lumber Grade Rules, including supplements.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. Refer to architectural drawings for additional submittal requirements.
C. Product Data: Submit technical data on insulated sheathing, wood preservative materials, and application instructions.

1.04 QUALITY ASSURANCE

A. Perform Work according to the following:
    1. Lumber Grading Agency: Certified by DOC PS 20.
    2. Wood Structural Panel Grading Agency: Certified by APA-The Engineered Wood Association.
    3. Lumber: DOC PS 20.
    4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
B. Surface-Burning Characteristics:
    1. Fire-Retardant-Treated Materials: Maximum 25/450 flame-spread/smoke-developed index when tested according to ASTM E84.
C. Apply label from agency approved by authority having jurisdiction to identify each preservative-treated and fire-retardant-treated material.
D. Perform Work according to 2019 OSSC and requirements of Washington County.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

PART 2 - PRODUCTS

2.01 FIREBLOCKING AND DRAFTSTOPPING

A. Fireblocking: Solid lumber, structural wood panel, or particleboard.
    1. Solid lumber nominal 2 inches thick.
    2. Two layers of solid lumber nominal 1 inch thick with broken lapped joints.
    3. Structural wood panel 23/32 inch thick with joints backed by structural wood panel.
    4. Particleboard 3/4 inch thick with joints backed by particleboard.
B. Draftstopping: Gypsum board, wood structural panel, or particleboard.
    1. Gypsum board, 1/2 inch thick.
    2. Wood structural panel, 3/8 inch thick.
    3. Particleboard, 3/8 inch thick.

2.02 LUMBER MATERIALS

A. Lumber Grading Rules: APA.
B. Beam Framing: As indicated on Drawings.
C. Studding: As indicated on Drawings.
D. Miscellaneous Framing: As indicated on Drawings.
E. Roof Nailers: Minimum 2 x 4 inches, mechanically secured, kiln dried, as indicated on Drawings. Refer to Section 07 54 19 – Polyvinyl-Chloride (PVC) Roofing: System description and system assembly.
F. Miscellaneous Lumber:
    1. Provide lumber for support or attachment of other construction, including the following:
        a. Blocking

b. Nailers
c. Furring

2. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species.
   a. Western woods; WCLIB or WWPA.
3. For concealed boards, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content and any of the following species and grades:
   a. Western woods; WCLIB or WWPA.

2.03 SHEATHING MATERIALS

A. Wood Structural Panel Sheathing: APA-rated sheathing; Structural I, plywood; Exposure Durability 1.
B. Composite Sheathing Panels: Shear panels consisting of a 5/8-inch Type X gypsum board panel laminated to a 22-gauge galvanized steel sheet; Sure-Board Series 200 structural panels or approved equal.

2.04 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment): AWPA U1, commodity specification A-sawn products or F-wood composites using waterborne, ACQ, SBX preservative.
B. Wood Preservative (Surface Application): Clear type.
C. Fire-Retardant Treatment: Chemically treated and pressure impregnated; having flame spread of 25 or less when tested according to ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20-minute period; interior type.
D. Moisture Content after Treatment: Kiln dried (KDAT).
   1. Lumber: Maximum 19 percent.
   2. Structural Panels: Maximum 15 percent.

2.05 ACCESSORIES

A. See structural drawings for detailed requirements for connectors, fasteners, and anchors.
B. Fasteners and Anchors:
   1. Fasteners: ASTM A153, hot-dip galvanized steel for high-humidity and treated wood locations, unfinished steel elsewhere.
   2. Nails and Staples: ASTM F1667.
C. Structural Framing Connectors: Hot-dip galvanized steel, sized to suit framing conditions, manufactured by Simpson Strong-Tie or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.
B. Section 01 73 00 – Execution and Closeout Requirements: Examination.

3.02 PREPARATION

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Cleaning: Clean surfaces.

3.03 APPLICATION

A. Framing:
   1. Carefully select all members. Select individual pieces so that knots and defects will not interfere with placement of bolts, when nailing or making connections. Discard defective pieces.
   2. Set structural members level and plumb, in correct position.
   3. Fasten framing according to 2019 OSSC or as indicated on Drawings.

4. Make provisions for erection loads and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
5. Place horizontal members, crown side up.
6. Construct load-bearing framing and curb members full length without splices.
7. Double members at openings over 24 inches wide. Space short studs over and under opening to stud spacing.
8. Construct double joist headers at floor and ceiling openings and under wall stud partitions parallel to floor joists. Frame rigidly into joists.
9. Bridge joists and framing in excess of 8 feet span at mid-span. Fit solid blocking at ends of members.
10. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.
11. Coordinate curb installation with installation of decking and support of deck openings and roofing vapor retardant.

B. Sheathing:
1. Fasten sheathing according to 2019 OSSC.
2. Secure roof sheathing with longer edge (strength axis) perpendicular to framing members and with ends staggered and sheet ends over bearing.

C. Fireblocking and Draftstopping:
1. Install fireblocking to cut off concealed draft openings.
   a. Concealed Framed Wall and Furred Spaces: Install fireblocking vertically at floor and ceiling levels and horizontally at maximum 10 feet o.c.
   b. Connections between Horizontal and Vertical Spaces: Install fireblocking between vertical walls and partitions and the following:
      1) Horizontal floor and roof framing.
      2) Soffits, dropped ceilings, cove ceilings, and other horizontal concealed spaces.
   c. Stairs: Install fireblocking between stair stringers at top and bottom of each run.
   d. Exterior Combustible Architectural Trim: Install fireblocking at maximum 20 feet o.c.
2. Install draftstopping in floors and attics at locations indicated on Drawings.
   a. Floors and Attics: In line with dwelling unit and sleeping unit separations.
   b. Floors: In locations to limit each area to 1,000 sq. ft.
   c. Attics: In locations to limit each area to 3,000 sq. ft.

D. Wood Blocking and Nailer Installation:
1. Install where indicated and where required for attaching work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
2. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
3. Blocking shall be a minimum thickness of 1-1/2” and provide adequate support for any fixture that hangs on the walls or ceilings. Fixtures requiring blocking include, but are not limited to:

Sinks
Drinking Fountains
Alarms
Video Monitors
Door Stops
Door Hold Open Devices
Casework
Cane Guards
Grab Bars
Artwork
Electrical Framing
Marker Boards
Dispensers

Door Hold Open Devices
Projection Equipment

Gym Equipment
Mirrors
Shelving
Speakers
Signage
Fire Extinguishers
Tack Boards
Wainscot and Wall Panels

E. Wood Furring Installation
   1. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
F. Miscellaneous fasteners, where not otherwise specified:
   1. Furring to receive plywood: Install 1-by-3 inch nominal- size furring horizontally and vertically at 24 inches o.c.
   2. Furring to Receive Gypsum Board: Install 1-by-2 inch nominal- size furring vertically at 16 inches o.c.

3.04 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.
B. Framing and Furring Members to Receive a Finished Wall or Ceiling: Align finish surface to vary not more than 1/8 inch from a theoretical plane or surfaces of the room or space.
C. Other Framing Members: 1/4 inch from indicated position, maximum.
D. Surface Flatness of Floor: 1/4 inch in 10 feet minimum, and 1/2 inch in 30 feet maximum.

3.05 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Counter tops.
      a. Solid surface counter tops.
   2. Cabinet hardware.
   3. Interior finish carpentry.
      a. Standing and running trim.
      b. Wood baseboard in gymnasium.
      c. Plastic laminate wainscot paneling.
   4. Pre-finish the Work of this Section.

B. Related Requirements:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 09 91 00 - Painting and Coating

1.02 REFERENCE STANDARDS

A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A156.9 - Cabinet Hardware.
   3. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. APA - The Engineered Wood Association:
   1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

C. Architectural Woodwork Institute, Woodwork Institute, and Architectural Woodwork Manufacturers Association of Canada:
   1. AWS - Architectural Woodwork Standards.
   2. Supplemented with The WI Approach.

D. ASTM International:
   1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   2. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
   3. ASTM D638 – Tensile Properties of Plastics.
   4. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.
   5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

E. Hardwood Plywood and Veneer Association:
   1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.

F. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High-Pressure Decorative Laminates.

G. U.S. Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 20 - American Softwood Lumber Standard.
   2. WRCA - Lumber Grades and Standards.

1.03 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 - Project Management and Coordination: Requirements for pre-installation meeting.
B. Convene minimum one week prior to commencing Work of this Section.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals, including AWS Section 1.

B. Product Data: Submit data on:

1. High-pressure decorative laminates.
2. Hardware accessories.

C. Shop Drawings:

1. Indicate dimensions, materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location, schedule of finishes, and Certified Compliance Label on each set.

D. Qualification Statements:

1. Submit qualifications for fabricator and installer.

1.05 QUALITY ASSURANCE

A. Perform Work according to AWS, Section 6, Section 10, and Section 11; grades identified in Section.

1.06 QUALIFICATIONS

A. Fabricator: Company specializing in fabricating products specified in this Section with minimum five years' documented production experience similar to this Project.

B. Installer: Company that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Protect units from moisture damage.

C. Store components indoors prior to installation

D. Handle materials to prevent damage to finished surfaces

1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.08 AMBIENT CONDITIONS

A. Section 01 60 00 – Product Requirements: Requirements for ambient conditions control facilities for product storage and installation.

B. Maintain storage space relative humidity within ranges indicated in AWS Section 2.

C. Subsequent Conditions: Maintain same temperature and humidity conditions in building spaces as will occur after occupancy during and after installation of Work of this Section.

1.09 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.10 WARRANTY

A. Provide manufacturer’s warranty against defects in materials

1. Warranty shall provide material and labor to repair or replace defective materials
2. Damage caused by physical or chemical abuse from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.01 MATERIALS AND FINISHES

A. Refer to architectural drawings for details on materials and finishes.

2.02 INTERIOR FINISH CARPENTRY

A. Interior Standing and Running Trim: Hardwood lumber.
   1. Profile: Sizes and profiles as indicated on Drawings.
   2. Transparent-Finished Trim: AWS Section 6; premium grade.

B. Plastic Laminate Wainscot: Fabricated from decorative laminate protection panel laminated to plywood backer panel and framed with an aluminum channel.

2.03 CASEWORK MATERIALS

A. Hardwood Lumber: Birch species for opaque finish; white maple or match existing species for transparent finish.
   1. Species for Transparent Finish: As indicated in architectural drawings. White maple species if not indicated.
   2. Species for Opaque Finish: As indicated in architectural drawings. Birch species if not indicated.
   3. Cut: Plain sawn.
   4. Finger Jointing: Not permitted.

B. Lumber Moisture Content Range: 5 to 10 percent.

C. Hardwood Plywood: HPVA HP-1; lumber core; birch face species.

D. Medium-Density Overlay: APA/EWA PS 1; softwood plywood, exterior type, with paper face suitable for opaque finish.

E. Combination Core Panel: Panel consisting of softwood veneer inner plies and MDF crossbands. Product: ArmorCore by States Industries or approved equal. Faces: Birch or MDO paper face.

2.04 INTERIOR FINISH CARPENTRY MATERIALS

A. Interior Hardwood Lumber: Species as indicated in Section 09 06 00, Schedules for finishes. If not indicated, birch species for opaque finish; white maple or match existing species for transparent finish.
   1. Cut: Plain sawn.
   2. Finger Jointing: Not permitted.

B. Lumber Moisture Content Range: 5 to 10 percent.

C. Interior Hardwood Plywood: HPVA HP-1; lumber core; birch face species.

D. Decorative Laminate Protection Panels (PL-1)
   1. Core: Fiberglass

E. Tackable Wall Surface: As detailed in architectural drawings, and meeting the following requirements:
   1. Homogeneous tackable, self-healing surface material made of primary natural materials consisting of linseed oil, cork, rosin binders and dry pigments with a jute backing.
   2. Meets or exceeds requirements of ASTM F2034.
   3. Class B when tested in accordance with ASTM E84.
   4. Contains no vinyl.

2.05 FABRICATION

A. Fabricate interior finish carpentry to AWS Section 6 premium grade.

B. Fabricate casework to AWS Section 10 premium grade.

C. Shop-assemble casework for delivery to Site in units easily handled and to permit passage through building openings.

D. Fit exposed plywood edges with matching 1/8” thick hardwood edging unless noted otherwise. Use one piece for full length only.

E. Cap exposed high-pressure decorative laminate finish edges with material of same finish and pattern.

F. Door and Drawer Fronts
   1. Fronts: 3/4 in thick, tongue and groove into sides.
   2. Sides: 1/2 in. plywood.

G. When necessary to cut and fit on-site, fabricate materials with ample allowance for cutting. Furnish trim for scribing and Site cutting.
H. Solid Surface Counter tops
    1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
    2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
        a. Reinforce with strip of solid polymer material, 2" wide.
    3. Provide factory cutouts for plumbing fittings as indicated on the drawings.
    4. Rout and finish component edges with clean, sharp returns
        a. Rout cutouts, and contours to template
        b. Repair or reject defective and inaccurate work

2.06 FINISHES

A. Sand Work smooth and set exposed nails and screws.
B. Apply wood filler in exposed nail and screw indentations.
C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and types recommended for applied finishes.
D. Finish Work scheduled to receive transparent finish according to AWS Section 5; premium grade; stained transparent finish to match existing adjacent cabinet types:
    1. System 5; conversion varnish.
E. Seal, stain, and varnish internal exposed-to-view and semi-concealed surfaces.
F. Seal surfaces in contact with cementitious materials.
G. For items to receive opaque finish, shop-prime in preparation for field painting.

2.07 ACCESSORIES

A. Fasteners and Anchors:
    1. Fasteners: ASTM A153, hot-dip galvanized steel for high-humidity and treated wood locations, unfinished steel elsewhere.
    2. Nails and Staples: ASTM F1667.
    3. Provide tamper-proof fasteners for wood backing at drinking fountain locations.
B. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; finish in concealed locations and finish in exposed locations.
C. Aluminum Channel Trim: Clear anodized aluminum channel with 1 inch legs; width sized to fit the thickness of the panel assembly; mechanically fastened to back of panel assembly. Must match appearance of channel trim specified for tackboards in section 10 11 00 – Visual Display Surfaces.
D. Z-Clips:
    1. Manufacturer – Monarch Metal Fabrication or approved equal.
    2. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
    3. Material: Aluminum
    4. Size: 2 inches
    5. Lift off: 3/8 inch
    6. Projection: 1/ 4 inch
    7. Length: Continuous
E. Concealed Joint Fasteners: Threaded steel.
F. Edge Band: Polyethylene T molding matching panel thickness. Color: Black.
G. Hardware: BHMA A156.9, Types: cabinet hinges, cabinet pulls or knobs, cabinet catches or latches, shelf rests. Match existing pulls, locks and hinges where cabinets are repaired and refinished. Provide the following unless indicated otherwise:

1. Drawer and Door Pulls:
   a. D-shaped, stainless steel with satin sheen finish, 1-¼" protrusion. Must meet ADA requirements.
2. Cabinet Locks: Keyed cylinder, two keys for each lock, master keyed, steel with satin finish.
   a. Product: Schlage CL-1000, Olympus 777 series, or approved equal.
   b. Coordinate keying with Beaverton School District
   c. Provide lock for each single cabinet door and each pair of cabinet doors.
3. Catches: Roller latch.
4. Drawer Slides: Self-closing, galvanized steel construction, ball bearings separating tracks, rail mounted full extension type.
   a. Manufacturers: Knape & Vogt and Accuride.
   b. Load Capacity: Bins and drawers: 150 pounds per pair.
5. Hinges: Institutional, 5 knuckle overlay, commercial quality.
   a. Two hinges for doors up to 36" high, 24" wide.
   b. Three hinges for doors up to 48" high, 24" wide.

H. Joint adhesive:
1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

I. Sealant:
1. Manufacturer's standard mildew resistant, FDA-compliant, NSF 51-compliant (food zone – any type), UL-listed silicone sealant in colors matching components.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for installation examination.
B. Verify adequacy of backing and support framing.
C. Verify location and sizes of utility rough-in associated with Work of this Section.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Prime paint surfaces of woodwork items and assemblies to be in contact with cementitious materials.

3.03 INSTALLATION
A. Install interior finish carpentry according to AWS Section 6 premium grade.
B. Install casework according to AWS Section 10 premium grade.
C. Install counter tops according to AWS Section 11 premium grade.
D. Set and secure casework, interior finish carpentry, and counter tops in place; rigid, plumb, and level.
E. Install wainscot using concealed z-clips. Mount to 2x wood blocking in wall installed per Section 06 10 00 – Rough Carpentry.
F. Use fixture attachments in concealed locations for wall-mounted components.
G. Use concealed joint fasteners to align and secure adjoining cabinet units, counter tops, and woodwork.
H. Carefully scribe casework abutting other components, with maximum gaps of 1/32 in. Do not use additional overlay trim for this purpose.
I. Secure woodwork cabinet and counter bases to floor using appropriate angles and anchorages.
J. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.04 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

B. Conform to AWS Sections 6 and 10 requirements for the following:

1. Smoothness.
2. Gaps.
3. Flushness.
4. Flatness.
5. Alignment

3.05 ADJUSTING

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.

B. Adjust moving or operating parts to function smoothly and correctly.

3.06 CLEANING

A. Section 01 73 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

07 21 16
BLANKET INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes thermal batt insulation in wall construction; and thermal batt insulation for filling cavities in roof curbs .

B. Related Sections:

1. Section 06 10 00 – Rough Carpentry
2. Section 07 54 19 – Polyvinyl-Chloride (PVC) Roofing
3. Section 07 84 00 – Firestopping.
4. Section 09 29 00 – Gypsum Board: Acoustical insulation.

1.02 REFERENCES

A. ASTM International:

1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM E970 - Standard Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source.

1.03 SYSTEM DESCRIPTION

A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 07 54 19 – Polyvinyl-Chloride (PVC) Roofing, and as indicated on Drawings.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on product characteristics, performance criteria, and limitations,

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Insulation Installed in Concealed Locations Surface Burning Characteristics:

1. Batt Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

B. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1. Attic Floor Insulation: Minimum 0.12 watt per sq cm critical radiant flux when tested in accordance with ASTM E970.

1.06 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

PART 2 - PRODUCTS

2.01 BATT INSULATION

A. Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville; a Berkshire Hathaway company.
3. Owens Corning.

4. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 COMPONENTS

A. Batt Insulation: ASTM C665; preformed glass fiber batt; conforming to the following:
   1. Thermal Resistance as indicated on drawings, or as follows if not indicated:
      a. 2x6 Wall Framing: R-30.
   2. Facing: Batts to be faced on one side with asphalt-treated Kraft paper.

B. Wire or metal straps: Galvanized; type and size to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.02 INSTALLATION

A. Install in roof-mounted equipment curbs, skylight curbs, and other locations shown on drawings without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.

D. Staple or nail facing flanges in place at maximum 6 inches oc.

E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

F. Install in accordance with manufacturer's instructions.

END OF SECTION

07 54 19

POLYVINYL CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes Polyvinyl-Chloride (PVC) sheet membrane roofing system with insulation, tapered insulation, coverboard and base flashing. For a "Roof System Type" description of Type 1B and 1C refer to paragraph 3.04 – 3.05 of this section.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications: Ladders.
2. Section 06 10 00 - Rough Carpentry.
3. Section 07 56 30 - Fluid Applied Roofing restoration.
4. Section 07 62 00 - Sheet Metal Flashing and Trim.
5. Section 07 72 30 - Roof Accessories.
6. Section 07 90 00 - Joint Protection.

1.02 REFERENCES

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated:

B. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

1. SPRI ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

C. American Society of Civil Engineer/Structural Engineering Institute (ASCE/SEI):

1. ASCE/SEI-7-10 – Minimum Design Loads for Buildings and Other Structures

D. ASTM International (ASTM)

1. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
2. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
3. ASTM D4434 – Standard Specification for Poly (vinyl chloride) Sheet roofing.
4. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
5. ASTM D6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
8. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.
9. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
10. ASTM E408 – Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
11. ASTM E903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
12. ASTM E1980 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.

E. National Roofing Contractors Association:

1. NRCA - The NRCA Roofing and Waterproofing Manual.

F. Underwriters Laboratories Inc.:

1. UL - Fire Resistance Directory.
2. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
3. UL 1256 - Fire Test of Roof Deck Construction.

4. UL 1897 - Uplift Tests for Roof Covering Systems.

G. Factory Mutual (FM Global) – Approval Guide
   1. Factory Mutual Standard 4470 – Approval Standard for Class 1 Roof Covers.

1.03 EXTENT OF WORK

A. The project consists of installing a new mechanically attached Polyvinyl-Chloride (PVC) Sheet Membrane Roofing System. At specified locations, work includes a partial removal of the existing roofing system. At other specified locations work includes a complete tear-off removal of the existing roofing system down to the roof deck substrate. Refer to paragraph 3.04 – 3.05 of this section, Roof Layout Demo Plans AD-221, and Roof Layout Plans A-221 for more information on selective roofing demolition and Roof System Types. Work also includes installing new sheet metal counter-flashings and coping cap materials.

B. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of the PVC 0.080” thick white membrane roofing, including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details. The PVC roofing system is to be induction heat weld Rhinobond attachments or approved equal.

1.04 DESIGN REQUIREMENTS

A. The completed roofing system as defined below in paragraphs 3.04 – 3.05 of this section shall satisfy the following performance and design criteria:
   1. **Roof Assembly Fire Classification:** The completed PVC membrane roofing system shall achieve a UL Class A Fire Rated assembly at all roof areas.
   2. **Wind Uplift Performance:** The PVC mechanically attached roofing system shall satisfy ASCE-07 (2010) calculated uplift pressures defined for this project. As part of the ASCE-07 (2010) formulas, calculations shall take into account project location, project exposure, building type, roof elevation height, and project specific wind-speed design criteria. Membrane manufacturer shall provide an Assembly Letter of the system to be installed, and letter shall confirm conformance of the ASCE 2010 calculations.
      a. Windspeed Design: Based on project location, windspeed design for this project is 115 MPH 3-second gust.
      b. Exposure Category B: Based on project location, project is designated Exposure B.
      c. Building Category III/IV: Based on building type, project is designated as Building Category III/IV.
   3. **Manufacturer Guarantee:** Completed roofing system installation shall qualify for manufacture’s 15-yr “No Dollar Limit” (NDL) Guarantee, which shall include wind-speed protection up to 85-MPH.

1.05 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Prior to starting work, the roofing contractor must submit the following:

C. Submit an Assembly Letter from the membrane manufacturer’s technical department confirming the proposed roof system at all areas has been reviewed and approved accordingly. Assembly Letter shall describe the roofing system from the roof deck up at all areas, including main roof areas, canopy areas, etc., and shall list fastening densities of individual components. Assembly Letter shall confirm the proposed roofing system will satisfy all performance criteria noted within these specifications, including wind-uplift criteria, ASCE-7 wind-uplift calculations, UL Fire Classification, and manufacturer warranty type and term.

D. Submit Shop Drawings: Contractor to submit shop drawings showing layout, details of construction and identification of materials and details of attachment to other work include:

1. Outline and size of the roof with locations indicating types of penetrations, base and perimeter flashing and membrane terminations with detail references to manufacturer's standards.
2. Plan for tapered insulation, layout of seams, direction of laps, base flashing, details, and indicate finished slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns.

E. Submit Product Data: Contractor to submit appropriate Product Data Sheets for each product to be used including the following information:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

F. Submit Safety Data Sheets of materials to be installed including membrane materials, base flashing materials, insulation and cover board.

G. Submit a sample of the manufacturer's Roofing System Warranty.

H. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system.

I. Submit a manufacturer's Field Reports: Indicate procedures followed ambient temperatures and wind velocity during application.

J. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the specifier prior to the issuance of the manufacturer's warranty.

1.06 QUALITY ASSURANCE

A. The roofing contractor shall confirm all given information and advise the building owner/architect, prior to bid, of any conflicts that will affect their cost proposal.

B. Any contractor who intends to submit a bid using a roofing system other than the approved manufacturer must submit for pre-qualification in writing fourteen (14) days prior to the bid date. Any contractor who fails to submit all information as requested will be subject to rejection. Bids stating "as per plans and specs" will be unacceptable.

C. Perform Work in accordance with NRCA Roofing and Waterproofing Manual. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Manufacturer's Field Representative: to be present as indicated in Part 1.11 – Warranty of this section and as recommended by the roofing manufacturer.

E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified including operation of hot air welding equipment and power supply. Provide at least one thoroughly trained and an experienced foreman and/or superintendent on the job at all times roofing work is in progress.

There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the Architect. Any deviation from the manufacturer's installation procedures and approved details must be supported by a written certification on the manufacturer's letterhead and presented for the Architect's consideration.

F. Weather: Proceed with the roof installation only when existing and forecasted weather conditions permit. Ambient Temperatures shall be above 45 degrees F when applying hot steep asphalt, water-based adhesives of urethane adhesives. 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.

G. Inspection: Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum fifteen (15) years documented experience in the production of thermoplastic scrim-reinforced roofing membrane and related accessories. Membrane manufacturer shall be listed in UL and have FM Approvals for membrane roofing systems for a minimum of 20 years. The roofing membrane manufacturer is defined as a company which makes the primary roofing membrane and flashing membrane in its own factories from rawer states of material. No “Private Label” material, in which one company’s name goes on a product manufactured by others, is acceptable.

B. Applicator: Company specializing in performing Work of this section with minimum ten (10) years documented experience. The roofing system must be installed by an applicator authorized in the application of PVC membrane roofing systems and shall be trained and certified by the manufacturer of the membrane system. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.

1.08 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meetings.

B. A pre-job meeting shall be held a minimum of one week prior to commencing Work of this section. Representatives from other trades whose work will impact the roofing system shall be present at this meeting. A representative of the roofing manufacturer shall also be present. Contact the General Contractor to set the meeting up with all interested parties, including the Architect and Owner's Project Manager.

C. Review all installation procedures and coordination required with related Work.

D. The roofing contractor should schedule a job site inspection to observe actual conditions and verify all dimensions on the roof. The job site inspection may occur on the day of or prior to the pre-job meeting.

E. Any conditions that are not shown on the shop drawings should be indicated on a copy of the shop drawing and included with bid submittal if necessary, to clarify any conditions not shown.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

C. Comply with manufacturer’s written instructions for proper material storage.

1. Store membrane materials in the original unopened packaging until ready for installation in clean, dry, well ventilated areas protected from weather and other trades. Membrane shall be stored elevated above the roof deck and completely protected from moisture with tarpaulins.
2. Store curable materials (adhesives and sealants) between 60 and 80 degrees F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60 degrees F minimum temperature before using.
3. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life. Store and dispose of solvent-based materials, and materials used with solvent-based materials in accordance with requirements of local authorities having jurisdiction.

D. Store products in weather protected environment, clear of ground, moisture and humidity conditions and protect with waterproof coverings. Leave product wrapped and protected in original packaging with identification labels, until ready for use on the job.

E. Stand roll materials on end.

F. Insulation must be on pallets, off the ground and tightly covered with waterproof materials.

G. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense.

1.10 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.
B. Coordinate Work with installing associated metal flashings as work of this section proceeds.
C. Coordinate Work with existing gutters, adjacent roofing systems to remain, adjacent roofing systems specified in other sections, and other roof accessories.
D. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection for the interior of the building and to ensure water does not flow beneath any completed sections of the membrane system.
E. Do not disrupt activities in occupied spaces.

1.11 WARRANTY

A. Section 01 73 00 - Execution: Product warranties and product bonds.
B. Provide manufacturer’s 15-year Total System Warranty in which the materials installed shall be free from defects in materials supplied and/or defective workmanship provided by the authorized applicator with no dollar limitation covering material and labor warranty to cover failure to prevent penetration of water.
    1. The Manufacturers Field Representative shall inspect the project not less than three (3) days per week during construction, completed roof system, and upon acceptance, the manufacturers shall issue the specified warranty commencing on the Date of Substantial Completion.
    2. Manufacturer guarantee shall include all roof system components, including vapor barrier/temporary roof materials, insulation, cover board, roof membrane and flashings, and specified prefabricated edge metal materials.
C. Roofing Contractor shall issue a three (3) year workmanship warranty covering all defects.
D. Roofing Contractor is required to re-tighten bolts on all new roof drains both one year and two years after substantial completion.
E. The maximum wind speed coverage shall be peak gusts of 72 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
F. Pro-rated System Warranties shall not be accepted.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturers:
    1. Basis of Design: Johns Manville; a Berkshire Hathaway
    2. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 POLYVINYL-CHLORIDE (PVC) MEMBRANE

A. PVC Membrane:
    1. Roofing Membrane Product: 80 mil PVC sheet, ASTM D 4434, Type III, fabric reinforced that contains KEE (Elvaloy) to reduce plasticizer migration. Basis of design: JM PVC or approved equal.
    2. Membrane materials shall meet or exceed the requirements of ASTM D 4434 standard for polyvinyl chloride (PVC) membrane sheet roofing.
    3. Solar Reflectance Index (SRI) in accordance with ASTM E 1980, Cool Roof Rating Council (CRRC), and Energy Star Criteria, including the following:

a. SRI: Of no less than 78
b. CRRC: Reflectivity: 0.80. Emissivity: 0.90. for 75% of roof surface.
c. Energy Star: Reflectivity: 0.078 (initial). Emissivity: 0.087 (initial).

4. Membrane Qualifications: Membrane shall be factory certified, first run material, seconds will not be permitted. Independent testing agencies include State of Florida Building Code Product Approval, Miami-Dade, Underwriters Laboratories, and Factory Mutual.
   a. Material and packaging to bear the FM label and shall meet FM 1-60 requirements.

2.03 INSULATION, COVERBOARD, AND SUBSTRATE BOARD

A. Polyisocyanurate Insulation – Flat Stock Materials: Provide closed cell polyisocyanurate foam core laminated to black (non-asphaltic) with fiber-reinforced felt faces. Manufactured in accordance with ASTM C 1289, Type II, Class 1, Grade 2 (20 p.s.i. compressive value).
   1. Product: ENRGY 3 by Johns Manville, or approved equal.

B. Tapered Polyisocyanurate Insulation and/or Cricketing Materials: Insulation materials shall meet the requirements of ASTM C 1289, Type II, Class 4, Grade 1 Compressive strength to be equal or greater than 109 psi.
   1. Product: Tapered ENRGY 3 by Johns Manville or approved equal.

C. High-Density Polyisocyanurate Cover Board Separation Layer – FR Rated: Provide 1/2-inch coverboard, high strength Polyisocyanurate Foam materials with coated Glass Facers. ASTM C 1289, Type II, Class 4, Grade 3, High-density Polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 140 lbs. of compressive strength. Cover board shall be “FR” rated.
   1. Product: ProtectoR HD by Johns Manville or approved equal.

D. Insulation shall be installed singularly, or in layers, depending on the location and overall thickness; refer to paragraph 3.04 – 3.05 of this section and the Architectural Roof Layout Plans Drawings for identification of assembly types. The insulation shall be mechanically attached to the roof deck substrates in accordance with the manufacturer's published specifications. Provide insulation in 4 foot by 4 foot sheets. Maximum thickness of an insulation layer shall not exceed 2 inches. Insulation for induction weld can be 4’ x 8’.

2.04 ADHESIVES AND CLEANERS

A. Membrane Bonding Adhesive: Compatible with roofing materials and recommended by roofing manufacturer.

B. Flashing Adhesive: Compatible with roofing materials and recommended by roofing manufacturer.
   Insulation Adhesive: Two-part urethane foam insulation adhesive for adhering insulation or coverboards to approved substrates, as recommended by roofing manufacturer.

2.05 FASTENERS AND PLATES

A. To be used for mechanical attachment of insulation where/when specified and to provide membrane securement to plywood / Solid Wood Decks. Screw type fasteners to be applied in a Factory Mutual approved pattern and method.

B. Provide fasteners as recommended by roofing manufacturer.

C. Attachment Plates: Rhinobond Plates and attachments or approved equal.

D. Kiln Dried Wood Nailer Materials: Provide minimum 2” x 4” Number 2 grade kiln dried and salt treated for rot and fire resistance lumber material. Wood nailer to be wolmanized, osmose treated and pressure treated. Wood nailers are required where roof slopes exceed 1/2:12. General Contractor to coordinate wood nailer installation, refer to Section 06 10 11 – Rough Carpentry and paragraph 3.02.D Wood Nailer Installation of this section for dimensioning between nailers relative to roof slope.

2.06 ACCESSORIES

A. Walkway Pad: Provide Walkway Traffic Pad protection at the service side of mechanical equipment, top and bottom of ladders, at the operable side of roof hatches and where identified on Architectural Roof Plan Drawing page(s). Walkway Pad shall be 30-inches wide by 60-feet long, and 0.80-inch (2mm) thick thermoplastic material.

B. Roofing Nails: Galvanized, hot dipped or non-ferrous type, size as required to suit application.

C. Sealants: As recommended by membrane manufacturer.

D. Pipe Support System: Provide OMG PipeGuard Support System, Model PGL-BK (2.5” to 5.0”) or approved equal. Pipe supports are to be installed wherever gas lines and/or electrical conduit lines traverse across the new roofing system or approved equal.

2.07 EDGE TERMINATIONS, COUNTERFLASHING, COPING AND SHEET METAL MATERIALS:

A. Furnish and install sheet metal counter flashing materials at equipment curbs, skylight curbs, interior wall conditions, reglets and other miscellaneous conditions where necessary to counter-flash and terminate membrane materials. All drip and rake edge materials shall include a continuous cleat to improve and prevent wind-uplift failure at roof edges.

B. Size and profile as indicated on drawings.

C. Profile and designs engineered for roof perimeter attachment. Components from the membrane manufacturer shall be approved for FM 1-90 rating and ANSI/SPRI/FM 4435 ES-1-2011 Wind Design Standard for Edge Systems.

D. Roof Edge and Perimeter: Low profile FM rated factory fabricated system as specified in section 07 62 00, Sheet Metal Flashing and Trim.

E. Clad Metal: Where through-wall overflow scupper conditions exist and where noted on Architectural Roof Detail page(s), provide Clad Metal scupper inserts for hot air weldable condition. Clad Metal materials shall match field membrane color and shall be fabricated to dimensions noted within the Architectural Plan pages. Refer to section 07 62 00, Sheet Metal Flashing and Trim.

F. For all Copings, Gravel Stops, Flashing and Counter flashings, and Reglets, and other flashings, see Section 07 62 00 – Sheet Metal Flashing and Trim.

2.08 FLASHING MEMBRANE

A. Reinforced Membrane: Material to match roof membrane in color and thickness for all curbs, walls and penetrations.

1. Product: JM PVC or approved equal.

B. Detail Flashing: multi angled intersections, sealant pockets and other conditions that would be impractical for reinforced membrane application.

2.09 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Liquid Applied Flashing: Manufacturer’s single ply liquid and fabric reinforced flashing system created with a fleece polyester scrim and a two-component polyurethane based liquid applied flashing material, consisting of a liquid resin and a curing agent.

1. Basis of design: JM SP Liquid Flashing Resin and JM SP Liquid Flashing Scrim

C. Liquid Applied Flashing Primer: Manufacturer’s single ply liquid flashing primer.

1. Basis of design: JM SP Liquid Flashing TPO and PVC Primer, JM SP Liquid Flashing Concrete Primer, or JM SP Liquid Flashing Metal and Wood Primer

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Section 01 31 00 – Project Management and Coordination.
B. General contractor to coordinate removal of existing roofing at existing roofs scheduled to receive new roofing.
C. Prepare deck surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Report conditions that are of concern prior to proceeding with roofing installation. Do not begin installation until substrates have been properly prepared.
D. Verify surfaces and site conditions are ready to receive work and confirm dry deck moisture content acceptable to roofing manufacturer. Clean surfaces thoroughly prior to installation.
E. Verify deck is supported and secured, clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, or eaves.
F. Verify deck surfaces are dry and free of snow or ice.
G. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, and vents through roof are solidly set, and wood nailing strips and reglets are in place.
H. At wood decks, verify that no dry rot or other conditions exist that would compromise the structural integrity of the deck.
I. Do not overload any portion of the building, by either use of or placement of equipment, storage of debris, or storage of materials. Protect building surfaces against damage from roofing work.
J. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.
K. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.

3.02 ROOFING SYSTEM APPLICATION - GENERAL

A. Install roof systems in accordance with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, job site considerations and weather restrictions.
B. The roofing system is to be mechanically attached.
C. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water where and when possible.
D. Wood Nailers:
    1. Locate and install along gravel stops and drip edges and other areas as required by membrane manufacturer.
    2. Anchor nailer to structural deck with manufacturers approved fasteners, spaced appropriately for the specified installation; minimum withdrawal resistance 100 pounds (45 kg) per fastener.
E. Insulation R-Value and Tapered Insulation and/or Cricket Materials are defined per Zone Areas on Architectural Roof Plan Pages A-221.
F. Damaged or Wet Materials: Examine existing insulation and/or cover board materials carefully for damage or wetness. Existing materials that are found to be damaged or wet shall be completely removed.

3.03 INSTALLATION

A. Insulation: Install insulation boards to the substrate with Fasteners and connection plates. Installation of the fastener pattern to be in accordance with FM Guidelines. Tapered Insulation and/or Cricket materials are required at all HVAC equipment curbs greater than 12 inches, between roof drains, wherever ponding water may occur, and at specified locations as

identified on the roof plan. Tapered insulation and cricket materials shall obtain a finished slope of 1/4:12 inches, unless otherwise noted on the roof plan page(s).

1. FM 1-90 approved fastener assemblies placed on a 2'x3' grid pattern.
2. Do not overdrive the fastener and plate. The fastener and plate should be tight and flat to the substrate with no dimpling of the surface.
3. Multiple layers of insulation board may be fastened simultaneously.
4. Insulation board size as recommended by manufacturer for mechanically attached application.
5. Do not install wet, damaged or warped insulation boards.
6. Install insulation boards with staggered board joints.
7. Insulation boards to be installed so that no gaps larger than ¼ inch (6 mm) are found at the end joints and that the adjoining top surfaces are flat and smooth. All gaps in excess of ¼ inch (6 mm) shall be filled with like insulation material.
8. If more than one layer of insulation board is to be installed the joints of the subsequent layers must be staggered. Stagger the joints in the additional layers a minimum of 6 inches (152 mm) from the underlying insulation boards to eliminate vertical gaps.
9. Do not install any more insulation than will be completely waterproofed each day.

B. Cover Board: Install 1/2-inch coverboard, high strength Polyisocyanurate Foam materials with coated Glass Facers. Cover board type shall be FR rated.

1. Recover boards to be installed so that no gaps larger than 1/4 inch (6 mm) are found at the end joints and that the adjoining top surfaces are flat and smooth.
2. Stagger the joints in the recover board a minimum of 6 inches (152 mmm) from the underlying insulation boards to eliminate vertical gaps.
3. Insulation and cover board materials shall be mechanically attached to the roof deck substrate using Insulation. Fasteners, PVC induction weld plates. Where membrane materials are mechanically attached, insulation materials shall be secured using a minimum fastening density as specified by the manufacturer.
4. Do not install any more cover board than will be completely waterproofed each day.

C. Membrane Installation: Induction Welding Installation:

1. Perform calibration and set-up as detailed by the Induction Welder Owner's Manual
2. Center the Induction Welder over the first plate in pattern and activate the weld.
   a. Induction Welder shall be centered over the plate to create a 100% bond.
   b. If an error occurs during activation, refer to the induction welder owner's manual for corrective action.
3. Prior to every use, clean face of Heat Sink Magnet.
4. Place Heat Sink Magnet over the welded plate.
   a. Keep Heat Sink Magnet in place at least 45 seconds while the assembly cools.
5. Repeat process for each plate.

D. Flashing: Flash penetrations, walls, curbs, expansion joints, drains as shown on details and approved shop drawings and in accordance with manufacturers requirements.

1. Use prefabricated sealant pockets and pre-molded vent / pipe flashing.
2. Mechanically fasten flashing at terminations according to approved details. Fastening flashing membrane through counter-flashing metal is not acceptable.
3. Flashing membranes shall be adhered to the approved substrate with Flashing Adhesive. Flashing Membrane is to be installed flat and wrinkle free. Flashings shall be rubbed or rolled onto the substrate for proper adhesion.
4. **Perimeter and Corner Enhancements:** At all exterior perimeter and corner locations, membrane requires additional fastening enhancements. Contractor

shall install no less than 2-each PVC perimeter sheets. When using 10-foot wide field sheets, perimeter sheet width may be 6-foot. When using 8-foot wide field sheets, perimeter sheet width shall be 5-foot. Perimeter sheets shall be installed in a picture-frame layout and shall use a fastening density of 12-inches on center at all areas.

3.04 **TYPE 1A – NEW PVC ROOF OVERLAY (Not in Scope)**

3.05 **TYPE 1B – NEW PVC ROOF ASSEMBLY (Roof Areas A.4)** Existing Built-up Roof System demolished to expose roof deck substrate and replaced with new Insulated Roof System:

A. **Roof Deck Substrate:** Plywood Roof Deck Substrate.

B. **Demolition:** Existing built-up roofing system, including insulation, cover board, substrate board materials are to be completely demolished down to the roof deck to expose substrate for seismic work prior to installation of new membrane roofing system. Existing wood crickets are to be demolished and new roof sheathing to be installed where noted on plans. Existing base flashing materials at all curb and wall conditions are to be removed and replaced with new. Existing sheet metal materials including coping metal at top of parapets, sheet metal counter flashings at all equipment curb conditions, and sheet metal drip and rake edge materials, shall be removed and replaced with new. Properly clean up and discard of existing materials and prepare substrates for new roof system installation.

C. **Insulation:** Install new flat stock Insulation, Tapered Insulation and/or Cricketing Materials. Insulation R-Value and Tapered Insulation and/or Cricket materials are defined by Zone Area as noted on Architectural Roof Plan Schedule, pages A-221. Install flat stock insulation tapered polyisocyanurate insulation and/or cricket materials, directly over the previously installed insulation materials. Cricket materials are required at all HVAC equipment curbs, skylight curbs, between roof drains, wherever ponding water may occur, and at specified locations as identified on the roof plan. Refer to Drawings for taper slopes, to be installed at a minimum of 1/4":12" unless otherwise noted on the Architectural Roof Plan Schedule where existing slopes of 1/8:12 are to remain.

1. For full demolition roofs (areas A.4) install a minimum insulation R value of R-30.
2. For roof areas above unconditioned spaces and at exterior walkway canopies no minimum insulation is required. Tapered insulation required to improve slopes of 0"/12" to create a minimum slope of 1/4" / 12".
3. For roof areas indicating both partial and full tear off, install flat stock insulation to match height of adjacent partial tear off condition with boards butted tightly together with no joints or gaps greater than ¼ inch. Additional demolition required to properly stagger joints a minimum of 6-inches both horizontally and vertically where multiple layers are required and at seams between partial tear off and full tear off roofs to eliminate all vertical gaps.

D. **Coverboard:** Install 1/2 inch High-Density Polyisocyanurate Coverboard per manufacturer's requirements.

E. **Membrane**: Install 80-mil Membrane using Induction weld installation method. Mechanically attach PVC membrane materials to the wood roof deck substrate using manufactured approved fasteners for substrate conditions.

3.06 TYPE 1C NEW PVC OVERLAY (Roof Areas A.5, A.6, A.7) Existing Built-up Roof System demolished to expose roof deck substrate and replaced with new Roof Membrane & Tapered Insulation:

A. **Roof Deck Substrate:** Plywood Roof Deck Substrate.

B. Demolition: Existing Built-Up Roofing Membrane to be demolished and existing roof assembly containing 1/4" coverboard, 1/2" rigid fiberglass insulation and 1 ½" a rigid polyisocyanurate insulation.

C. **Insulation:** Install new tapered Insulation and/or Cricketing Materials. Insulation R-Value and Tapered Insulation and/or Cricket materials are defined by Zone Area as noted on Architectural Roof Plan Schedule, pages A-221. Cricket materials are required at specified locations as identified on the roof plan. Refer to Drawings for taper slopes, to be installed at a minimum of 1/4":12" unless otherwise noted on the Architectural Roof Plan Schedule where existing slopes of 1/8:12 are to remain.
   1. For roof areas above unconditioned spaces and at exterior walkway canopies no minimum insulation is required. Tapered insulation required to improve slopes of 0"/12" to create a minimum slope of 1/4" / 12".

D. **Coverboard:** Install 1/2 inch High-Density Polyisocyanurate Coverboard per manufacturer's requirements.

E. **Membrane**: Install 80-mil Membrane using Induction weld installation method. Mechanically attach PVC membrane materials to the wood roof deck substrate using manufactured approved fasteners for substrate conditions.

3.07 ADDITIONAL REQUIREMENTS

A. **Flashing membrane:** Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced membrane per manufacturer's requirements. Non-reinforced membrane shall be used for flashing pipe penetrations, sealant pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded accessories is not feasible. Installation of flashing membrane to follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

B. **Perimeter and Corner Enhancement Requirements and Dimensions:** Enhance attachment of all exterior roof perimeter and corner insulation and cover board materials according to roofing manufacturer's requirements.

3.08 WALKWAYS

A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc), under all downspout splash blocks and all other locations as identified on the specifier's drawing.

B. Hot air weld walkway pads to the membrane in accordance with the manufacturer's specifications.

C. Apply single ply liquid applied flashing system per manufacture's written instructions.

3.09 SHEET METAL COUNTER FLASHING MATERIALS

A. Install new Sheet Metal Coping materials where identified on the architectural roof plan and/or where agreed to by contract. Install new Drip Metal, Reglet Counter-Flashings, and Equipment Curb Sheet Metal Counter-Flashings where necessary to complete the project.

B. New materials shall satisfy architectural requirements as defined under Sheet Metal Flashing and Trim section 07 62 00, roofing manufacturer requirements, and as defined within the roofing details and roof plan pages.

3.10 PIPE SUPPORT SYSTEMS

A. Install new Pipe Guard Support System, 2.5" to 5.0" wherever gas lines and/or electrical conduit lines traverse across the roofing system or approved equal.

B. Pipe supports shall be installed at all roof areas where required and as identified on the architectural plan page(s).

3.11 DAILY SEAL

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.12 TEMPORARY ROOF TIE-OFFS

A. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
C. Remove and discard temporary seals before beginning work on adjoining roofing.

3.13 CLEANING

A. Section 01 73 00 – Execution and Close-Out: Final cleaning.
B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
C. Repair or replace defaced or disfigured finishes caused by work of this section.
D. Perform daily clean up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
E. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

3.14 INSPECTION

A. Seam Inspection:
    1. All seams are to be completed by the hot air welding method each day as the installation progresses.
    2. The roofing contractor is to designate a responsible person experienced in hot air welding techniques to inspect the completed installation each day as the installation progresses. The inspection is to include hand probing of al weld seams.
    3. Any defects found during these inspections should be immediately corrected.
B. Manufacturer’s Field Services:
    1. Provide manufacturer’s field service consisting of product use recommendations and periodic site visits for inspection of system installation in accordance with manufacturer’s instructions.
    2. Site Visits: Final inspection and acceptance of the installation by the manufacturers technical representative is required before a warranty can be issued.

3.15 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 – Execution and Close-Out: Protecting installed construction.
B. Where traffic must continue over finished roof membrane, protect surfaces.
C. Protect installed products until completion of project.
D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

07 56 30

FLUID APPLIED ROOFING RESTORATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes Fluid Applied Roofing Restoration for existing TPO membrane roofs and Built-up roof systems. For a “Roof Restoration System Type” description of Type 3A, 3B, and 4 Roofs, refer to paragraph 3.04 – 3.06 of this section. For “Roof System Type” description of Type 1A, 1B, and 1C Roofs, see Part 3 of Section 07 54 19 - Fluid Polyvinyl-chloride (PVC) Roofing.

B. Related Sections:
   1. Section 01 11 00 - Summary of Work
   2. Section 07 62 00 - Sheet Metal Flashing and Trim
   3. Section 07 71 23 – Gutters and Downspouts
   4. Section 07 90 00 – Joint Protection
   5. Section 22 40 00 - Plumbing Fixtures

1.2 REFERENCE STANDARDS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated:

B. ASTM International (ASTM)
   1. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete.
   2. ASTM C 92 - Standard Test Methods for Sieve Analysis and Water Content of Refractory Materials.
   3. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
   4. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
   5. ASTM C 1250 - Standard Test Method for Nonvolatile Content of Cold Liquid-Applied Elastomeric Waterproofing Membranes.
   6. ASTM D 5 - Standard Test Method for Penetration of Bituminous Materials.
   7. ASTM D 36 - Standard Test Method for Softening Point of Bitumen.
   8. ASTM D 43 - Standard Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing.
   9. ASTM D 71 - Standard Test Method for Relative Density of Solid Pitch and Asphalt.
   10. ASTM D 75 - Standard Practice for Sampling Aggregates.
   11. ASTM D 92 - Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester.
   12. ASTM D 93 - Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester.
   13. ASTM D 113 - Standard Test Method for Ductility of Bituminous Materials.
   14. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
   15. ASTM D 562 - Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer-Type Viscometer.
   16. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
   17. ASTM D 816 - Standard Test Methods for Rubber Cements.
   18. ASTM D 1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
   19. ASTM D 1370 - Standard Test Method for Contact Compatibility Between Asphaltic Materials (Oliensis Test).
   20. ASTM D 1475 - Standard Test Method For Density of Liquid Coatings, Inks, and Related Products.
   21. ASTM D 1863 - Standard Specification for Mineral Aggregate Used on Built-Up Roofs.

22. ASTM D 1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test).
23. ASTM D 2042 - Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene.
24. ASTM D 2196 - Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer.
25. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.
26. ASTM D 2369 - Standard Test Method for Volatile Content of Coatings.
27. ASTM D 2939 - Standard Test Methods for Emulsified Bitumens Used as Protective Coatings.
28. ASTM D 3111 - Standard Test Method for Flexibility Determination of Hot-Melt Adhesives by Mandrel Bend Test Method.
29. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
30. ASTM D 4209 - Standard Practice for Determining Volatile and Nonvolatile Content of Cellulosics, Emulsions, Resin Solutions, Shellac, and Varnishes.
31. ASTM D 4212 - Standard Test Method for Viscosity by Dip-Type Viscosity Cups.
32. ASTM D 4402 - Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer.
33. ASTM D 4479 - Standard Specification for Asphalt Roof Coatings - Asbestos-Free.
34. ASTM D 5040 - Standard Test Methods for Ash Content of Adhesives.
35. ASTM D 5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
36. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

C. National Roofing Contractors Association (NRCA) –
   1. Roofing and Waterproofing Manual.

1.3 EXTENT OF WORK

A. The project consists of the fluid applied restoration of existing Built-up roof and TPO membrane roof systems.
   1. Built-Up Roof Surface Restoration Work includes:
      a. Demolition of existing gravel ballast.
      b. Demolition of existing base flashing materials at all curb and wall conditions; coping metal, sheet metal counter flashing and sheet metal drip and rake edge materials.
      c. Repair blistered, stressed or cracked membrane. Cut back and patch with new HPR Torch Applied base and cap membrane sheets. At specified locations, work includes a full removal of the existing roofing system to expose the roof deck substrate. New built-up roof system to be installed per manufacturer requirements.
      d. Topcoat entire roof surface and resurface entire roof with new gravel while wet.
   2. Single Ply TPO Membrane Roof Restoration Work includes:
      a. Surface preparation removal of membrane chalking, dust, dirt, and debris.
      b. Sheet metal inspection/repair and repairs to membrane.
         1) Parapets and Vertical Surfaces: Inspect and make repairs to any splits or membrane deterioration.
         2) Metal Flashings: Damaged fascia edges, gutters, copings and all related sheet metal materials to be repaired / replaced.
         3) Roof Repairs: Repair blisters, stressed or cracked membrane. Cut back, patch with new membrane

1.4 **SUBMITTALS**

A. See Specification Section 01 33 00 - Submittal Procedures.
B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit shop drawings including installation details of roofing, flashing, fastening, insulation and vapor barrier, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.
D. Verification Samples: For each product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, and color.
E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
F. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.5 QUALITY ASSURANCE

A. The roofing contractor shall confirm all given information and advise the building owner/architect, prior to bid, of any conflicts that will affect their cost proposal.
B. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.
C. Manufacturer Qualifications: Manufacturer: Company specializing in manufacturing products specified in this section with documented ISO 9001 certification and minimum twelve years of experience.
D. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.
E. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.
F. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.
G. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.
Weather: Proceed with the fluid applied restoration only when existing and forecasted weather conditions permit. Ambient Temperatures shall be above 45 degrees F when applying hot steep asphalt, water-based adhesives of urethane adhesives. 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.

1.6 QUALIFICATIONS

A. Applicator to be a company specializing in performing Work of this section with minimum ten (10) years documented experience. The roofing restoration system must be installed by an applicator authorized in the application of restorative coatings and shall be trained and certified by the manufacturer of the restoration product. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two weeks before scheduled commencement of roofing system installation and associated work.

B. Require attendance of installers of deck or substrate construction to receive roofing, installers of rooftop units and other work in and around roofing which must precede or follow roofing work including mechanical work, Architect, Owner, roofing system manufacturer's representative.
C. Objectives include:
   1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
   2. Tour representative areas of roofing substrates, inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work.
   3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
   4. Review roofing system requirements, Drawings, Specifications and other Contract Documents.
   5. Review and finalize schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
   6. Review required inspection, testing, certifying procedures.
   7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
   8. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.
B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.
C. Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface. No wet or damaged materials will be used in the application.
D. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.
E. Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/Engineer.
F. Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
B. Weather Condition Limitations: Do not apply roofing system during inclement weather or when a 40 percent chance of precipitation or greater is expected.
C. Proceed with roofing work only when existing and forecasted weather conditions will permit unit of work to be installed in accordance with manufacturer's recommendations and warranty requirements.
D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.
E. When applying materials with spray equipment, take precautions to prevent over spray and/or solvents from damaging or defacing surrounding walls, building surfaces, vehicles or other property. Care should be taken to do the following:
   1. Close air intakes into the building.

2. Have a dry chemical fire extinguisher available at the jobsite.
3. Post and enforce "No Smoking" signs.

F. Avoid inhaling spray mist; take precautions to ensure adequate ventilation.
G. Protect completed roof sections from foot traffic for a period of at least 48 hours at 75 degrees F (24 degrees C) and 50 percent relative humidity or until fully cured.
H. Take precautions to ensure that materials do not freeze.
I. Minimum temperature for application is 40 degrees F (4 degrees C) and rising for solvent based materials and 50 degrees F (10 degrees C) and rising for water based.

1.10 WARRANTY

A. Upon completion of the work, provide the Manufacturer's written and signed Limited Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due to defective material, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the materials necessary to return the defective area to a watertight condition.
   1. Warranty Period: 10 years from date of acceptance.
B. Upon completion of the work, provide the Manufacturer's written and signed limited labor and materials Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition.
   1. Warranty Period: 15 years from date of acceptance after required inspection by Garland
C. Installer is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work.
   1. Warranty Period:2 years from date of acceptance.

PART 2 PRODUCTS

2.1 GENERAL

A. Manufacturers:
   1. Basis of Design: Johns Manville; a Berkshire Hathaway
   2. Contractor must verify that listed manufacturers, other than Basis of Design, can provide equivalent products.
   3. Substitutions: Section 01 25 00 – Substitution Procedures

B. All products (including roof membrane, insulation, temporary roof membrane, fasteners, fastening plates, adhesives, coatings, and prefabricated edge metal components) must be manufactured and/or supplied by the roofing system manufacturer and covered by the warranty.

2.2 ROOF RESTORATION SYSTEM FOR BUILT-UP SURFACE ROOFS

A. Membrane: SBS Ply Sheets (for repair of existing roof system).
   1. HPR Torch Base SBS Torch Applied Base Sheet.
   2. StressPly IV Mineral SBS Torch Applied Cap Sheet or approved equal.
B. Primer: Per manufacturer recommendation.
C. Restoration Coating: Heavy-bodied, rubberized, fiber reinforced, fire-rated restoration treatment. Product: “Weatherscreen” or approved equal.
   a. Viscosity @ 77 degrees F (25 degrees C) Stormer, Special Blade: 20-25 sec.
   b. Density @ 77 degrees F (25 degrees C) 9.1 lbs./gal. (1.10 g/cm3
   c. Non-Volatile, ASTM D 4479: Typical 75%
   d. Asphalt Content, ASTM D 4479: 63% (by weight)
   e. Flash Point, ASTM D 93: 105 degrees F (41 degrees C)
   f. Uniformity, ASTM D 4479: Pass

g. Wet Film Thickness
   1) New Flood Coat @ 4-5 gal. (15-19 l): 64-80 mils (1,625.6 - 2,032 microns)
   2) Restoration @ 6-8 gal. (22.7-30.3 l): 96 - 128 mils (2,438.4 - 3,251.2 microns)
h. VOC: 250 g/l

D. Surfacing: Pea gravel, ASTM D 1863

2.3 ROOF RESTORATION SYSTEM FOR SINGLE-PLY TPO MEMBRANE ROOFS

A. Flashing Membrane: Repair or replace as needed.
B. Primer: None.
C. Reinforcement and Finish Coating:
   1. Product: White-Knight Plus/ White-Stallion Plus or White-Knight Plus WC Highly reflective multi- purpose, single-component aliphatic urethane, liquid waterproofing membrane or approved equal.
D. Surfacing: None.

2.4 ACCESSORIES

A. Urethane Sealant:
   1. One part, non-sag sealant. Product: “Tuff Stuff” or approved equal.

2.5 EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

A. Flashing boot: Neoprene pipe boot for sealing single or multiple pipe penetrations adhered in approved adhesives as recommended and furnished by the membrane manufacturer.
B. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.
C. Liquid Flashing: An asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings.
   1. Tensile Strength, ASTM D 412: 400 psi
   2. Elongation, ASTM D 412: 300%
   3. Density @77 degrees F 8.5 lb/gal typical
D. Fabricated Flashings: Fabricated flashings and trim are specified in Section 07 62 00, Sheet Metal Flashing and Trim.
   1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual".
E. Manufactured Roof Specialties: Manufactured copings, fascia, gravel stops, and related flashings and trim are specified in Section 07 62 00, Sheet Metal Flashing and Trim.
   1. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

A. See Specification Section 01 31 00 – Project Management and Coordination.
B. Do not begin installation until substrates have been properly prepared.
C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 GENERAL ROOFING PREPARATION AND REPAIR FOR FULID APPLIED RESTORATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
B. Clean the entire roof surface by removing all dirt, algae, paint, oil, talc, rust or foreign substance. Use a 10 percent solution of TSP (tri-sodium phosphate), Simple Green and warm water. Scrub heavily soiled areas with a brush. Rinse with fresh water to remove all TSP solution. Allow roof to dry thoroughly before continuing.
C. Clean and seal all parapet walls, gutters and coping caps, and repair any damaged metal where necessary. Seal watertight all fasteners, pipes, drains, vents, joints and penetrations where water could enter the building envelope.
D. Remove all wet, deteriorated, blistered or delaminated roofing membrane or insulation and fill in any low spots occurring as a result of removal work to create a smooth, even surface for application of new roof membranes.
E. Repair existing roof membrane as necessary to provide a sound substrate for the liquid membrane. All surface defects (cracks, blisters, tears) must be repaired with similar materials. Repair all defects such as deteriorated roof decks and damaged wood nailers; replace saturated insulation board, replace loose or brittle membrane or membrane flashings.
    1. Existing membrane is either fully adhered or that the membranes mechanical fasteners are secured and functional.
    2. Application of roofing materials over a brittle roof membrane is not recommended.
F. Pre-Treatment of Known Growth - General Surfaces: Once areas of moss, mold, algae and other fungal growths or vegetation have been removed and surfaces have also been thoroughly cleaned, apply a biocide wash at a maximum spread rate of 0.2 gallons/square (0.08 liters/m), to guard against subsequent infection. Allow to dry onto absorbent surfaces before continuing with the application. On non-absorbent surfaces, allow to react before thoroughly rinsing to remove all traces of the solution.
G. When mechanically attached, the fastening pattern for the insulation/recovery board shall be as recommended by the specific product manufacturer.
H. Re-roofing over coal tar pitch requires a mechanically attached recovery board or insulation and a base sheet prior to the application of roofing system.

3.3 GENERAL FLUID APPLIED RESTORATION INSTALLATION

A. Install in accordance with manufacturer's instructions. Apply to minimum coating thickness required by the manufacturer.
    1. Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.
    2. Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.
    3. Protect work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore work damaged by installation of the roofing system.
    4. Keep roofing materials dry during application. Phased construction can be allowed as long as no, more than 7 days pass between coats excluding primers.
    5. Coordinate counter flashing, cap flashings, expansion joints and similar work with work specified in other Sections under Related Work.
    6. Coordinate roof accessories and miscellaneous sheet metal accessory items, including piping vents and other devices with work specified in other Sections under Related Work.

3.4 **TYPE 2A – EXISTING BUILT-UP ROOF RECOAT (Not Used)**

3.5 **TYPE 2B – NEW BUILT-UP ROOF ASSEMBLY (Not Used)**

3.6 **TYPE 3 – EXISTING TPO ROOF RECOAT (Not Used)**

3.7 SHEET METAL COUNTER FLASHING MATERIALS

A. Install new Sheet Metal Coping materials where identified on the architectural roof plan and/or where agreed to by contract. Install new Drip & Rake Edge Metal, Reglet Counter-Flashings, and Equipment Curb Sheet Metal Counter-Flashings where necessary to complete the project. New materials shall satisfy architectural requirements as defined under Sheet Metal Flashing and Trim section 07 62 00, roofing manufacturer requirements, and as defined within the roofing details and roof plan pages.

B. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the Copper Development Association "Copper in Architecture - Handbook" as applicable.

C. Installation of Sheet Metal Coping for Built-Up Roof Membrane:
   1. Inspect the nailers to assure proper attachment and configuration.
   2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
   3. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
   4. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailers every 3 inches (76 mm) o.c. staggered.
   5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.
   6. Strip in flange with base flashing ply covering entire flange in bitumen with 6 inches (152 mm) on to the field of roof. Assure ply laps do not coincide with metal laps.
   7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Seal outside edge with rubberized cement.

3.8 WALKWAYS

A. Install walkways at all traffic concentration points (such as roof hatches, access doors, rooftop ladders, etc), under all downspout splash blocks and all other locations as identified on the specifier's drawing.

B. Hot air weld walkway pads to the membrane in accordance with the manufacturer's specifications.

3.9 CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.

B. Remove asphalt markings from finished surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.10 PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.

B. Protect exposed surfaces of finished walls with tarps to prevent damage.

C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.

D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.

E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.11 FIELD QUALITY CONTROL

A. Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system.
B. Perform field inspection and [and testing] as required under provisions of Section 01 41 0.
C. Correct defects or irregularities discovered during field inspection.

3.12 FINAL INSPECTION

A. At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, roofing system manufacturer's representative and others directly concerned with performance of roofing system.
B. Walk roof surface areas, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. Identify all items requiring correction or completion and furnish copy of list to each party in attendance.
C. If core cuts verify the presence of damp or wet materials, the installer shall be required to replace the damaged areas at his own expense.
D. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation that is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
E. Architect upon completion of corrections.
F. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

3.13 PROTECTION

A. Section 01 73 00 – Execution and Close-Out Requirements: Protecting installed construction.
B. Where traffic must continue over finished roof membrane, protect surfaces.
C. Protect installed products until completion of project.
D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07 56 30

07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Copings, gravel stops, flashings and counter flashings, reglets and accessories, through-wall scuppers, and other fabricated sheet metal items indicated for installation as part of roofing scope.
2. Flashing for metal framed glass skylights and fiberglass panel skylights.
3. Miscellaneous flashings and trim as indicated on Drawings.
4. Repair and repainting of existing metal flashings to be reused.

B. Related Sections:

1. Section 07 54 19 – Polyvinyl-Chloride (PVC) roofing.
2. Section 07 71 23 – Gutters and Downspouts: Modified leaderhead & downspouts.
3. Section 07 90 00 - Joint Protection: Sealants.
4. Section 09 96 00 - High-Performance Coatings: Field painting.
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment: Flashing requirements for mechanical equipment.
6. Section 26 05 29 - Hangers and Supports for Electrical Systems: Roof conduit supports and fasteners for electrical equipment.

1.02 REFERENCES

A. American Architectural Manufacturers Association:

1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
3. AAMA 2604 - Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:

1. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A625/A625M - Standard Specification for Tin Mill Products, Black Plate, Single Reduced.
3. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
7. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
8. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
9. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
10. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

C. Federal Specification Unit:
    1. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
D. Sheet Metal and Air Conditioning Contractors:
    1. SMACNA - Architectural Sheet Metal Manual.
E. National Roofing Contractors Association:
    1. NRCA – Waterproofing manual

1.03 DESIGN REQUIREMENTS

A. Sheet metal flashing and trim assemblies 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. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
B. Conform to SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 100 years.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Shop Drawings: Indicate dimensions, material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.
D. Samples: Submit color charts showing the manufacturer's full range of colors available for selection.
E. Samples: Submit two samples, 6x6 inch in size illustrating metal finish color and texture.

1.05 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup. Coordinate mockups with related Section 06 10 00 – Rough Carpentry for installation of curb and scupper flashing.
B. Mockups:
    1. Construct one mockup of parapet coping. Mockup to be 5' wide.
    2. Construct one mockup of scupper to roof drain. Coordinate mockup with work of Section 07 45 00 – Polyvinyl-Chloride (PVC) roofing.
C. Evaluation:
    1. Determine preparation, sealing, and finishing requirements; take action necessary for correction of mock-up.
    2. Verify sheet metal flashing transitions over bracing elements do not allow water penetration or compromise adjacent materials.
    3. Verify sealants, primers, and other components are compatible with adjacent materials.
D. Locate where directed by Architect.
E. Incorporate accepted mockup as part of Work.

1.06 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA "Architectural Sheet Metal Manual" and NRCA "The NRCA Roofing Manual". Conform to dimensions and profiles shown unless more stringent requirements are indicated.
B. Fabricator and Installer: Company specializing in sheet metal work with minimum five years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
C. Prevent contact with materials causing discoloration or staining.

1.09 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

1.10 WARRANTY

A. Section 01 73 00 – Execution and Closeout Requirements: Product warranties and product bonds.
B. Furnish two (2) year installer's weather tight guarantee against leakage of sheet metal copings, roof related flashings and sealants.
C. Provide 20-year warranty on finish covering color fade, chalk, and film integrity of the prefinished galvanized steel sheet metal to include, but not limited to the following;
    1. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
    2. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
    3. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 - PRODUCTS

2.01 SHEET METAL FLASHING AND TRIM

A. Exposed Locations:
    1. Pre-Finished Galvanized Steel Sheet Metal: ASTM A755/A755M; structural steel sheet, G90 zinc coating, gauge as scheduled in paragraph 3.05 or as required for application.
        a. Finish to be factory applied Kynar 500 fluorocarbon coating or equal containing two coat fluoropolymer, finish not less than 70% PVDF resin by weight in color-coat; color as selected by Architect from manufacturer's full range.
        b. Finish to have minimum thickness of 0.70-mil over 0.25-mil prime coat.
B. Concealed Locations:
    1. Galvanized Steel Sheet Metal: ASTM A653/A653M; structural steel sheet, G90 zinc coating; hot-dipped galvanized with baked enamel, 24-gauge galvanized steel.
    2. Coated Galvanized Steel Sheet Metal: C90 zinc coating, 0.030 membrane thickness, color to match field membrane, gauge as scheduled in paragraph 3.05 or as required for application.
        a. JM PVC coated metal or approved equal.
C. Lead: ASTM B749, 99% pure lead.
D. Stainless Steel: ASTM A240/240M; Type 304, dead soft fully annealed, 26 gauge dead soft flashing grade stainless steel.
E. Clad Metal Flashing: PVC-coated galvanized steel compatible with PVC roofing system for hot air weldable condition. Provide at through-wall scuppers and where noted on drawings. Clad Metal materials shall match roofing field membrane color; reference section 07 54 19, Polyvinyl-Chloride (PVC) Roofing, for additional information.
F. Joints in wall and cap flashing, standing seam only.
G. Refer to section 07 54 19, Polyvinyl Chloride (PVC) Roofing, and section 07 56 30, Fluid Applied Roofing Restoration, for additional material and fabrication requirements.
H. Provide pre-manufactured flashing components where required by roof manufacturer and where indicated on drawings.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal; with soft neoprene washers.
    1. Use concealed fasteners wherever possible, hot-dipped galvanized nails, or cadmium plated screws.

2. For exposed fasteners use neoprene gasketed screws.
3. Drive pins or similar hammer / expanding fasteners are prohibited.

B. Underlayment:
1. Sheet Metal Underlayment: Minimum 40-mil, self-adhering, high temp butyl rubber flexible membrane flashing. Product: Blueskin PE 200 manufactured by Henry Company or approved equal.
2. Manufacturers:
a. Henry Company.
b. WR Grace and Company.
c. Carlisle Coatings and Waterproofing, Inc.
d. Substitutions: Section 01 25 00 - Substitution Procedures.

C. S Lock: Same material and finish as flashing metal.
D. Primer: Zinc molybdate type.
E. Protective Backing Paint: Zinc molybdate alkyd.
F. Flashing Tape: Butyl type.
G. Sealant: As recommended and approved by sealant and sheet metal Manufacturer's standard type, suitable for use with installation of system. Product: Dow Corning 795 as basis of design, or approved equal; color as selected, as specified in Section 07 90 00.
H. Flashing Cement: ASTM D4586, Type I.
I. Reglets:
1. Recessed Type: Galvanized steel, 26 gage or as scheduled in paragraph 3.05.
a. Product: Springlok ‘CO’ Concrete Reglet Flashing manufactured by Fry Reglet or approved equal.
2. Surface-Mounted Type: Galvanized steel, 24 gage or as scheduled in paragraph 3.05, back face and ends covered with butyl flashing tape.
a. Product: Springlok ‘SM’ Surface Mounted Reglet Flashing manufactured by Fry Reglet or approved equal.
J. Solder: ASTM B32; type suitable for application and material being soldered.

2.03 FABRICATION

A. Form section shapes indicated on Drawings, accurate in size, square, and free from distortion or defects.
B. Fabricate copings and gravel stops from extruded, pre-finished galvanized steel, shaped as indicated on Drawings. Include matching cover plates to conceal and weather-seal joints and attachment flanges.
1. Caps to extend a minimum of 3” over edge, with felts tucked underneath or single-ply to extend over the top of curb or parapet wall.
C. Fabricate through wall scuppers to accommodate project conditions during roofing installation.
1. Include matching cover plates to conceal and weather-seal joints and attachment flanges.
2. Stainless steel, shaped in conformance to SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 100 years.
3. Fabricate scupper with a 2” minimum top mounting flange, 4” minimum side flanges and a bottom flange extending a minimum of 4 inches out onto roof surfaces.
D. Fabricate cleats of same material as sheet metal, interlocking with sheet.
E. Form pieces in longest possible lengths.
F. Hem exposed edges on underside 1/2 inch; miter and seam corners.
G. Provide drip flashing at head flashing, base flashing, parapets, roof trim, etc.
H. Seams:
1. Form material with flat lock seams, except where otherwise indicated.
2. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

3. At horizontal joints, including copings, use standing seams.

I. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

J. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

K. Fabricate vertical faces for copings and gravel stops to extend 4” below horizontal edge, unless noted otherwise in Drawings.

L. Seal metal joints.

2.04 FACTORY FINISHING

A. Fluoropolymer Coating: Multiple coat as specified for sheet metal system, thermally cured, conforming to AAMA 2605.

1. Product: Kynar 500 manufactured by Arkema or approved equal. Custom Color to match existing to be selected by Architect.
2. Manufacturers:
   a. Arkema.
   b. Solvay Solexis.
   c. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Washcoat: Finish concealed side of metal sheets with washcoat compatible with finish system, as recommended by finish system manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination

B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.

C. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

D. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, manufacturer’s installation instructions. Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Perform Work in accordance with SMACNA “Architectural Sheet Metal Manual” and NRCA “The NRCA Roofing Manual” including details listed below:

1. Figure 1-26 – Scupper Design and Installation
2. Figure 1-29 – Scupper Design and Installation
3. Figure 1-30 – Scupper Overflow Types – Design and Installation.
4. Figure 2-1 – Formed Gravel-Stop-Fascia – Design Data.
5. Figure 3-1 – Formed Metal Copings – Design Data.
6. Figure 3-6 – Formed Metal Copings – With Flashing.
7. Figure 4-4 – Counter Flashing System.
8. Figure 4-5 – Counter Flashing Systems – Installation.

C. Installation of reglets

1. Following installation of roofing, insert flashings into reglets to form tight fit in accordance with manufacturer’s product data. Overlap adjacent lengths 6” minimum, to

allow for expansion and contraction. Secure in place with plastic wedges. Pack remaining spaces with lead wool.

2. Concealed reglets at existing concrete: Sawcut joint to receive reglet to a depth of approximately 1/4" greater than the depth of the horizontal back leg of reglet.
   a. Insert reglet into sawcut and wedge in place using lead wedges installed at 2'-0" o.c., maximum. Hammer wedges to a depth which will not interfere with sealant or backer rod.
3. Install exterior sealant in accordance with Sealants and Caulking section, to form fillet bead minimizing holding of water.
4. Install with top of reglet minimum 8" above finished surface of adjacent roof (including tapered insulation height) unless indicated otherwise.
5. Install reglets with 1" factory formed end lap and counter flashing with 3" end lap.

D. Installation of lead flashing
1. Extend lead flashing a minimum of 2'-0" from the centerline of the drain, set in flashing cement.
2. Insulated roofs provide at least 3'-0" square depression at drain, formed with tapered insulation board. Taper insulation and crickets towards drains to prevent ponding.

E. Coordination: Coordinate installation of components of this section with installation of roofing membrane and base flashings Section 07 54 19 Polyvinyl-Chloride (PVC) Roofing.
1. Coordinate installation of sealants and roofing cement with Work of this section to ensure water tightness, apply plastic cement compound between metal flashing and felt flashings.
2. Coordinate installation of face plate flashing flanges into reglets.
3. Coordinate through wall scupper installation with leaderheads and downspouts in Section 07 71 23 Manufactured Gutters and Downspouts.

F. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles. Provide factory-fabricated corners at changes in direction.

G. Fastenings must not exceed 8 inches on center, field paint exposed fasteners and similar components use to fasten steel sheet metal with a touch up paint which matches the color of prefinished sheet metal materials.

H. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Inspection services.

B. Section 01 73 00 – Execution and Closeout Requirements: Testing, adjusting, and balancing.

C. Inspection will involve surveillance of Work during installation to ascertain compliance with specified requirements.

3.05 SCHEDULE

A. Galvanized Steel:
1. Coping: 24 gauge.
2. Gravel stops: 24 gauge.
3. Concrete reglet: 26 gauge.
4. Parapet flashing: 24 gauge.
5. Counterflashings at Roofing Terminations (over roofing base flashings): 22 gauge.
6. Counterflashings at Curb-Mounted Roof Items: 22 gauge.
7. Miscellaneous flashings and trim: 24 gauge.
8. Term-bar retainer: 20 gauge.

B. Stainless Steel:
1. Through-wall scuppers: 24 gauge.

C. Lead:
1. Roof drain flashing: 4-pound thickness.

END OF SECTION

07 71 23
GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Modifying existing galvanized steel leader heads.
   2. Reinstalling salvaged gutters, downspouts and leaderheads.
   3. Pre-cast concrete splash pads.
   4. Hangers, anchors and supports for salvaged gutters, downspouts and leaderheads.

B. Related Sections:
   1. Section 07 54 19 - Polyvinyl-Chloride (PVC) roofing.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim.
   3. Section 07 90 00 - Joint Protection.
   4. Section 09 96 00 - High-Performance Coatings: Field painting of metal surfaces.
   5. Division 33 - Utilities: Coordinate with these construction trades for downspout size and connection to storm sewer system.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM B32 - Standard Specification for Solder Metal.

B. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Architectural Sheet Metal Manual

1.03 DESIGN REQUIREMENTS

A. Conform to SMACNA Manual for sizing components for rainfall intensity determined by storm occurrence of 1 in 100 years.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

C. Product Data: Submit data on all manufactured components, materials, and finishes.

D. Product Data: Submit data on Anchors and Supports for all reinstalled salvaged materials.

E. Samples: Submit color charts showing the manufacturer’s full range of colors available for selection.

F. Samples: Submit two samples, three inches long, illustrating component design, finish, color and configuration.

1.05 MOCKUP

A. Section 01 40 00 – Quality Requirements: Requirements for mockup.

B. Coordination: Coordinate mockups with related Section 07 45 19 – Polyvinyl Chloride (PVC) roofing and Section 07 62 00 – Sheet metal flashing and trim for scupper requirements.

C. Mockups:
   1. Construct one mockup of a leaderhead and downspout at a through wall scupper.

D. Evaluation:
   1. Determine preparation, sealing, and finishing requirements; take action necessary for correction of mock-up.
   2. Verify sheet metal flashing transitions over bracing elements do not allow water penetration or compromise adjacent materials.

3. Verify sealants, primers, and other components are compatible with adjacent materials.

E. Locate where directed by Architect.

F. Incorporate accepted mockup as part of Work.

1.06 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA “Architectural Sheet Metal Manual” and NRCA “The NRCA Roofing Manual”. Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.

1.09 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination

B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.

1. Coordinate Work with downspout discharge pipe inlet.

1.10 WARRANTY

A. Section 01 73 00 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for downspout finishes.

PART 2 - PRODUCTS

2.01 COMPONENTS

A. Splash Pads: Precast concrete type, size and profiles indicated in Drawings; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

2.02 ACCESSORIES

A. Downspout Supports:

1. Brackets, painted to match approved downspout color for new downspouts.

2. For salvaged downspouts, paint to match existing color.

B. Fasteners: Same material and finish as gutters and downspouts, with soft neoprene washers; paint to match approved and existing downspout color.

C. Primer: Zinc molybdate Galvanized iron type.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Sealant: Silicone type, as specified in Section 07 90 00 - Joint Protection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Verify surfaces are clean, dry, straight, secure, of proper dimensions and ready to receive gutters, downspouts and leader heads. Notify Architect of conditions that would adversely affect installation. Do not begin installation until unacceptable conditions are corrected.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instruction, approved submittals, and in proper relationship with adjacent construction at locations indicated on the Drawings.

B. Connect downspouts to storm sewer system. Seal connection watertight in accordance with manufacturer's instructions and/or SMACNA recommendations.

C. Existing gutters to be removed, stored, cleaned, and reinstalled.

D. Salvage, store and modify existing leaderheads and downspouts as indicated in Drawings before reinstallation.

1. Protect salvaged components from damage.
2. Hem and seal all exposed edges of metal, seal all joints with compatible sealant, repaint any exposed or damaged surfaces.
3. All modifications to sheet metal materials to be done in conformance with SMACNA recommendations.
4. Store all salvaged materials to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to drain. Prevent contact with materials during storage capable of causing discoloration, staining, or damage.
5. Install materials with anchors and supports compatible with existing system, as indicated in Drawings and in conformance with SMACNA – Architectural Sheet Metal Manual drawing details as noted below:
   a. Figure 1-31 – Downspouts – Manufactured, Style 'A'
   b. Figure 1-33 - Downspout – Gutter Connections

E. See Section 09 96 00 – High Performance Coatings for field painting of metal surfaces where paint is damaged or deficient.

F. Joint Sealants: Apply joint sealants in accordance with manufacturer's instructions.

G. Provide splash pads at all locations where downspouts discharge onto a lower roof and at locations indicated in Drawings. Splash pads to be placed on top of approved TPO roof Walk Pad noted in section 07 54 00 – Thermoplastic Polyolefin (TPO) roofing. Do not penetrate roof membrane.

3.04 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Protect installed products until completion of project.

END OF SECTION

07 72 00
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Roof hatch railing.
   2. Installation of salvaged roof hatch.

B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry: Wood framing for curb.
   2. Section 07 54 19 - Polyvinyl Chloride (PVC) roofing: Roof system.
   3. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashing to roof system.

1.02 REFERENCES

A. Underwriters Laboratories Inc.:
   1. UL - Building Materials Directory.

B. Occupational Health And Safety Administration (OSHA)
   1. OSHA 29 CFR 1910.23 and OSHA 29 CFR 1910.27
   2. OSHA 1926.502 – Fall Prevention Systems Criteria and Practices

C. American Society for Testing and Materials (ASTM)

1.03 PERFORMANCE REQUIREMENTS

A. Roof hatch railing system to withstand a 200 pounds test load

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.

C. Manufacturer's Installation Instructions: Indicate special installation criteria and interface with adjacent components.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum two years' experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Deliver and store products in manufacturer's unopened packaging until ready for installation.

1.07 WARRANTY

A. Provide the Owner with a seven (7) year manufacturer’s warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Product: Bil-Guard Roof Hatch Safety Railing System by Bilco Company.

B. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 COMPONENTS

A. General: Roof Hatch Railing System shall consist of a top rail, mid rail, and self-closing gate with the hatch curb acting as the toe plate installed as indicated in Documents. Match

proper model with existing roof hatch, contact manufacturer for proper model selection if necessary.

B. Railing and Brackets: Galvanized steel pipe, 1 ¼" ID, A53 Grade B seamed pipe
   1. Railing shall extend to a minimum height of 42 inches overall height above roof surface; self-latching hinged gate protecting hatch access side. Pipe ends and tops shall be covered or plugged with weather and light resistant material
   2. Guard Openings: Maximum 21 inches.
   3. Galvanized Steel Finish: Factory painted, color as selected by Architect.

C. Self Closing Gate: Furnished in dimension and type capable of engaging adjacent railing column. Minimum dimension from top of gate arm to bottom of gate arm to be 22".

D. Mounting Hardware: Manufacturer's standard corrosion-resistant type for attachment to hatch without penetrating roof membrane.

E. Gate Hardware: Manufacturer's standard corrosion-resistant hinges and latching mechanism,.

2.03 ACCESSORIES

A. Anchorage Devices: Type recommended by manufacturer.

B. Sealant: Manufacturer's recommended sealants.

C. Product label: Include easy reading "NO HOISTING" warning along with manufacturer's identification and patent label.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.

B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.

C. Examine existing salvaged roof hatch, curb framing and substrates and verify surfaces are clean, dry, straight, secure and of proper dimensions and ready to receive materials. Do not begin installation until unacceptable conditions are corrected.

D. Verify curb and hatch conditions comply with structural requirements for proper system performance.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction at locations indicated on the Drawings.

B. Existing hatch to be removed, stored, cleaned, and reinstalled. Contractor is responsible for reinstalling the hatch without voiding the existing warranty.

3.03 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements

B. Section 01 73 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

3.04 CLEANING

A. Section 01 73 00 - Execution and Closeout Requirements: Final cleaning.

B. Wash down exposed surfaces; wipe surfaces clean.

C. Remove excess sealant.

END OF SECTION

07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Firestopping through-penetrations of fire rated assemblies.
   2. Firestopping joints in fire rated assemblies.
B. Related Sections:
   1. Section 09 29 00 - Gypsum Board.

1.2 REFERENCES
A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
B. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.
C. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.
D. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 1479 - Fire Tests of Through-Penetration Firestops.
   3. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   4. UL - Fire Resistance Directory.

1.3 DEFINITIONS
A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS
A. Conform to applicable code and UL for fire resistance ratings and surface burning characteristics.

1.5 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Product Data: Submit data on product characteristics, performance and limitation criteria.
C. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
D. Manufacturer's Installation Instructions: Submit preparation and installation instructions.
E. Manufacturer's Certificate: Certify products meet or exceed applicable code requirements.

1.6 QUALITY ASSURANCE
A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
   1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings but not less than 1-hour.
    a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
1. Smoke Barrier Joints Air Leakage: Maximum 5 cfm per foot0.30 inches water gage pressure differential

D. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, and approved by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

D. Provide ventilation in areas to receive solvent cured materials.

PART 2 - PRODUCTS

2.1 FIRESTOPPING

A. Manufacturers:
1. 3M Fire Protection Products
2. Hilti, Inc.
3. HOLDRITE
4. JohnsManville
5. Specified Technologies Inc.
6. Tremco, Inc.
7. Passive Fire Protection Partners
8. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.

4. Fiber Stuffing and Sealant Firestopping: Composite of ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.
8. Intumescent Composite Sheet: Rigid aluminum foil-faced intumescent sheet with steel mesh and galvanized steel sheet backer.
    a. Product: SpecSeal CS Composite Sheet by Specified Technologies Inc. or approved equal.

C. Color: As selected from manufacturer's full range of colors.

2.2 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
B. Dam Material: Permanent:
    1. Match existing materials to maintain rating.
C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.
B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.
C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
B. Remove incompatible materials affecting bond.
C. Install backing damming materials to arrest liquid material leakage.

3.3 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
D. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.
E. Dam material to remain.

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 73 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.5 CLEANING

A. Section 01 73 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 - Execution and Closeout Requirements: Protecting installed construction.
B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

07 90 00
JOINT PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes sealants and joint backing, pre-compressed foam sealers, hollow gaskets, and accessories.

B. Related Sections:

1. Section 07 54 19 – Polyvinyl-Chloride (PVC) Roofing: Sealants required in conjunction with roofing.
2. Section 07 62 00 - Sheet Metal Flashing and Trim: Sealants required in conjunction with waterproofing.
3. Section 07 71 23 - Gutters and Downspouts: Sealants required in conjunction with waterproofing.
4. Section 07 84 00 - Firestopping: Firestopping sealants.
5. Section 09 29 00 - Gypsum Board: Acoustic sealant.

1.02 REFERENCES

A. ASTM International:

1. ASTM C834 - Standard Specification for Latex Sealants.
2. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.
3. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
4. ASTM C1193 - Standard Guide for Use of Joint Sealants.
5. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
6. South Coast Air Quality Management District:

B. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 2 x 2 inch in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation, and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience and approved by manufacturer.

1.05 QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Section 01 73 00 – Execution and Closeout Requirements: Testing.

C. Product testing: Obtain test results from a qualified testing agency based on the testing current sealant formulations within a 12-month period.

1. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

2. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer's recommendations.
   1. Location test joints where indicated or, if not indicated, as directed by the Architect.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of non-elastomeric sealant and joint substrate indicated.
   3. Notify the Owner and Architect seven days in advance of dates and times when test joints will be erected.

E. VOC: Acrylic latex and Silicon sealants shall have less than 50 g/l VOC content.

F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and executions.
   1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this section.

G. Verify sealants, primers, and other components do not stain adjacent materials.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

C. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
   2. When joint substrates are wet.

D. Joint-Width Conditions:
   1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

E. Joint-Substrate Conditions:
   1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.07 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

1.08 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

PART 2 - PRODUCTS

2.01 JOINT SEALERS

A. Manufacturers:
   1. Dow Corning Corporation.
   2. Tremco Commercial Sealants and Waterproofing; An RPM Company.

3. DAP Products, Inc.; An RPM Company
4. GAF, Commercial Roofing Products
5. Bostik, Inc.
6. 3M Industrial Adhesives and Tapes Division
7. Watson Bowman Acme Corp – BASF
8. Pecora Corporation.
9. Crafco Inc., an ERGON company.
10. Sika Company.
11. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Products Description:

1. S-1:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type M.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 20-40
2. S-2:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type M.
   c. Class 25.
   d. Grade P.
   e. Shore A hardness of 25-40
3. S-3:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 15-2
   f. Minimum elongation of 700 percent.
4. S-4:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 25-40
5. S-5:
   a. ASTM C920, polyurethane or polysulfide.
   b. Type S.
   c. Class 25.
   d. Grade P.
   e. Shore hardness of 15-45
6. S-6:
   a. ASTM C920, silicone, neutral cure.
   b. Type S.
   c. Class Joint movement range of plus 100 percent to minus 50 percent.
   d. Grade NS.
   e. Shore A hardness of 15-20

7. S-7:
   a. ASTM C920, silicone, neutral cure.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 25-30
   f. Structural glazing application.
8. S-8:
   a. ASTM C920, silicone, acetoxy cure.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 25-30
   f. Structural glazing application.
9. S-9:
   a. ASTM C920, silicone.
   b. Type S.
   c. Class 25.
   d. Grade NS.
   e. Shore A hardness of 25-30
10. S-10:
   a. ASTM C920, coal tar extended fuel resistance polyurethane.
   b. Type M/S.
   c. Class 25.
   d. Grade P/NS.
   e. Shore A hardness of 15-20
11. S-11:
   a. ASTM C920, polyurethane.
   b. Type M/S.
   c. Class 25.
   d. Grade P/NS.
   e. Shore A hardness of 35-50
12. S-12:
   a. ASTM C920, polyurethane.
   b. Type M/S.
   c. Class 25, joint movement range of plus or minus 50 percent.
   d. Grade P/NS.
   e. Shore A hardness of 25-50
13. C -1: ASTM C834, acrylic latex.
14. C -2: One component acoustical caulking, non-drying, non-hardening, synthetic rubber.

2.02 COLOR:

A. Sealants used with exposed masonry shall match color of mortar joints.
B. Sealants used with unpainted concrete shall match color of adjacent concrete.
C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.
D. Caulking shall be light gray or white, unless specified otherwise.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

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

1. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

a. Type C: Closed-cell material with a surface skin.

2. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

3. Bond Breaker: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

D. Filler: As recommend by manufacturer of caulking or sealant material; stain free type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.

B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.

C. Verify substrate surfaces and joint openings are ready to receive work.

D. Verify joint backing and release tapes are compatible with sealant.

E. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.02 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

C. Clean and prime joints.

D. Perform preparation in accordance with ASTM C1193.

E. Do not cut or damage joint edges.

F. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking or sealing compounds.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

G. Apply primer to sides of joints wherever required by compound manufacturer’s printed instructions.

1. Apply primer prior to installation of back-up rod or bond breaker tape.

2. Use brush or other approved means that will reach all parts of joints.

H. Take all necessary steps to prevent three sided adhesion of sealants.
I. Protect elements surrounding Work of this section from damage or disfiguration.

3.03 BACKING INSTALLATION:

A. Install back-up material, to form joints enclosed on three sides as required to specified depth of sealant.
B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.
C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.
D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 3mm (1/8 inch) for sealant depths specified.
E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.04 INSTALLATION

A. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
B. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementations materials may be present.
C. Do not use sealant type listed by manufacture as not suitable for use in locations specified.
D. Apply caulking and sealing compound in accordance with manufacturer’s printed instructions.
E. Avoid dropping or smearing compound on adjacent surfaces.
F. Fill joints solidly with compound and finish compound smooth.
G. Finish paving or floor joints flush unless joint is otherwise detailed.
H. Apply compounds with nozzle size to fit joint width.
I. Test sealants for compatibility with each other and substrate. Use only compatible sealant.
J. Perform installation in accordance with ASTM C1193.
K. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
L. Tool joints concave.
M. Pre-compressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.
N. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.
O. Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
    1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
    2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
    3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
    4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
    5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.05 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:

1. Whether sealants in joints connected to pull-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
3. Whether sealants filled joint cavities and are free from voids.
4. Whether sealant dimensions are configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants are installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesion failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.06 CLEANING

A. Section 01 73 00 – Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 73 00 – Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

3.08 LOCATIONS

A. Exterior Building Joints, Horizontal and Vertical:

1. Metal to Metal: Type S-1, S-2
2. Metal to Masonry, Stone or Concrete: Type S-1
3. Masonry to Masonry, Stone or Concrete: Type S-1
4. Stone to Stone: Type S-1
5. Cast Stone to Cast Stone: Type S-1
6. Threshold Setting Bed: Type S-1, S-3, S-4
7. Masonry Expansion and Control Joints: Type S-6
8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:

1. Flashings to Wall: Type S-6
2. Metal to Metal: Type S-6

C. Sanitary Joints:

1. Walls to Plumbing Fixtures: Type S-9
2. Countertops to Walls: Type S-9
3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:
    1. Concrete Paving, Unit Pavers: Type S-11 or S-12
E. High Temperature Joints over 204 degrees C (400 degrees F):
    1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8
F. Interior Caulking:
    1. Typical Narrow Joint 6mm (1/4 inch) or less at Walls and Adjacent Components: Types C-1 and C-2.
    2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Types C-1 and C-2.
    3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Types C-1 and C-2.
    4. Exposed Isolation Joints at Top of Full Height Walls: Types C-1 and C-2.
    5. Exposed Acoustical Joint at Sound Rated Partitions: Type C-2
    6. Concealed Acoustic Sealant: Types S-4, C-1 and C-2.

END OF SECTION

09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
   2. Acoustical insulation.

B. Related Sections include the following:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 07 21 16 - Blanket Insulation.
   3. Section 09 90 00 - Painting and Coating.

1.03 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Product Data: For each type of product indicated.

C. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.04 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.

   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PANELS, GENERAL

A. Recycled Content: Provide gypsum panel products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 10 percent by weight.

B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.02 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Gypsum Co.
   2. BPB America Inc.
   3. G-P Gypsum.
   4. Lafarge North America Inc.
   5. National Gypsum Company.
   6. PABCO Gypsum.
   7. Temple.
   8. USG Corporation.

C. Abuse-Resistant Type: ASTM C 1629, Level 1. Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board
   1. Core: 5/8 inch, Type X, unless otherwise noted.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3272, score of 10.

D. Gypsum Board, Type X: ASTM C 1396
   1. Thickness: 5/8 inch unless otherwise noted.
   2. Long Edges: Tapered.

E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

F. High-Impact Type: Manufactured with Type X core, plastic film laminated to back side for greater resistance to through-penetration (impact resistance).
   1. Core: 5/8 inch thick
   2. Plastic-Film Thickness: 0.020 inch

2.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Stainless steel or aluminum-coated steel sheet.
   2. Shapes: as indicated on drawings.
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Material: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Acoustical Insulation.
   1. Description: Preformed glass fiber; friction-fit type; unfaced.
   2. Comply with ASTM C665.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. For required control joints not shown on Drawings, verify locations with Architect prior to installation.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

J. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

K. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

L. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: As indicated on Drawings.
   2. Abuse Resistant Type: At all high traffic including corridors as indicated on Drawings.
   3. Type X: Vertical surfaces, unless otherwise indicated.
   4. High-Impact Type: At all high impact areas including gym and locker room walls and as indicated on Drawings

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   3. Stagger abutting end joints not less than one framing member in alternate courses of panels.
   4. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   5. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   6. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, according to ASTM C 840.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. Bullnose Bead: Use at outside corners.
   3. LC-Bead: Use at exposed panel edges.
   4. L-Bead: Use where indicated.
   5. U-Bead: Use at exposed panel edges.

D. Aluminum Trim: Install in locations indicated on Drawings.

E. Acoustic Accessories Installation:
   1. Install resilient channels at maximum 24 inches o.c.
   2. Locate joints over framing members.
   3. Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
   4. Install acoustic sealant within partitions.

3.05 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas.
   2. Level 2: Concealed panels that are used as substrates.
   3. Level 3: Mechanical, electrical rooms, custodial closets and storage rooms.
   4. Level 4: At all classrooms unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.
   5. Level 5: At all corridors, gymnasiums, locker rooms, cafeteria, offices, and all high traffic/public areas, skylight wells.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.06 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

09 90 00
PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes surface preparation and field application of paints, and other coatings.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications: Shop primed items.
2. Section 06 41 00 - Architectural Woodwork: Shop finished cabinet work and standing and running trim.
3. Section 09 96 00 - High-Performance Coatings: Field-applied coatings for metal surfaces.

1.02 REFERENCES

A. ASTM International:

1. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
2. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Painting and Decorating Contractors of America:

1. PDCA - Architectural Painting Specification Manual.

C. South Coast Air Quality Management District:

1. SCAQMD Rule 1113-January 1, 2004 - Architectural Coatings.

D. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.

E. California Department of Health

1. Standard Method v1.1-2010 using applicable exposure scenario

F. Greenguard Gold

G. Collaborative for High Performance Schools (CHPS)

H. SCS Indoor Advantage Gold

I. VOC Limits according to California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data on finishing products.

C. Samples:

1. Submit two paper chip samples, 12x12 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

D. Manufacturer's Installation Instructions: Submit special surface preparation procedures, substrate conditions requiring special attention.

1.05 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Closeout requirements.

B. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section approved by manufacturer.

1.07 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Paint mockup panel, floor to ceiling by 5 feet wide, illustrating coating, color, texture, and finish. Paint one mockup per color scheme. Mockup to include baseboard, trim and built-in casework where applicable.

C. Locate where directed by Architect.

D. Incorporate accepted mockup as part of Work.

E. Mockup review is required. Attendance by the Owner, Contractor, Installer and Architect is mandatory.

1.08 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

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

C. 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.

D. Paint Materials: Store at minimum ambient temperature of 45 degrees F and maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by paint product manufacturer.

C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity ranges, or moisture content of surfaces exceed those required by paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candle measured mid-height at substrate surface.

1.11 SEQUENCING

A. Section 01 31 00 – Project Management and Coordination: Work sequence.

B. Sequence application to the following:

1. Do not apply finish coats until paintable sealant is applied.
2. Back prime wood trim before installation of trim.

1.12 WARRANTY

A. Section 01 73 00 – Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for paints and coatings.

1.13 EXTRA MATERIALS

A. Section 01 73 00 – Execution and Closeout Requirements: Spare parts and maintenance products.
B. Supply 1 gallon of each color, type, and surface texture; store where directed.
C. Label each container with color, type, texture, room location, and school name in addition to manufacturer's label.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS

A. Manufacturers: Paint, Transparent Finishes, Stain, and Primer Sealers.
    1. Miller Paint Co.
    2. Rodda Paint Co.
    3. Benjamin Moore & Co.
    4. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 COMPONENTS

A. Paint (P): As detailed in architectural drawings.
B. Coatings: Ready mixed, except field catalyzed coatings. Prepare coatings:
    1. To soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.
    2. For good flow and brushing properties.
    3. Capable of drying or curing free of streaks or sags.
C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve finishes specified; commercial quality.
D. Patching Materials: Filler compatible with finish system.
E. Fastener Head Cover Materials: Filler compatible with finish system.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.
B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.
C. Verify surfaces are ready to receive Work as instructed by product manufacturer.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report conditions capable of affecting proper application.
E. Test shop applied primer for compatibility with subsequent cover materials.
F. Measure moisture content of surfaces using electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
    1. Plaster and Gypsum Wallboard: 12 percent.
    2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
    3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
    4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Surface Appurtenances: Remove or electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
B. Surfaces: Correct defects and clean surfaces capable of affecting work of this section. Remove or repair existing coatings exhibiting surface defects. Scrape existing paint as required to provide smooth surface free from peeling or bubbling substrates. Fill nail holes, cracks,

open joints and other blemishes and sealant, putty, or caulking compatible with finish system after priming coat has dried.

C. Marks: Seal with shellac those which may bleed through surface finishes.
D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
G. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
H. Interior Wood Items Scheduled to Receive Paint 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.
I. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior paintable caulking compound after prime coat has been applied.
J. Wood Doors Scheduled for Painting: Seal wood door top and bottom edge surfaces with clear sealer.
K. Metal Doors Scheduled for Painting: Prime metal door top and bottom edge surfaces.
L. Priming: Prime surfaces in compliance with coating manufacturer’s instructions for each substrate condition and applications. Use stain-blocking primers.
M. Ceilings: Schedule for Painting: New sprinkler heads to be protected during painting.

3.03 EXISTING WORK

A. Extend existing paint and coatings installations using materials and methods compatible with existing installations and as specified.

3.04 APPLICATION

A. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
B. Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless specified otherwise.
C. Sand wood and metal surfaces lightly between coats to achieve required finish.
D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
E. Prime concealed surfaces of interior and exterior woodwork with primer paint.
F. Finishing Mechanical And Electrical Equipment:
    1. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are shop finished.
    2. Paint exposed conduit and electrical equipment occurring in finished areas.
G. Fire-rated frames/rails: Paint must be heat resistant to 300 degrees f and be spray applied, maximum 5 mils thick including primer.

3.05 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Inspecting
B. Section 01 73 00 – Execution and Closeout Requirements: Testing, adjusting, and balancing.

C. Inspect and test questionable coated areas in accordance with SSPC and industry standards.

3.06 CLEANING

A. Section 01 73 00 – Execution and Closeout Requirements: Final cleaning.
B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

3.07 SCHEDULE - INTERIOR SURFACES

A. Wood - Painted:
    1. One coat of acrylic primer sealer.
    2. Two coats of 100% acrylic Rodda AC-911 or equal, semi-gloss.
B. Concrete, Concrete Block
    1. One coat of acrylic latex primer sealer.
    2. Two coats of acrylic latex, low gloss.
C. Gypsum Board and Plaster Walls:
    1. One coat of PVA primer sealer.
    2. Two coats of acrylic latex, Rodda Lasyn, or equal.
        a. Corridor Walls: Low gloss finish.
        b. Office Walls: Low gloss finish.
        c. Classroom Walls: Egg shell finish.
D. Gypsum Board and Plaster Ceilings:
    1. One coat of latex primer sealer.
    2. Two coats of latex enamel, flat.

3.08 SCHEDULE – INTERIOR COLORS

a. See architectural drawings.

END OF SECTION

09 96 00
HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes high performance coatings and special preparation of surfaces for exterior and interior metal surfaces to receive field-applied coatings.

B. Related Sections:

1. Section 05 50 00 - Metal Fabrications
2. Section 09 90 00 - Painting and Coating.

1.02 REFERENCES

A. ASTM International:

1. ASTM D 6386 – Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

B. South Coast Air Quality Management District:

1. SCAQMD Rule 1113-January 1, 2004 - Architectural Coatings.

C. SSPC: The Society for Protective Coatings:

1. SSPC - Steel Structures Painting Manual.
2. SSPC Paint 16 - Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint.
3. SSPC SP 2 - Hand Tool Cleaning.
4. SSPC SP 3 - Power Tool Cleaning.
5. SSPC SP 5 - White Metal Blast Cleaning.
6. SSPC SP 6 - Commercial Blast Cleaning.
7. SSPC SP 7 - Brush-Off Blast Cleaning.
8. SSPC SP 10 - Near-White Blast Cleaning.
9. SSPC SP 11 - Power Tool Cleaning to Bare Metal.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit data indicating coating materials, performance ratings, and VOC content.

C. Submit four samples 8x8 inch in size illustrating selected colors and textures for each color and sheen and system selected. Submit on cardstock.

D. Maintenance Data: Submit on cleaning, touch-up and repair of painted and coated surfaces. Submit manufactured-approved process for re-painting as desired by Owner, including surface preparation, cleaning, and stripping for re-painting.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 77 00 – Closeout Procedures: Closeout requirements.

B. Operation and Maintenance Data: Submit maintenance and cleaning requirements for coatings, repair and patching techniques.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.06 MOCKUP

A. Section 01 40 00 - Quality Requirements: Mock-up requirements.

B. Construct one mock-up, minimum one foot long by one foot wide, illustrating coating, color and surface sheen for each specified coating.
C. Locate where directed by Architect.
D. Incorporate accepted mockup as part of Work.
E. Mockup review is required. Attendance by the Owner, Contractor, Installer and Architect is mandatory.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Pre-installation meeting.
B. Convene minimum one week prior to commencing work of this section.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.
B. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
C. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.
E. Restrict traffic from area where coating is being applied or is curing.

1.09 WARRANTY

A. Section 01 73 00 – Execution and Closeout Requirements: Product warranties and product bonds.
B. Warranty: Include coverage for bond to substrate, and degradation of chemical resistance.
C. Manufacturer’s Warranty: Manufacturer’s standard five year performance warranty.
D. Installer’s Warranty: Installer to provide three year installation warranty.

1.10 EXTRA MATERIALS

A. Section 01 73 00 – Execution and Closeout Requirements: Spare parts and maintenance products.
B. Supply 1 gallon of each color of each type of coating specified, for Owner's maintenance use.
C. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

PART 2 - PRODUCTS

2.01 HIGH PERFORMANCE COATINGS

A. Manufacturers:
    1. Tnemec Company.
    2. Precision Coatings.
    3. PPG Architectural Finishes, Inc.
    4. Sherwin Williams.
    5. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 COMPONENTS

A. Coatings - General: Furnish complete multi-coat systems formulated and recommended by manufacturer for applications indicated, in thicknesses indicated; number of coats specified does not include primer or filler coat.
    1. Lead content: None.
    2. Chromium content, as zinc chromate or strontium chromate: None.
    3. Maximum VOC content: As required by applicable regulations.

4. Colors: As selected by Architect from manufacturer's full range.

B. Urethane Coating: Two-part, aliphatic acrylic polyurethane, semi-gloss finish.
   1. Percentage of solids by volume: 58, minimum.
   2. Dry film thickness, per coat: 2.5 mils, minimum.
   3. Number of coats: As recommended by manufacturer for specific substrate, two coats minimum.
   4. Product: Series 73 Endura-Shield manufactured by Tnemec or approved equal.

C. Primers: As recommended by coating manufacturer for specific substrate, unless otherwise specified.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.

B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.

C. Verify substrate surfaces are ready to receive work as instructed by coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

3.02 PREPARATION

A. Prepare all surfaces according to manufacturer's recommendations for each type of substrate.

B. Clean surfaces of loose foreign matter.

C. Remove substances that would bleed through finished coatings. When removal is not possible, seal surface with shellac.

D. Remove finish hardware, fixture covers, and accessories and store.

E. Existing Painted and Sealed Surfaces:
   1. Strip existing paint and coatings from surface.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.

F. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

G. Galvanized Surfaces: Remove surface contamination and oils and then profile by sweep blasting, wash primer or acrylic pre-treatment in accordance with requirements of ASTM D6386. Remove all loose zinc oxide and zinc hydroxide particles. Comply with preparation recommendations of coating system manufacturer.

H. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

I. Shop Primed Steel 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.

J. Ferrous Metal:
   1. Solvent clean.
   2. Remove loose rust, loose mill scale, and other foreign substances using hand tools according to SSPC-SP 2, power tools according to SSPC-SP 3, or by blasting according to SSPC-SP 6 or SSPC –SP 7.

K. Protect adjacent surfaces and materials not receiving coating from overspray; mask when necessary to provide adequate protection. Repair damage.

3.03 INSTALLATION

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer.

B. Apply coatings to thicknesses specified.

C. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.04 CLEANING

A. Section 01 73 00 - Execution and Closeout Requirements: Final cleaning.

B. Collect waste material which may constitute fire hazard, place in closed metal containers, and remove daily from site.

C. Clean surfaces immediately of overspray, splatter, and excess material.

D. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

END OF SECTION

10 11 00
VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.01 SUMMARY
A. Section includes markerboards and tackboards.
B. Related Sections:
   1. Section 06 10 00 - Rough Carpentry: Concealed blocking in new walls.

1.02 REFERENCES
A. American National Standards Institute:
   1. ANSI A135.4 - Basic Hardboard.
   2. ANSI A208.1 - Mat-Formed Wood Particleboard.
B. ASTM International:
   1. ASTM A424 - Standard Specification for Steel, Sheet, for Porcelain Enameling.
   2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board.
C. National Fire Protection Association:
   1. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
D. South Coast Air Quality Management District:
   1. SCAQMD Rule 1168-January 7, 2005 - Adhesive and Sealant Applications.

1.03 SUBMITTALS
A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
B. Shop Drawings: Indicate wall elevations, dimensions, and joint locations, and special anchor details.
C. Product Data: Submit data on markerboards, and trim and accessories.
D. Samples: Submit four 8x8 inch in size illustrating materials and finish, color and texture of markerboard.

1.04 CLOSEOUT SUBMITTALS
A. Section 01 77 00 - Closeout Procedures: Closeout requirements.
B. Operation and Maintenance Data: Submit Operation and Maintenance Data.

1.05 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD MEASUREMENTS
A. Verify field measurements prior to fabrication.

1.07 WARRANTY
A. Section 01 73 00 – Execution and Closeout Requirements: Product warranties and product bonds.
B. Furnish 50 year manufacturer warranty for visual display boards.
C. Include coverage of markerboard surface from discoloration due to cleaning, crazing or cracking, or staining.

PART 2 - PRODUCTS

2.01 VISUAL DISPLAY BOARDS

A. Manufacturers:
   1. ADP Lemco, Inc.
   2. Best-Rite; MooreCo, Inc.
   3. Claridge Products and Equipment, Inc.
   4. Forbo Group
   5. Koroseal
   6. Ghent Manufacturing, Inc.
   7. Platinum Visual Systems.
   8. Substitutions: Section 01 25 00 – Substitution Procedures.

2.02 COMPONENTS

A. Sheet Steel: ASTM A424, Type I, commercial quality.
B. Cork: Fine grain natural cork, homogeneous composition.
C. Plywood: APA Structural I, Grade C-D HPVA HP, birch species.
D. Hardboard: ANSI A135.4, tempered, smooth face.
E. Frame and Chalkrail: Aluminum extrusions, ASTM B221.

2.03 ACCESSORIES

A. Adhesives: Type used by manufacturer.
B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.
C. Cleaning Instruction Plate: Provide instructions for chalkboard cleaning on metal plate fastened to perimeter frame near chalkrail.

2.04 FABRICATION – MARKER BOARDS

A. Outer Face Sheet: Steel, 24 gage thick, magnetic.
B. Core: Fiberboard, 1/2 inch thick.
C. Backing Surface: Aluminum sheet, 0.015 inch thick.
D. Splice Joint: Concealed spline of sheet steel.
E. Aluminum Frame: Profile to match existing; concealed fasteners, map rail over markerboard.
F. Aluminum Chalkrail: Profile to match existing, one piece full length of markerboard, ends to match existing; concealed fasteners.
G. Display rail: Aluminum with cork insert; color as selected by Architect. Install at top of marker board.

2.05 FABRICATION – TACKBOARDS

A. Cork Surface: 1/4 inch thick.
B. Core: Plywood, thickness as indicated on drawings.
C. Frames for tackboards in corridors: Anodized aluminum channel with 1 inch legs; width sized to fit the thickness of the tackboad assembly; mechanically fastened to back of panel assembly. Must match appearance of channel trim specified for wainscot panels in section 06 41 00 – Architectural Woodwork

2.06 FINISHES

A. Porcelain Enamel: Glass fibered enamel, baked to vitreous surfaces; Porcelain Enamel Institute Type A; color: white.
B. Tackboard Surface: Color as detailed in architectural drawings.
C. Aluminum Frames and Accessories: Clear anodized finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Coordination.
B. Section 01 73 00 – Execution and Closeout Requirements: Examination, preparation.
C. Verify internal wall blocking is ready to receive Work and positioning dimensions are as instructed by manufacturer.

3.02 INSTALLATION

A. Mount visual display units to 2x wood blocking in wall installed per Section 06 10 00 – Rough Carpentry.
B. Establish mounting height as indicated on drawings.
C. Secure units level and plumb.
D. Markerboards: Butt panels tight with concealed spline to hairline joint.
E. Tackboards and Markerboards: Mechanically fasten to wall with tamper-resistant screws through perimeter frame.

3.03 CLEANING

A. Section 01 73 00 – Execution and Closeout Requirements: Final cleaning.
B. Cover markerboard and tackboard surfaces with protective cover, taped to frame.
C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

22 00 00
PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

A. Contents of Section applies to Division 22, Plumbing Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:
   a. OAR - Oregon Administrative Rules
   b. OESC - Oregon Electrical Specialty Code
   c. OFC - Oregon Fire Code
   d. OMSC - Oregon Mechanical Specialty Code
   e. OPSC - Oregon Plumbing Specialty Code
   f. OSSC - Oregon Structural Specialty Code
   g. OEESC - Oregon Energy Efficiency Specialty Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act
2. ADA - Americans with Disabilities Act
3. AHRI - Air-Conditioning Heating & Refrigeration Institute
4. ANSI - American National Standards Institute
5. ASCE - American Society of Civil Engineers
6. ASCE 41-17 - Seismic Evaluation and Retrofit of Existing Buildings
7. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
8. ASHRAE Guideline 0, the Commissioning Process
9. ASME - American Society of Mechanical Engineers
10. ASPE - American Society of Plumbing Engineers
11. ASSE - American Society of Sanitary Engineering
12. ASTM - ASTM International
13. AWWA - American Water Works Association
14. CFR - Code of Federal Regulations
15. CGA - Compressed Gas Association
16. CISPI - Cast Iron Soil Pipe Institute
17. EPA - Environmental Protection Agency
18. FM - FM Global
19. IAPMO - International Association of Plumbing and Mechanical Officials
20. GAMA - Gas Appliance Manufacturers Association
21. HI - Hydraulic Institute Standards
22. ISO - International Organization for Standardization
23. MSS - Manufacturers Standardization Society
24. NEC - National Electric Code
25. NEMA - National Electrical Manufacturers Association
26. NFGC - National Fuel Gas Code
27. NFPA - National Fire Protection Association
28. NRCA - National Roofing Contractors Association
29. NSF - National Sanitation Foundation
30. OSHA - Occupational Safety and Health Administration
31. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
32. TEMA - Tubular Exchanger Manufacturers Association
33. TIMA - Thermal Insulation Manufacturers Association
34. UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

1.04 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section

method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.

3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
    c. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.
7. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
8. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
9. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
10. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring

diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.

a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

11. Samples: Provide samples when requested by individual Sections.
12. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
        1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
        2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
13. Operation and Maintenance Manuals, Owner's Instructions:
    a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
        3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        4) Include copy of startup and test reports specific to each piece of equipment.
        5) Include copy of pressure, flow, leakage and purity test data and air and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
        6) Include copy of valve charts/schedules.
        7) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
        8) Include product certificates of warranties and guarantees.
        9) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
    b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration".

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

14. Record Drawings:
    a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
    b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
    c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
    d. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

1.06 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
B. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.08 WORK INCLUDED

A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.
B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities.
B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
C. Hazardous Materials:
    1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
    2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
    3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.03 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.
B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 22, Plumbing Sections. In the absence of specific requirements, comply with the following:

1. Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.
   a. Ceiling access panels to be minimum 24-inch by 24-inch required and approved size. Screwdriver operated catch.
   b. Wall access panels to be minimum of 12-inch by 12-inch required and approved size. Wall panels to be keyed.
   c. Provide cylinder type locks. Provide two keys for each cylinder. Locks to be keyed for Master Keying.
   d. Manufacturers and Models:
      1) Drywall: Karp KDW.
      2) Plaster: Karp DSC-214PL.
      3) Masonry: Karp DSC-214M.
      4) 2 hour rated: Karp KPF-350FR.
      5) Milcor, Elmdor, Acudor, or approved equivalent.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

C. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

D. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

E. Pipe Installation:
   1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and

building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

F. Plenums:

1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 22 Plumbing Sections.

B. General:

1. Earthquake resistant designs for Plumbing (Division 22) plumbing systems and piping to conform to regulations of jurisdiction having authority.
2. Provide stamped Shop Drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
3. Provide stamped Shop Drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

C. Piping:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping, and wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
    a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. Organize work to minimize duration of power interruption.

3.05 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
    1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer.
    2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
    3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
    4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
    5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
    1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
    2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
    3. Protect bright finished shafts, bearing housings and similar items until in service.

3.07 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and

installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.08 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.09 INSTALLATION

A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In absence of specific requirements in Division 01, General Requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Coordinate locations/sizes of access panels with Architect prior to work. Label access panels with engraved nameplates indicating function of panel.

3.12 DEMOLITION

A. Confirm Demolition requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
   1. Scope:
      a. It is the intent of these documents to provide necessary information and adjustments to plumbing system required to meet code, and accommodate installation of new work.
      b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
      c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
   2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
   3. Unless specifically indicated on Drawings, remove exposed, unused piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap piping and patch surfaces to match surrounding finish.
   4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.13 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:
   1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
      a. Testing and Balancing Reports
      b. Cleaning
      c. Operation and Maintenance Manuals
      d. Record Drawings
      e. Warranty and Guaranty Certificates

3.14 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
B. Tests:
   1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
   2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

END OF SECTION

22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Pipe Hangers and Supports for Plumbing Piping and Equipment
  2. Wall and Floor Sleeves
  3. Building Attachments
  4. Flashing
- B. Seismically bracing existing piping where indicated.
- C. Seismically bracing fall-prone plumbing equipment, such as water heaters, throughout building.

1.02 RELATED SECTIONS
- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. ASCE 7-10, Minimum Design Loads for Buildings and Other Structures.
  2. ASCE 41-17, Seismic Evaluation and Retrofit of Existing Buildings, for seismic bracing of existing piping and equipment.
  3. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
  4. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
  5. Install piping per SMACNA's requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. Engineering Responsibility:
  1. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
     a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.07 PERFORMANCE REQUIREMENTS
- A. General - Provide pipe and equipment hangers and supports in accordance with the following:
  1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.

2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:
1. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.
E. Provide seismic restraint hangers and supports for piping and equipment.
F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pipe Hangers and Supports for Plumbing Piping and Equipment:
1. Pipe Hangers/Supports:
a. B-Line Systems, Inc.
b. Anvil International
c. HOLDRITE
d. Erico Co., Inc.
e. Snappitz Thermal Pipe Shield Manufacturing
f. Rilco Manufacturing Co. Inc.
g. Nelson-Olson Inc.
h. Or approved equivalent.
2. Channel Support Systems:
a. B-Line Systems, Inc.
b. Anvil International, Anvit-Strut
c. Erico Hanger Co., Inc.; O-Strut Div.
d. Unistrut Corp.
e. HOLDRITE EZ-Strut Systems
f. Or approved equivalent.
3. Thermal-Hanger Shield Inserts:
a. Erico Hanger Co., Inc.
b. Pipe Shields, Inc.
c. Rilco Manufacturing Co., Inc.
d. HOLDRITE Insulation Couplings
e. Or approved equivalent.
4. Freestanding Roof Supports:
a. Erico Hanger Co., Inc.
b. Nelson-Olsen Inc.
c. B-Line
d. M. Fab
e. Or approved equivalent.
5. Pipe Alignment and Secondary Supports:
a. HOLDRITE
b. Starquick
c. Or approved equivalent.

B. Wall and Floor Sleeves:
1. Below Grade and High Water Table Areas:
a. Modular Link Sealing System at Pipe Sleeves:
1) Thunderline Corporation
2) Or approved equivalent.

2. Pre-Engineered Firestop Pipe Penetration Systems:
    a. HOLDRITE HydroFlame
    b. Proset
    c. Or approved equivalent.

C. Building Attachments:
1. Anchor-It
2. Gunnebo Fastening Corp.
3. ITW Ramset/Red Head
4. Masterset Fastening Systems, Inc.
5. Or approved equivalent.

D. Flashing:
1. Fastenal
2. Or approved equivalent.

2.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:
1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
2. Use only one type by one manufacturer for each piping service.
3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
5. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.

B. Pipe Hangers, Guides and Channel Systems:
1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
5. Pipe Guides:
    a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
    b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A570 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring

1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

C. Pipe Saddles and Shields:
   1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
   2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.
   1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
   2. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate.
   3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
   4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
   5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
   6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.
E. Roller Hangers:
   1. Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.
F. Concrete Inserts:
   1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.
G. Continuous Concrete Insert:
   1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
H. Beam Clamps:
   1. MSS Type 19 and 23, wide throat, with retaining clip.
   2. Universal Side Beam Clamp: MSS Type 20.
I. Hangers for Pipe Size 2-inches and Smaller:
   1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.
J. Hangers for Pipe Size 2-1/2-inches and Larger:
   1. Adjustable clevis type, UL listed, Type 1.
K. Riser Clamps:
   1. Steel, UL listed. MSS Type 8.
L. Plumbers Tape:
   1. Not permitted as pipe hangers or pipe straps.
M. Pipe Alignment and Secondary Support Systems:
   1. Secondary Pipe supports for general applications (Non-Acoustical).
      a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
      b. Supports may be used when sound and/or vibration transfer is not a concern.
   2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
      a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
      b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.
      c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not

limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.

d. Support Products:
   1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or approved equivalent.
   2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or approved equivalent.
   3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or approved equivalent.
   4) Drop-Ear Fitting Support: HOLDRITE #265, or approved equivalent.
   5) Floor Riser Isolation Pads: HOLDRITE #275-T, or approved equivalent.
   6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or approved equivalent.

N. Freestanding Roof Pipe Supports:
   1. Polyethylene high-density U.V. resistant quick "pipe" block with foam pad.
   2. Recommended installation is for pipe blocks to be freestanding.
   3. Piping 3-inches and larger mounted on block type supports.

2.03 WALL AND FLOOR SLEEVES

A. Below Grade and High Water Table Areas:
   1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
   2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51, cement lined. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.

D. Fabricated Accessories:
   1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
   2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
      a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
      b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
      c. Sleeve Sizes 7-inches and Larger: 14 gauge.
      d. Fire-Rated Safing Material:
         1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
         2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.04 BUILDING ATTACHMENTS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.

B. Anchor Bolts:

1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

C. Beam Clamps:
1. MSS Type 19 and 23, wide throat, with retaining clip.
2. Universal Side Beam Clamp: MSS Type 20.

D. Powder-Actuated Drive Pin Fasteners:
1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

F. Grout: ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and non-gaseous.
3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.05 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

D. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examination:
1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Preparation:
1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.02 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Hangers and Supports:
1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
2. Pipe Ring Diameters:

a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.

3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
4. Pipe Support Brackets: Support pipe with pipe slides.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
   a. Field assemble and install according to manufacturer's written instructions.
7. Pipe Guides:
   a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
   b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.
   a. 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.
   b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1
9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
10. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
11. Do not support piping from other piping.
12. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
13. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
14. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
15. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
16. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
17. Insulated Piping: (comply with the following)
    a. Attach clamps and spacers to piping.
       1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
       2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
       3) Do not exceed pipe stress limits according to ASME B31.9.

b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
   1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
d. Shield Dimensions for Pipe, not less than the following:
   1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
   2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
   3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
   4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
   5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
f. Insert Material: Length at least as long as protective shield.
g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

18. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.
19. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.

B. Vertical Piping:
   1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
   2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
   3. Riser to be supported at each floor penetration.
   4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.
C. Adjusting and Painting:
   1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
   2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.03 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.
B. Fabricated Pipe Sleeves:
   1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.

2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.04 BUILDING ATTACHMENTS

A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.
B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.
C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
E. Install powder-actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
G. Anchor Bolts:
    1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
    2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.
H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.
I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.
J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
    1. Install fabricated pipe sleeve.
    2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
    3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.
K. Piping Penetrations Through Fire-rated (1 to 3 hour) Assemblies:
    1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
    2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.
L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.05 FLASHING

A. Flash and counterflash where piping passes through weather or waterproofed walls, floors and roofs.
B. Flash vent soil pipes with flashings per Division 01, General Requirements.
C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches x 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.
D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

END OF SECTION

22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
  2. Piping Specialties
  3. Cleanouts

1.02 RELATED SECTIONS
- A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. NSF 61, Annex G.
  2. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
  3. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
  4. Manufacturer's Standards Society (MSS) for valving and support reference standard.
  5. American Water Works Association (AWWA) for Valving Assembly Standards.
  6. American Society of Sanitation Engineers (ASSE) for Valving Standards.
  7. American National Standards Institute (ANSI) for Piping Standards.
  8. NFPA Standard 51B - “Fire Prevention in Use of Cutting and Welding Processes”.

1.04 SUBMITTALS
- A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. See component manufacturers listed in individual articles below.
- B. Uponor
- C. Cerro
- D. Dodge Phelps
- E. Tyler
- F. ADS
- G. Charlotte
- H. Elkhart
- I. Enfield
- J. Fuseseal
- K. Gruvlok
- L. Spears
- M. Nibco

N. Orion
O. American-USA
P. Sioux Chief
Q. Mueller
R. Or approved equivalent.
S. Cleanouts:
    1. J.R. Smith
    2. Zurn
    3. Wade
    4. Watts
    5. Sioux Chief
    6. Or approved equivalent.
T. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:
    1. Hilti
    2. Proset
    3. Or approved equivalent.

2.02 GENERAL

A. Provide pipe, tube and fittings of the same type, fitting requirements, grade, class and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.
B. Manufactured materials delivered, new to the project site and stored in their original containers.
C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.03 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A 74 extra heavy weight or service weight weight hub and spigot.
    1. Fittings: Cast iron.
    2. Joints: Hub-and-spigot ASTM C564 neoprene gaskets and conform to ASTM C1563.
B. Cast Iron Pipe: ASTM A888/CISPI 301 hubless.
    1. Fittings: Cast iron.
    2. Coupling Assembly:
        a. Standard Duty: ASTM C1277 or CISPI 310.
C. Copper Tube: ASTM B 306, DWV
    1. Fittings: ASME B16.29, wrought copper.
    2. Joints: ASTM B32, alloy Sn50 solder.

2.04 PIPING SPECIALTIES

A. Pipe Escutcheons:
    1. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
    2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
    3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

2.05 CLEANOUTS

A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:

1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and standard screws.
2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.
3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
4. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
5. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. General Installation:

1. Work performed by experienced journeyman plumbers. No exceptions.
2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.
5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.
   a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
   b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
   c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.

d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.
f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.
g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

B. Testing:
1. General:
a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
b. Notify Architect and local Plumbing Inspector 2 days before tests.
c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.
2. Testing of Pressurized Systems:
a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

C. Protection:
    1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.
D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
    1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.
E. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.
F. Provide joints of type indicated in each piping system.
G. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
H. Sleeves:
    1. Pipe Sleeves:
        a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
        b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
        c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.
        d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
    2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
        a. Install fabricated pipe sleeve.
        b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
        c. Seal each end airtight with a resilient nonhardening seal per code.
    3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
        a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
        b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.02 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:
   1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:
   1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
   2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on direct waste or drain piping exceeding 60-inches.
   3. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.

3.03 PIPING SPECIALTIES

A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

3.04 CLEANOUTS

A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

END OF SECTION

23 00 00
HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

A. Contents of Section applies to Division 23, HVAC Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:
   a. OAR - Oregon Administrative Rules
   b. OESC - Oregon Electrical Specialty Code
   c. OFC - Oregon Fire Code
   d. OMSC - Oregon Mechanical Specialty Code
   e. OPSC - Oregon Plumbing Specialty Code
   f. OSSC - Oregon Structural Specialty Code
   g. OEESC - Oregon Energy Efficiency Specialty Code
   h. Oregon Elevator Specialty Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
   1. ABA - Architectural Barriers Act
   2. ABMA - American Bearing Manufacturers Association
   3. ADA - Americans with Disabilities Act
   4. AHRI - Air-Conditioning Heating & Refrigeration Institute
   5. AMCA - Air Movement and Control Association
   6. ANSI - American National Standards Institute
   7. ASCE - American Society of Civil Engineers
   8. ASCE 41-17 - Seismic Evaluation and Retrofit of Existing Buildings
   9. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
   10. ASHRAE Guideline 0, The Commissioning Process
   11. ASME - American Society of Mechanical Engineers
   12. ASPE - American Society of Plumbing Engineers
   13. ASSE - American Society of Sanitary Engineering
   14. ASTM - ASTM International
   15. AWWA - American Water Works Association
   16. CFR - Code of Federal Regulations
   17. CGA - Compressed Gas Association
   18. CISPI - Cast Iron Soil Pipe Institute
   19. EPA - Environmental Protection Agency
   20. ETL - Electrical Testing Laboratories
   21. FM - FM Global
   22. GAMA - Gas Appliance Manufacturers Association
   23. HI - Hydraulic Institute Standards
   24. IAPMO - International Association of Plumbing & Mechanical Officials
   25. IFGC - International Fuel Gas Code
   26. ISO - International Organization for Standardization
   27. MSS - Manufacturers Standardization Society
   28. NEC - National Electric Code
   29. NEMA - National Electrical Manufactures Association
   30. NFPA - National Fire Protection Association
   31. NFGC - National Fuel Gas Code
   32. NRCA - National Roofing Contractors Association
   33. NSF - National Sanitation Foundation
   34. OSHA - Occupational Safety and Health Administration
   35. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
   36. TEMA - Tubular Exchanger Manufactures Association
   37. TIMA - Thermal Insulation Manufactures Association
   38. UL - Underwriters Laboratories, Inc.
D. See Division 23, HVAC individual Sections for additional references.

1.04 SUBMITTALS
A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.
B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
C. In addition:
   1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication

processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
    c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
    d. For vibration isolation of equipment, list make and model selected with operating load and deflection.
    e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed

acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.

b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
    a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
        1) Resubmit for review until review indicates no exception taken or make "corrections as noted".
        2) When submitting drawings for Engineers re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:
    a. Submit, at one time, electronic files (PDF format) on Construction Online of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
        3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
        4) Include product certificates of warranties and guarantees.
        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.

6) Include copy of startup and test reports specific to each piece of equipment.
7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
8) Include commissioning reports.
9) Include copy of valve charts/schedules.
10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration".
c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:
a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.
c. At completion of project, input changes to original project CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
d. At completion of project, show changes and deviations from the Drawings in red on one set of black-line drawings. Include written Addendums, RFIs, and change order items. Make changes to Drawings in a neat, clean, and legible manner.
e. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
F. Provide products that are UL listed.
G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.
H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.
I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.06 WARRANTY
A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS
A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, equipment, fire sprinklers, plumbing, cable trays, lights, and electrical services with architectural and structural requirements, and other trades (including ceiling suspension, and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP
A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL approved or have adequate approval or be acceptable by State, County, and City authorities.
B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
C. Hazardous Materials:

1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:
   1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
      a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:
   1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building

with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.

2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect / Engineer of any discrepancy.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 23 HVAC Sections.

B. General:

1. Earthquake resistant designs for HVAC (Division 23) equipment and distribution, i.e. motors, ductwork, piping, equipment, etc. to conform to regulations of jurisdiction having authority.
2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
3. Provide stamped Shop Drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic bracing and seismic movement assemblies for piping equipment and water heaters. Submit Shop Drawings along with equipment submittals.
4. Provide stamped Shop Drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

C. Piping and Ductwork:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

D. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground system installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. After major equipment is installed.
5. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
    1. During remodeling or addition to existing structures, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
    2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new piping and ductwork, and wiring to point of connection. Where existing systems are being utilized, clean existing distribution systems (ductwork, piping, fans, air handlers) prior to connecting new ductwork or piping.
    3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
        a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
    4. Organize work to minimize duration of power interruption.

3.05 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
    1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
    2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
    3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
    4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
    5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.
B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
    1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
    2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
    3. Protect bright finished shafts, bearing housings and similar items until in service.

3.08 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.09 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
    1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.
D. Provide miscellaneous supports/metals required for installation of equipment, piping and ductwork.

3.11 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
   2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
   3. See individual equipment Specifications for other painting.
   4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
   5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
   6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.12 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. Scope:
      a. It is the intent of these documents to provide necessary information and adjustments to the HVAC system required to meet code, and accommodate installation of new work.
      b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
      c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to exactly locate and preserve utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.
   2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
   3. Unless specifically indicated on Drawings, remove exposed, unused ductwork and piping to behind finished surfaces (floor, walls, ceilings, etc.). Cap and patch surfaces to match surrounding finish.
   4. Unless specifically indicated on Drawings, remove unused equipment, fixtures, fittings, rough-ins, and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).

3.13 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

a. Testing and Balancing Reports
b. Cleaning
c. Operation and Maintenance Manuals
d. Training of Operating Personnel
e. Record Drawings
f. Warranty and Guaranty Certificates
g. Start-up/Test Document
h. Commissioning Reports

3.14 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.
B. Tests:
    1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
    2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.15 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.16 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION

23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
  2. Building Attachments
  3. Flashing
  4. Miscellaneous Metal and Materials
- B. Seismically bracing existing HVAC piping, ductwork, and equipment where indicated.
- C. Seismically bracing fall-prone HVAC equipment throughout building.
- D. Seismically bracing existing natural gas piping throughout building.

1.02 RELATED SECTIONS
- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Welding:
     a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".
  2. Welding for Hangers:
     a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
  3. Engineering Responsibility:
     a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
        1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.
  4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
  5. Support systems to be supplied by a single manufacturer.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS
- A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:
1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
E. Provide seismic restraint hangers and supports for piping, ductwork and equipment.
F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.
G. All seismic bracing design for existing systems to comply with requirements of ASCE 41-17.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:
1. Anvil International
2. B-Line Systems, Incorporated
3. Erico Company, Incorporated
4. Nelson-Olsen Incorporated
5. Rilco Manufacturing Company, Incorporated
6. Snappitz Thermal Pipe Shield Manufacturing
7. Unistrut Corporation
8. Or approved equivalent.

B. Building Attachments:
1. Anchor-It
2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Incorporated
6. Or approved equivalent.

2.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
C. Channel Hanging System:
1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A570 GR33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.
E. Pipe Hangers:
    1. Pipe Rings for Hanger Rods:
        a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.
        b. Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or approved equivalent.
        c. Pipe hangers to have same finish as hanger rods.
F. Pipe Saddles and Shields:
    1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
    2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).
G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.
H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
I. Pipe Guides:
    1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
    2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
J. Pipe Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.
K. Below Ground Pipe Supports:
    1. Pipe Hangers All Sizes: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 304. MSS Type 1. Erico 406.
    2. Rod: 5/8-inch stainless steel Type 18-8.
    3. Eyebolt: Stainless steel Type 18-8.
    4. Nuts and Washers: Stainless steel Type 18-8.
L. Thermal Hanger Shield Inserts:
    1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.
    2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.
    3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.
    4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
    5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
    6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
    7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.
M. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.03 BUILDING ATTACHMENTS

A. Beam Clamps:
   1. MSS Type 19 and 23, wide throat, with retaining clip.
   2. Universal Side Beam Clamp: MSS Type 20.

B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Anchor Bolts:
   1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
   2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
   3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
   4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.04 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.
B. Safes: 8 mil thick neoprene.
C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.05 MISCELLANEOUS METAL AND MATERIALS

A. General:
   1. Provide miscellaneous metal items specified, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
   2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

I. Grout:
   1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
   2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
   3. Properties: Nonstaining, noncorrosive, and non gaseous.
   4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.
B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall", "2-Hour Fire/Smoke Barrier", and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.
C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.
D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.02 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.
B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.
C. Provide aluminum supports for aluminum ductwork.
D. Provide stainless steel supports for stainless steel ductwork.
E. Support vertical ducts at maximum intervals of 16-feet and at each floor.
F. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
G. Use double nuts and lock washers on threaded rod supports.
H. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.
I. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps to roof deck. Do not support ducts from other ducts, piping or equipment.
J. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.
K. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.
L. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.

M. Channel Support System Installation:
    1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
    2. Field assemble and install according to manufacturer's written instructions.
N. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
O. 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.
P. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
Q. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.
R. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.
S. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:
    1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.
    2. Use only one type by one manufacturer for each piping service.
    3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
    4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.
    5. Provide copper-plated hangers and supports for uninsulated copper piping systems.
T. Plumber's Tape not permitted as pipe hangers or pipe straps.
U. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
V. Pipe Ring Diameters:
    1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.
    2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
W. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
X. Pipe Support Brackets: Support pipe with pipe slides.
Y. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
Z. Pipe Guides:
    1. Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
    2. Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
AA. Heavy-Duty Steel Trapeze Installation:
    1. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.
    2. 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.

3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

AB. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.

AC. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.

AD. Do not support piping from other piping.

AE. Fire protection piping will be supported independently of other piping.

AF. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

AG. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.

AH. Insulated Piping:

1. Attach clamps and spacers to piping.
   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Do not exceed pipe stress limits according to ASME B31.9.
3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe, not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
   b. NPS 4 (DN100): 12-inches long and 0.06-inch thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
   d. NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
   e. NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
7. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   a. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

AI. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

AJ. Pipe Curb Assemblies:

1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

AK. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

AL. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe.
   a. Riser to be supported at each floor of penetration.
   b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

AM. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise.

3.03 BUILDING ATTACHMENTS

A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.
B. Select size of building attachments to suit hanger rods.
C. Space attachments within maximum piping span length indicated in MSS SP-58.
D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.
F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.
H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.
I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.
J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.
K. Anchor Bolts:
    1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.
    2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.04 FLASHING

A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.
B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.05 MISCELLANEOUS METAL AND MATERIALS

A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
B. Finishes:

1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.
D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.
E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.
F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.
J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
L. 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.

M. Provide galvanized components for items exposed to weather.

END OF SECTION

23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. General Requirements and Procedures
2. Pre-Construction Balance (Existing Systems)
3. Fundamental Air Systems Balancing Procedures
4. Temperature Control Verification
5. Constant Volume Air Systems Balancing Procedures
6. Pre-Balance Reporting
7. Final Reports:
   a. Report Requirements
   b. General Report Data
   c. System Diagrams
   d. Air Handling Units
   e. Fans
   f. Duct Traverses
   g. Diffusers/Registers/Grilles
   h. Instrument Calibration
8. Additional Tests

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and this Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
2. Pre-Construction Phase Report:
   a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
      1) A complete set of report forms intended for use on the project, with data filled in except for the field readings. Forms to be Project-specific.
      2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
      3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
      4) A narrative of any project specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.
3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.
4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 below. Include a complete set of report forms intended for use on this Project.
5. Specify reports required because of editing procedures in Part 3 of this Section.

6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.
7. Sample Report Forms: Submit two sets of sample TAB report forms.
8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.
9. Final Report.
10. Provide additional submittals to commissioning authority as dictated in commissioning specifications.

1.05 QUALITY ASSURANCE

A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
B. In addition, provide:
    1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of any outlet, coil, or device listed in the final TAB report.
    2. Guarantee: Meet the requirements of the following programs:
        a. Provide a guarantee on AABC or NEBB forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
            1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.
            2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.07 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a persons skin than is normally dissipated.
D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
E. Report Forms: Test data sheets for recording test data in logical order.
F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.
G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.
H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
J. TAB: Testing, Adjusting, and Balancing.
K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
L. Test: A procedure to determine quantitative performance of a system or equipment.

M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.
N. AABC: Associated Air Balance Council.
O. AMCA: Air Movement and Control Association.
P. CTI: Cooling Tower Institute.
Q. NEBB: National Environmental Balancing Bureau.
R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.08 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.
C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS AND PROCEDURES

A. Project Conditions:
    1. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during TAB operations to minimize conflicts with the Owner's operations.
B. General Requirements:
    1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
    2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
    3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.
C. Examination:
    1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
        a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
        b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
    2. Examine approved submittal data of HVAC systems and equipment.
    3. Examine project record documents described in Division 01, General Requirements.
    4. Examine Architect's and Engineer's design data, including Basis of Design, 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.
    5. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in

all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

6. Coordinate requirements in system and equipment with this Section.
7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
8. Examine system and equipment test reports.
9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
11. Examine equipment for installation and for properly operating safety interlocks and controls.
12. Report deficiencies discovered before and during performance of TAB procedures.
13. Beginning of work means acceptance of existing conditions.

D. Preparation:
   1. Prepare a TAB plan that includes strategies and step-by-step procedures.
   2. Complete system readiness checks and prepare system readiness reports. Verify the following:
      a. Permanent electrical power wiring is complete.
      b. Hydronic systems are filled, clean, and free of air.
      c. Automatic temperature-control systems are operational.
      d. Equipment and duct access doors are securely closed.
      e. Balance, smoke, and fire dampers are open.
      f. Isolating and balancing valves are open and control valves are operational.
      g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
      h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.
   3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
      a. Attendance is required by installers whose work will be tested, adjusted, or balanced.
   4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:
   1. Perform TAB procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
   2. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
   3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
3. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.
4. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:
   1. Field Logs: Maintain written logs including:
      a. Running log of events and issues.
      b. Discrepancies, deficient or uncompleted work by others.
      c. Contract interpretation requests.
      d. Lists of completed tests.
   2. Ensure recorded data represents actual measured or observed conditions.
   3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
   4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.
   5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
   6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
   7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

3.02 PRE-CONSTRUCTION BALANCE (EXISTING SYSTEMS)

A. Pre-Construction Balance - Air Systems
   1. Prior to start of construction or demolition; read and record airflow to establish “as-found” conditions. Provide pitot traverse of supply, return and exhaust ductwork at locations indicated on drawings and, as minimum, at central air handlers, main branch ductwork and at each floor.
   2. Read and record static pressure conditions across existing filters, coils and fans.
   3. Read and record amp draw and motor data from each existing air handler and fan that will be modified during project.

B. Report data and observations to Architect.

3.03 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
B. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
C. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
D. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.
E. Prepare schematic diagrams of systems' "as-built" duct layouts.
F. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

G. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
I. Verify that motor starters are equipped with thermal protection, sized for the connected load.
J. Check dampers for proper position to achieve desired airflow path.
K. Check for airflow blockages.
L. Check that condensate drains are installed, trapped and primed and routed to drain.
M. Check for readily observable leaks in air-handling unit components and ductwork.
N. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.

3.04 TEMPERATURE CONTROL VERIFICATION

A. Examine automatic temperature system components to verify the following:
    1. Dampers, valves, and other controlled devices operate by the intended controller.
    2. Dampers and valves are in the position indicated by the controller.
    3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
    4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
    5. Thermostats and humidistats are located to avoid adverse effects of sunlight, equipment, drafts, and cold walls.
    6. Sensors are located to sense only the intended conditions.
    7. Sequence of operation for control modes is according to the Contract Documents.
    8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
    9. Interlocked systems are operating.
    10. Changeover from heating to cooling mode occurs according to design values.
B. Verify that controllers are calibrated and commissioned.
C. Check transmitter and controller locations and note conditions that would adversely affect control functions.
D. Record controller settings and note variances between set points and actual measurements.
E. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
F. Verify free travel and proper operation of control devices such as damper and valve operators.
G. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
H. Confirm interaction of electrically operated switch transducers.
I. Confirm interaction of interlock and lockout systems.
J. Verify main control supply-air pressure and observe compressor and dryer operations.
K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.05 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES

A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.
    1. Measure fan static pressures to determine actual static pressure as follows:
        a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
        b. Measure static pressure directly at the fan outlet or through the flexible connection.
        c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each air-handling unit component under final balanced condition.
3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
7. Calibrate airflow measuring stations.

3.06 PRE-BALANCE REPORTING

A. Pre-Construction Phase Report:
   1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:
      a. A complete set of report forms intended for use on the project, with all data filled in except for the field readings. Forms to be project specific.
      b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
      c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
      d. A narrative of any project specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.07 FINAL REPORTS

A. Report Requirements:
   1. General:
      a. Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
      b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
         1) Include a list of the instruments used for procedures, along with proof of calibration.
      c. Final Report Contents: In addition to the certified field report data, include the following:
         1) 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, but do not include approved Shop Drawings and Product Data.

B. General Report Data:
1. In addition to the form titles and entries, include the following data in the final report, as applicable:
a. Title Page
b. Name and Address of TAB Agent
c. Project Name
d. Project Location
e. Architect's Name and Address
f. Engineer's Name and Address
g. Contractor's Name and Address
h. Report Date
i. Signature of TAB Agent who Certifies the Report
j. Summary of Contents, Including the Following:
1) Design versus Final Performance
2) Notable Characteristics of Systems
3) Description of System Operation Sequence if it varies from the Contract Documents
k. Nomenclature Sheets for Each Item of Equipment
l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings
m. Notes to explain why certain final data in the body of reports vary from design values.
n. Test Conditions for Fans and Pump Performance Forms, Including the Following:
1) Settings for Outside-, Return-, and Exhaust-air Dampers
2) Conditions of Filters
3) Cooling Coil, Wet- and Dry-bulb Conditions
4) Face and Bypass Damper Settings at Coils
5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
6) Inlet Vane Settings for Variable-Air-Volume Systems
7) Settings for Supply-air, Static-pressure Controller
8) Other System Operating Conditions that affect Performance

C. System Diagrams:
1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
a. Quantities of Outside, Supply, Return, and Exhaust Airflows
b. Water and Steam Flow Rates
c. Duct, Outlet, and Inlet Sizes
d. Pipe and Valve Sizes and Locations
e. Terminal Units
f. Balancing Stations

D. Air Handling Units:
1. For air-handling units, split systems, fan coils, pumps, and evaporator units with coils, include the following:
a. Unit Data: Include the following:
1) Unit Identification
2) Location
3) Make and Type
4) Model Number and Unit Size
5) Manufacturer's Serial Number
6) Unit Arrangement and Class
7) Discharge Arrangement

8) Sheave Make, Size in inches, and Bore
9) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
10) Number of Belts, Make, and Size
11) Number of Filters, Type, and Size

b. Motor Data: Include the following:
1) Make and Frame Type and Size
2) Horsepower and rpm
3) Volts, Phase, and Hertz
4) Full-load Amperage and Service Factor
5) Sheave Make, Size in Inches, and Bore
6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches

c. Test Data: Include design and actual values for the following:
1) Total Airflow Rate in cfm (L/s)
2) Total System Static Pressure in Inches wg (Pa)
3) Fan rpm
4) Discharge Static Pressure in Inches wg (Pa)
5) Filter Static-pressure Differential in Inches wg (Pa)
6) Preheat Coil Static-pressure Differential in Inches wg (Pa)
7) Cooling Coil Static-pressure Differential in Inches wg (Pa)
8) Heating Coil Static-pressure Differential in Inches wg (Pa)
9) Outside Airflow in cfm (L/s)
10) Return Airflow in cfm (L/s)
11) Outside-air Damper Position
12) Return-air Damper Position
13) Vortex Damper Position

E. Fans:
1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
a. Fan Data: Include the following:
1) System Identification
2) Location
3) Make and Type
4) Model Number and Size
5) Manufacturer's Serial Number
6) Arrangement and Class
7) Sheave Make, Size in Inches, and Bore
8) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches.

b. Motor Data: Include the following:
1) Make and Frame Type and Size
2) Horsepower and rpm
3) Volts, Phase, and Hertz
4) Full-load Amperage and Service Factor
5) Sheave Make, Size in Inches, and Bore
6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
7) Number of Belts, Make, and Size

c. Test Data: Include design and actual values for the following:
1) Total Airflow Rate in cfm
2) Total System Static Pressure in Inches wg
3) Fan rpm
4) Discharge Static Pressure in Inches wg
5) Suction Static Pressure in Inches wg

F. Duct Traverses:
1. Include a diagram with a grid representing the duct cross-section and record the following:

a. Report Data: Include the following:
1) System and Air-handling Unit Number
2) Location and Zone
3) Traverse Air Temperature in Degrees F
4) Duct Static Pressure in Inches wg
5) Duct Size in Inches
6) Duct Area in SF
7) Design Airflow Rate in cfm
8) Design Velocity in fpm
9) Actual Airflow Rate in cfm
10) Actual Average Velocity in fpm
11) Barometric Pressure in PSIG

G. Diffusers/Registers/Grilles:
1. For diffusers, registers and grilles, include the following:
a. Unit Data: Include the following:
1) System and Air-handling Unit Identification
2) Location and Zone
3) Test Apparatus Used
4) Area Served
5) Air-terminal-device Make
6) Air-terminal-device Number from System Diagram
7) Air-terminal-device Type and Model Number
8) Air-terminal-device Size
9) Air-terminal-device Effective Area in SF
b. Test Data: Include design and actual values for the following:
1) Airflow Rate in cfm
2) Air Velocity in fpm
3) Preliminary Airflow Rate as Needed in cfm
4) Preliminary Velocity as Needed in fpm
5) Final Airflow Rate in cfm
6) Final Velocity in fpm
7) Space Temperature in Degrees F

H. Instrument Calibration:
1. For instrument calibration, include the following:
a. Report Data: Include the following:
1) Instrument Type and Make
2) Serial Number
3) Application.
4) Dates of Use
b. Dates of Calibration.

3.08 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Type A, Flexible Glass Wool Blanket
  2. Type B, Duct Liner
  3. Duct Insulation Accessories
  4. Duct Insulation Compounds

1.02 RELATED SECTIONS
- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.04 SUBMITTALS
- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  1. Installer qualifications.
  2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
  3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
  4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
  5. Submit manufacturer's installation instructions.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
  2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
  3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
  4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 FIRE HAZARD CLASSIFICATION
- A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15".
C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Type A, Flexible Glass Wool Blanket:
1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning
5. Or approved equivalent.
B. Type B, Duct Liner:
1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning
5. Or approved equivalent.
C. Duct Insulation Accessories:
1. Certainteed
2. Johns Manville
3. Owens-Corning
4. Or approved equivalent.
D. Duct Insulation Compounds:
1. Certainteed
2. Johns Manville
3. Owens-Corning
4. Or approved equivalent.

2.02 TYPE A, FLEXIBLE GLASS WOOL BLANKET
A. ASTM C553, Type 1, Class B-2; flexible blanket.
B. 'K' Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F installed, maximum service temperature: 250 degrees F.
C. Density: 0.75 pounds per cubic foot.
D. DBDE-free. UL/E validated to be formaldehyde-free.
E. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

2.03 TYPE B, DUCT LINER
A. ASTM C1071; flexible blanket.
B. 'K' Value: ASTM C518, 0.25 BTU*in/(hr*sf*F) at 75 degrees F, maximum service temperature: 250 degrees F.
C. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."
D. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.
E. Adhesive: UL listed waterproof type.
F. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.
G. Erosion-Resistant Surfaces: UL 181.
H. ASTM G21 and ASTM G22 Microbial Growth Resistance.
I. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per

UL 2824-“GREENGUARD Certification Program Method for Measuring Microbial Resistance”. DBDE-free. UL/E validated to be formaldehyde-free.

2.04 DUCT INSULATION ACCESSORIES

A. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

2.05 DUCT INSULATION COMPOUNDS

A. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Verification of Conditions:
   1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed.
   2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:
   1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
   2. Piping and Equipment:
      a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.
      b. Cover insulation on pipes above ground, outside of building, with aluminum jacketing. Position seam on bottom of pipe.

D. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

E. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

F. Ductwork:
   1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
   2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
   3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
   4. Coat staples and seals with vapor barrier coating.
   5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 2-inches beyond break or penetration on all directions and secure with adhesive and staples. Seal staples and joints with vapor barrier coating.
   6. Fill jacket penetrations. i.e., hangers, thermometers and damper operating rods, and other voids in insulation with vapor barrier coating. Seal penetration with vapor barrier

coating. Insulate hangers and supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.

7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.
9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.

G. Ductwork Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Duct Size	Insulation Thickness
Supply ductwork where duct is not specified to be lined.	A	All	1.5-inch
Return ductwork where duct is not specified to be lined.	--	All	None
Supply ductwork (exposed to weather, in crawl space and in unheated attics)	A	All	3-inch
Return ductwork (exposed to weather, in crawl space and in unheated attics)	A	All	3-inch

1. Note: Insulation thickness shown is a minimum. If state codes require additional thickness, then provide insulation thickness per code requirements.

3.02 TYPE A, FLEXIBLE GLASS WOOL BLANKET

A. Install insulation in conformance with manufacturer's recommendations and requirements.
B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code.) Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

3.03 TYPE B, DUCT LINER

A. Install insulation in conformance with manufacturer's recommendations and requirements.
B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners 15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom Sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

3.04 DUCT INSULATION ACCESSORIES

A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.05 DUCT INSULATION COMPOUNDS

A. Install insulation in conformance with manufacturer's recommendations and requirements.

END OF SECTION

23 09 33
ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Room Thermostats
   2. Relays and Contactors
   3. Transformers
   4. Wiring
   5. Damper Operators

B. Integration of new rooftop HVAC units into central building management system to include the following:
   1. Installation of owner provided BMS controller.
   2. Provide and install new JCI TEC 7-day programmable thermostats in each classroom and wire to HVAC units.
   3. Network control wiring from thermostats to new BMS controller.
   4. System graphics
   5. Updated sequences

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:
   1. Power wiring per Division 26, Electrical.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:
   1. Drawings: complete control diagram, including written description of control sequences.
   2. Operation and Maintenance Manual: Include record wiring drawings showing installed condition and operating changes made during start-up.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:
   1. Within 30 days prior to warranty expiration date, control supplier to visit job site and check calibration, operation, and adjustment of temperature, pressure and humidity sensors, valves, dampers, thermostats and other devices installed by control supplier. Make repair or replacement of defective control equipment as required at no charge to Owner.
   2. Submit letter to Architect certifying that this work has been completed.
   3. Attach copy of service report signed by Owner's Authorized Representative.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Johnson Controls installed by one of the following:
   1. JCI
   2. Northwest Controls Company
   3. Automated Controls (Seattle)

B. Damper Operators:
   1. Belimo
   2. Honeywell
   3. Siemens
   4. Or approved equivalent.

2.02 ROOM THERMOSTATS

A. Electronic Thermostat: JCI TEC Thermostat
   1. Seven day programmable, PI control.
   2. Occupied/unoccupied heat and cool setpoints.
   3. Automatic heat/cool changeover and fan control.
   4. Touch screen display.
   5. Cooling Stages: Provide as required to match in air conditioner.

B. Electronic BACnet Thermostat/Controller: Wall mounted, 24 VAC, LED display, up to three universal inputs, up to four outputs, dedicated temperature sensor, up to four pre-programmed control strategies.

C. Provide opaque locking guards on new and existing thermostats. Provide matching key for covers.

2.03 RELAYS AND CONTACTORS

A. Provide relays and contactors where required or as shown on Drawing to meet operating sequence where not internal to manufacturer's equipment.

B. Furnish relays or contactors with required coil voltage and contact amperage rating for use specified on Drawing and in manufacturer's equipment.

C. Mount relays in single control cabinet with hinge door and latch.

D. Control cabinet contains relays and numbered terminal strips for connection of relays and field wiring. Mount cabinet on painted plywood panel securely attached to wall framing. Mount time clock, transformer and motor contactors (if required) on plywood adjacent to control panel.

2.04 TRANSFORMERS

A. Transformers selected and sized for appropriate VAC capacity and installed and fused according to applicable codes. Provide wiring to nearest suitable power source as required.

2.05 WIRING

A. In accordance with Division 26, Electrical and applicable codes.

B. Provide line and low voltage wiring relating to control system. Includes wiring of contactors, relays, circuits, and incidental power wiring: operation power for time clock, power when run through stat/timeclock/relay, transformers.

2.06 DAMPER OPERATORS

A. Size operators to operate dampers properly against system pressures, pressure differentials and velocities. Damper operators sized for 150 percent of damper forces normally encountered. Spring return closed for outside air applications.

PART 3 - EXECUTION

3.01 SEQUENCE OF OPERATION

A. AC Units: Room thermostats to modulate economizer cycle, cooling and heating in sequence to maintain setpoint. Provide motorized low leakage outside air dampers. Dampers to be closed on fan shutdown and during NLL operation. Program thermostats to time schedule coordinated with Owner.
B. Night Low Limit: Provide night low limit thermostat to bypass system clock to maintain night setting of 60 degrees F.
C. Bypass Timer: To override system and ventilation clocks, one timer for each AC unit.

3.02 MOTOR RUN STATUS SWITCH

A. Current Sensing Switches:
    1. Route conductors through window of device as recommended by manufacturer.
    2. Where equipment load is greater than amp rating of current transformer of current sensing switch, provide 5-amp secondary rated current transformer to monitor load, routing secondary wires through current transformer of current sensing switch. Manufacturers: Veris Industries H6800 series.
    3. Coordinate location of switch with Division 26, Electrical for switching of power to fire/smoke dampers.

3.03 INSTALLATION OF AUXILIARY CONTROL DEVICES

A. General:
    1. Install sensors and thermostats in accordance with manufacturer's recommendations.
    2. Room sensors and thermostats installed at 48-inches AFF to midline of sensor on concealed junction boxes properly supported by wall framing at the locations shown on the Drawings.
B. Actuators:
    1. General:
        a. Mount and link control damper actuators according to manufacturer's instructions.
        b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
    2. Actuator Mounting for Damper and Valve arrangements to comply to the following:
        a. Damper Actuators: Do not install in the air stream
        b. Use a weather proof enclosure (clear and see through) if actuators are located outside.
        c. Damper or valve actuator ambient temperature not-to-exceed 122 degrees F through any combination of medium temperature or surrounding air. Provide appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation as necessary. Mount per manufacturer's recommendations.
        d. Actuator cords or conduit to incorporate a drip leg if condensation is possible. Do not allow water to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point to be avoided to prevent water from condensing in conduit and running into actuator.

END OF SECTION

23 11 23
FACILITY FUEL - NATURAL GAS PIPING AND SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Fuel Pipe and Pipe Fittings - General
  2. Steel Pipe and Fittings, Above Grade
  3. Natural Gas Valves
  4. Natural Gas Pressure Regulators
  5. Flexible Pipe Connectors - Gas Piping (CSA Listed)

1.02 RELATED SECTIONS
- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
  1. Division 26, Electrical requirements for grounding fuel piping systems.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Fuel Pipe and Pipe Fittings - General:
  1. Flange Gaskets:
     a. Buna-N (Nitrile)
     b. NBR
     c. Viton
     d. Or approved equivalent.
- B. Steel Pipe and Fittings, Above Grade:
  1. American Piping Products
  2. US Steel
  3. Or approved equivalent.
- C. Natural Gas Valves:
  1. Apollo
  2. Jenkins Bros.
  3. Lunkenheimer Co.
  4. Nibco
  5. Watts
  6. Or approved equivalent.
- D. Natural Gas Pressure Regulators:
  1. Maxitrol
  2. Equimeter

3. Or approved equivalent.

E. Flexible Pipe Connectors - Gas Piping (CSA Listed):
   1. Dormont
   2. Proflex
   3. Or approved equivalent.

2.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

A. Flange Gaskets: Gaskets to be constructed from elastomeric materials.
B. Install per manufacturer's recommended installation requirements.

2.03 STEEL PIPE AND FITTINGS, ABOVE GRADE

A. Steel Pipe (Above Grade Installation):
   1. ASTM A53, electric-resistance welded Type E, Grade B black pipe, manufactured for threaded pipe connections.
      a. 2-inches and Smaller: Schedule 40, ASTM A53 black steel pipe and black malleable threaded fittings.
      b. 2-1/2-inches and Larger: Schedule 40, ASTM A53 black pipe with butt weld fittings.

B. Fittings for Steel Pipe (Above Grade Installations):
   1. General: Mark fittings, unions, and other products recognized as regularly available products in accordance with MSS SP-25. Marking on products of small size or shape may be omitted from sequence allowed by MSS SP-25, except for manufacturer's name or trademark.
   2. Threaded Fittings: Conforming to ANSI B2.1, ASTM A47, 150 PSI rating, except where otherwise specified or prevailing codes or requirements dictate use of 300 PSI ratings. Fittings to be fabricated from standard malleable iron with dimensions conforming to ANSI B16.3.
   3. Welded Fittings: Wrought carbon steel fittings, ASTM A234, ANSI B16.9, B16.28. Butt-welding type unless otherwise indicated to be socket welding type.
   4. Flanges: Carbon steel conforming to ASTM A105, ANSI B16.5, and factory forged in USA. Flanges which have been machined, remade, painted, or are non-domestic origin are not acceptable. Provide raised or full face ends wherever indicated or required.
   5. Flange Gaskets: Gaskets to be constructed from elastomeric materials.
   6. Flange Hardware: Bolting materials to be corrosion resistant carbon steel bolts and hex nuts conforming to ASTM A307. Provide bolting materials used in containment sumps below grade applications, stainless steel bolts and hex nuts conforming to ASTM A453. Threads and dimensions to be in accordance with ANSI B1.1 and B18.2.
   7. Unions: Conform to ANSI B16.39, ASTM A47 and fabricated from malleable iron with bronze-to-iron ground joints rated at 150 percent design operating pressure. Threads to conform to ANSI B2.1.
   8. Threaded Pipe Plugs: Conforming to ANSI B16.14.
   9. Thread Lubricant: Meet or exceed CGA ratings and compliant with Federal Specification TT-S-1732, manufactured compatible with fuel oil.

2.04 NATURAL GAS VALVES

A. 2-inches and Smaller: MSS SP-110 ball valves constructed in compliance with ASME B16.33. UL listed, FM approved, two-piece construction, threaded, bronze or brass body, full port, chrome plated brass ball, blowout-proof stem design, 125 PSI WOG working pressure.
B. 2-1/2-inches and Larger: 100 to 125 PSI rated, all bronze or iron body/bronze trimmed plug cock type, square head or tee/lever handle operation. CSA listed.

2.05 NATURAL GAS PRESSURE REGULATORS

A. Natural Gas: Diaphragm and spring actuated type, with ventless or vented relief feature. Construction, pressure range and venting features suitable for intended service. Regulator to meet code and serving utility requirements. Pipe vented type to atmosphere in approved location.

2.06 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED)

A. Inner Hose: Type 304 stainless steel.
B. Exterior Sleeve: Braided, Type 304 stainless steel.
C. Pressure Rating: 175 PSI at 70 degrees F up to 4-inch pipe.
D. Joint: Threaded carbon steel.
E. Maximum Offset: 3/4-inch on each side of installed center line.
F. Flexible Connectors: Flexible connectors used in LP and LPG piping systems compliant with following:
    1. Install in accordance with manufacturer's instructions.
    2. Flexible connectors and hose used as flexible connectors not exceed 3-feet in length where used with liquid or vapor piping on portable or stationary tanks.
    3. Hose permitted to be used if flexibility is required for liquid or vapor transfer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Inspection: Examine areas and conditions under which fuel systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
B. Identification: Install mechanical identification in accordance with Section 22 05 53, Identification for Plumbing Piping and Equipment.
C. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
D. Remove scale and dirt on inside and outside before assembly.
E. Prepare piping connections to equipment with flanges or unions.
F. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
G. Install piping systems in accordance with manufacturer's instructions.
H. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
I. Install piping to conserve building space and avoid interference with use of space.
J. Sleeve pipe passing through partitions, walls, and floors.
K. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
L. Provide piping mains, branches and runouts installed to allow for free expansion and contraction without developing leaks or undue stressing of pipe. Provide stresses within allowable limits of ANSI B31.1 for pressure piping.
M. Equipment Connections: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions. Flexible connections where required per ASCE 7-10 or shown on Drawings.
N. Piping Tests: Test natural gas piping in accordance with applicable mechanical code requirements, ANSI B31.2, and local utility requirements at a minimum of 100 psig for 24 hours.

3.02 FUEL PIPE AND PIPE FITTINGS - GENERAL

A. Black Steel: See 3.01 General Installation Requirements above and install per local code pressure test system to 100 psig for 24 hours.
B. Fuel Piping Installation:

1. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently leakproof piping systems, capable of performing each indicated service without piping failure. Install each route with a minimum of joints and couplings, but with adequate and accessible unions or flanges for disassembly, maintenance, and replacement of valves and equipment. Reduce sizes by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerance. Comply with ANSI B31.9 Code for Pressure Piping. Provide shutoff valves, pressure regulators and unions at connections to gas-fired equipment. Provide dirt legs at low points.
2. Installed piping not to interfere with maintenance of equipment, opening of doors or other moving parts nor be directly above or near any portion of electrical equipment.
3. Support piping such that connected equipment does not bear weight of piping.
4. Adequately support vertical lines at their bases or by suitable hanger placed in horizontal line near riser or, preferably, by base fitting set on a pedestal.
5. Piping Through Roof: Coordinate roof penetrations prior to installation of piping. Coordinate location with roof structure and roof mounted equipment.
6. Ream steel pipes after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods for opening and closure.
7. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
8. Threading: Thread steel pipe in accordance with ANSI B21.1 with standard right hand threads. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or proper pipe joint tape where recommended by pipe/fitting manufacturer on male threads at each joint and tighten joint to leave not more than three threads exposed.
9. Sealants: Use sealants on metal fuel piping threads which are chemically resistant to fuel. Use sealants sparingly and apply only to male threads of metal joints.
10. Maintain electrically continuous piping system; provide grounding jumper where required to maintain continuity. Provide grounding connection; install per requirements of Division 26, Electrical.
11. Install dirt legs in gas piping where indicated and where required by code or regulation. Do not rest dirt leg on surface of roof, floor or deck.
12. Support gas piping above roof on preformed pipe stands. Guide pipes with clamp one size larger than pipe. Provide supports at intervals per code manufacturer, and details and at each change in direction. Wood blocks are not approved supports.
13. Gas Regulator Vent Piping: Provide Schedule 40, A53 black steel pipe and threaded black malleable threaded fittings for vent piping. Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.
14. Piping: Paint piping exposed to weather with primer and one coat of Safety Yellow Rustoleum.

3.03 STEEL PIPE AND FITTINGS, ABOVE GRADE INSTALLATION

A. See 3.01 General Installation Requirements above and install per current version of manufacturer's installation guidelines. Test system in accordance with requirements of local code and ANSI LC-1.

3.04 NATURAL GAS VALVE INSTALLATION

A. Prepare valves for shipping as follows:
    1. Protect internal parts against rust and corrosion.
    2. Protect threads, flange faces and weld ends.
    3. Set ball valves open to minimize exposure of functional surfaces.
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. Do not attempt to repair defective valves; replace with new valves.
D. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and on risers and branches where indicated.
E. Locate gas valves where easily accessible and protected from possible damage.

3.05 NATURAL GAS PRESSURE REGULATORS INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.
B. Vent regulators to outdoors as required.
C. Pressure Regulating Valves: Install as required at gas-fired appliances; comply with utility/code requirements. Pipe atmospheric vent to outdoors, full size outlet with 90 degree elbow downturn. Install gas shutoff valve upstream of each pressure regulating valve. Install in accordance with manufacturer's instructions to prevent freezing.

3.06 FLEXIBLE PIPE CONNECTORS - GAS PIPING (CSA LISTED) INSTALLATION

A. Install in strict accordance with manufacturer's written instructions and approved submittals.

END OF SECTION

23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Ductwork, Joints and Fittings
  2. Ductwork Joint Sealers and Sealants

1.02 RELATED SECTIONS
- A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
  1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
  2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  1. Welding Certificates
  2. Field Quality Control Reports

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. NFPA Compliance:
     a. NFPA 90A Installation of Air Conditioning and Ventilating Systems.
     b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
  2. Comply with NFPA 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, Ch. 3, Duct System for range hood ducts, unless otherwise indicated.
  3. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
  4. If required, provide ductwork pressure testing per Section 23 05 93, Testing, Adjusting and Balancing for HVAC.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.07 SYSTEM DESCRIPTION
- A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Ductwork, Joints, and Fittings:
   1. Ductmate
   2. Lindab Inc
   3. Nexus Inc
   4. SEMCO
   5. United McGill Corporation
   6. Ward Industries
   7. Or approved equivalent

B. Ductwork Joint Sealers and Sealants
   1. Ductmate
   2. Durodyne
   3. Hardcast
   4. United McGill Corporation
   5. Vulkem
   6. Foster
   7. Childer
   8. Or approved equivalent

2.02 DUCTWORK, JOINTS AND FITTINGS

A. Materials:
   1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating. Ducts to have mill phosphatized finish for surfaces exposed to view.
   2. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
   3. Stainless Steel: Fabricated in accordance with ASTM A167 and A480.

B. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
   1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
   2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
   3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

C. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.
   1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
   2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
   3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.

D. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
   1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

E. 90-Degree Tees and laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
   a. Ducts 3- to 36-inches in Diameter: 0.034-inch .
   b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
   c. Ducts 52- to 60-inches in Diameter5: 0.052-inch.
   d. Ducts 62- to 84-inches in diameter: 0.064-inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
   a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
   b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
   c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
   d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows
   a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
   b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
   c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
9. Not acceptable:
   a. Corrugated or flexible metal duct.
   b. Adjustable elbows.

2.03 DUCTWORK JOINT SEALERS AND SEALANTS

A. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
B. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
C. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.
D. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.
E. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.
F. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
G. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
H. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Low pressure	+ 1-inch	A	3	6
Return main (>24-inch)	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	3	6
Return branch (<24-inch)	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	3	6

B. Ductwork Installation:
   1. General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
   2. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics

of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.

3. Install ducts with fewest possible joints.
4. Install fabricated fittings for changes in directions, size, shape, and for connections.
5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.
9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
11. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.
12. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and AHJ, including sleeves, and firestopping sealant.
13. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Reference SMACNA's Seismic Restraint Manual: Guidelines for Mechanical Systems, Mason Seismic Restraint and Support Systems.
14. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
15. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
16. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.

C. Flanged Take-Offs:
   1. Install at branch takeoffs to outlets using round or flex duct.
   2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
   3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:
   1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
   2. Grille and Exposed Duct Cleaning:
      a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.

b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.
c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

3.02 DUCTWORK, JOINTS AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:
1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Supply, Return, Transfer, and Exhaust - Low Pressure (downstream of terminal units)	Single Wall, Galvanized Steel

B. Ductwork Installation:
1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.03 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

A. Joints and Seam Joint Sealing:
1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
3. Seal ducts before external insulation is applied.
4. Tape joints of PVC coated metal ductwork with PVC tape.
5. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
6. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
7. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
8. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
9. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
10. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
11. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage.

Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

12. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION

23 74 00
ROOFTOP PACKAGED AIR CONDITIONING UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: Materials, installation and testing of roof-mounted, packaged direct expansion air conditioning units in the following configuration:
   1. Rooftop Packaged Air Conditioning Units, Constant Volume (up to 20 tons).

1.02 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
B. In addition, meet the following:
   1. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   2. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).
   3. AHRI 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   4. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils (with Addenda 1, 2 & 3).
   5. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

1.04 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.
B. In addition, meet the following
   1. Interior surfaces of units to meet erosion and growth resistance requirements as well as construction requirements for equipment of ASHRAE 62.1, latest edition.
   2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Fabricate and label refrigeration system to comply with ASHRAE 15, Safety Code for Mechanical Refrigeration.
   4. Energy-Efficiency Ratio: Meet minimum requirements shown on drawings.
   5. Coefficient of Performance: Meet minimum requirements shown on drawings.
   6. Comply with NFPA 54 for gas-fired furnace section. Classified in accordance with ANSI Z 21.47.
   7. AHRI Certification: Provide AHRI certified and listed units.
   8. AHRI Compliance for Units with Capacities Less Than 135,000 Btuh (39.6 kW): Rate rooftop air-conditioner capacity according to AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
   9. AHRI Compliance for Units with Capacities 135,000 Btuh (39.6 kW) and More: Rate rooftop air-conditioner capacity according to AHRI 340/360, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
   10. Sound Power Level Ratings: Comply with AHRI 270, Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Provide total 5 years manufacturer's warranty for compressor(s), including parts and labor.
2. Provide 5 year manufacturer warranty on heat exchanger.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One Set for each belt-drive fan.
2. Filters: One Set of filters for each unit.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Rooftop Packaged Air Conditioning Units, Constant Volume (up to 20 tons):

1. Trane Company
2. York/Johnson Controls
3. Daikin Applied
4. AAON
5. Or approved equivalent.

2.02 ROOFTOP PACKAGE AIR CONDITIONING UNITS, CONSTANT VOLUME (UP TO 20 TONS)

A. Description: Factory assembled and tested; designed for outdoor installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, gas furnace heat exchanger, filters, dampers and other accessories/devices listed in this specification and the drawings.

B. Casing: Galvanized steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 3/4-inch thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs. Single wall construction. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance. Unit base to overhang the roof curb for positive water runoff and to seat on the roof curb gasket to provide a positive weather tight seal.

C. Indoor Fan:

1. Double width, double inlet (DWDI) forward curved, centrifugal, belt driven by single speed motor.
2. Fan assembly to have adjustable pitched sheaves on the motor. Bushings to be used on sheaves to allow for easy removal of the pulleys from the fan and motor shaft. Fixed bore pulleys fastened to the shaft by setscrews will not be allowed. Drives selected with a 1.2 service factor.
3. Fan assemblies statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. Fan assemblies to employ solid steel fan shafts. Bearings sized to provide a L-50 life of 250,000 hours.
4. Provide fan motors heavy-duty, 1800 rpm, open drip-proof (ODP). Motors efficiencies to meet EPAct premium efficiencies. Motors mounted on an adjustable base that provides for proper alignment and belt tension adjustment.
5. Fan design to allow for the fan and motor assembly to slide out of the rooftop unit for ease of servicing the equipment.

D. Outside Coil Fan: Condenser fans to be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm to be 1140 rpm maximum. Fan blades constructed of steel and riveted to a steel center hub. Condenser fan motors to be heavy-duty, non

reversing type with permanently lubricated ball bearing and thermal protection. Motor design to be totally enclosed air over (TEAO).

E. Refrigerant Coils: Aluminum or Copper fin and seamless copper tube in steel casing with equalizing-type vertical distributor. Provide phenolic epoxy corrosion-protection coating to both coils. Coils factory leak tested with high pressure air under water. Provide condenser coils protected from incidental contact to coil fins by a coil guard.

F. Compressor: Hermetic reciprocating or scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief.

G. Refrigeration System:
   1. Compressor with an automatic-reset control that shuts compressor off after five minutes.
   2. Outside coil and fan.
   3. Indoor coil and fan.
   4. Four-way reversing valve and suction line accumulator.
   5. Thermal expansion valve with replaceable thermostatic element and liquid line filter drier.
   6. Refrigerant dryer.
   7. High-pressure switch.
   8. Low-pressure switch.
   9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
   10. Low-ambient switch.
   11. Brass service valves installed in discharge and liquid lines.
   12. Refrigerant gauge parts.
   13. Charge of refrigerant (R-410a or R-407c) and oil.
   14. Independent refrigerant circuits where unit has multiple compressors.

H. Drain Pan: Stainless steel, positively sloped drain pan provided with the cooling coil. Drain pan to extend beyond the leaving side of the coil and underneath the cooling coil connections. Drain pan to have a minimum slope of 1/8-inch per foot to provide positive draining. The slope of the drain pan to be in two directions and comply with ASHRAE Standard 62.1. Drain pan to be connected to a threaded drain connection extending through the unit base.

I. Filters: 2-inch thick throwaway filters in filter rack. MERV 13.

J. Heat Exchanger: Aluminized-steel construction for natural gas fired burners with the following controls:
   1. Redundant single or dual gas valve with manual shutoff.
   2. Direct-spark pilot ignition.
   3. Electronic flame sensor.
   4. Induced-draft blower with airflow safety switch.
   5. Flame rollout switch.
   6. High temperature limit switch.

K. Outdoor/Return Air Section: A return air plenum to be provided with an outdoor air hood. Hood to allow outdoor air to enter at the back of the return air plenum. Hood to include moisture eliminator filters to drain water away from the entering air stream. Return air plenum to allow return air to enter from the bottom of the unit. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed.

L. Outside-Air Damper: Linked damper blades, for 0 to 30 percent outside air, with fully modulating, spring return damper motor. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed. Damper blades to be gasketed with side seals and jamb seals to provide an air leakage rate of no more than 4 cfm/square foot of damper area at 1-inch differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested tin accordance with AMCA standard 500.

M. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed. Damper blades to be gasketed with side seals and jamb seals to provide an air

leakage rate of no more than 4 cfm/square foot of damper area at 1-inch differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested tin accordance with AMCA standard 500.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses outside-air temperature to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

N. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

O. Electrical: Unit wiring to comply with NEC requirements and with applicable UL standards. Electrical components to be UL recognized where applicable. Wiring and electrical components provided with the unit to be number and color coded and labeled according to the electrical diagram provided for easy identification. The unit to be provided with a factory wired weatherproof control panel. Unit to have a single point power connection for main power connection. A terminal board to be provided for low voltage control wiring. Each compressor and condenser fan motor to be furnished with contactors and thermal overload protection. Supply fan motors to have a factory installed and wired control contactor. Knockouts to be provided in the bottom of the main control panels for field wiring entrance.

P. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off relay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Defrost control.
7. Dehumidification control with dehumidistat.
8. Economizer control.
9. Electric heat staging.
10. Gas valve delay between first- and second-stage firing.
11. Indoor-air quality control with carbon dioxide sensor.
12. Low-ambient control, allowing operation down to 0 degrees F (minus 18 deg C).
13. Minimum run time.
14. Night setback mode.
15. Return-air temperature limit.
16. Smoke alarm with smoke detector installed in return air.
17. Low-refrigerant pressure control.
18. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.
19. Variable-Air-Volume Control: Variable-frequency drive controls supply-air static pressure. Supply-air, static-pressure limit shuts unit down on high pressure.

Q. Accessories:

1. Condensate drain trap.
2. Dirty-filter switch.
3. Power Exhaust Fan: Propeller or Centrifugal type. Direct drive.
4. Economizer with fully controllable modulating OSA and RA dampers.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Roof curb to be mounted level on roof in accordance to NRCA manuals and details. Secure to structure per engineered/sealed seismic installation details.
C. Unit to be secured to curb per seismic installation details.
D. Seal openings between curb, roof opening, ducts, electrical conduits, piping, and building interior.
E. Protect the roof from damage during installation. Secure factory touch-up paint to repair scratches and minor damage to equipment prior to start-up. Comb evaporator and condenser coils to repair any minor fin damage.
F. Control wiring from roof-mounted equipment must be routed in conduit from above roof to inside building or must be routed through roof curb inside unit. Control wiring must not be exposed to weather.
G. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
H. Perform the following field quality-control tests and inspections and prepare test reports:
    1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
    2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
    3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
I. Remove malfunctioning units, replace with new units, and retest as specified above.
J. Engage a factory-authorized service representative to perform startup service.
K. Protect or remove energy recovery devices prior to starting the units to ensure damage does not occur to the devices or media. Replace at no cost to Owner if devices/media get damaged or are no longer in "as-new" condition.
L. Complete installation and startup checks according to manufacturer's written instructions and do the following:
    1. Inspect for visible damage to unit casing.
    2. Inspect for visible damage to furnace combustion chamber.
    3. Inspect for visible damage to compressor, air-cooled outside coil, energy recovery devices, internal coils, and fans.
    4. Inspect internal insulation.
    5. Verify that labels are clearly visible.
    6. Verify that clearances have been provided for servicing.
    7. Verify that controls are connected and operable.
    8. Verify that filters are installed.
    9. Clean outside coil and inspect for construction debris.
    10. Clean furnace flue and inspect for construction debris.
    11. Connect and purge gas line.
    12. Adjust vibration isolators.
    13. Inspect operation of barometric dampers.
    14. Lubricate bearings on fan.
    15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
    16. Adjust fan belts to proper alignment and tension.
    17. Start unit according to manufacturer's written instructions.
        a. Coordinate starting of refrigeration system during winter with manufacturer.
        b. Complete startup sheets and attach copy with Contractor's startup report.
    18. Inspect and record performance of interlocks and protective devices; verify sequences.
    19. Operate unit for an initial period as recommended or required by manufacturer.

20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.
    a. Measure gas pressure on manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.
25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.
27. Simulate maximum cooling demand and inspect the following:
    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
    a. High-limit heat exchanger.
    b. Warm-up for morning cycle.
    c. Freezestat operation.
    d. Economizer to limited outside-air changeover.
    e. Alarms.
29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

M. Adjust initial temperature, humidity, and CO2 set points.
N. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
O. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.
P. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Reference Division 01, General Requirements.

3.02 ROOFTOP PACKAGE AIR CONDITIONING UNITS, CONSTANT VOLUME (UP TO 20 TONS) INSTALLATION

A. Verify gas flue clearance from adjacent air intakes and building openings per local code and latest version of ASHRAE 62.1 prior to installation. Provide manufacturer's flue extension(s) if unable to maintain horizontal clearances.
B. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to machine to allow service and maintenance.
    1. Gas Piping: Comply with applicable requirements in Division 23, HVAC. Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.
D. Duct installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
    1. Install ducts to termination in roof curb.
    2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
    3. Terminate return-air duct through roof structure.
    4. Fill void between roof and bottom of unit with 3-pound density acoustic batt.
E. Electrical System Connections: Comply with applicable requirements in Division 26, Electrical Sections for power wiring, switches, and motor controls.
F. Ground equipment according to Division 26, Electrical.
G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

26 00 00
ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.02 RELATED SECTIONS

A. Contents of Section applies to Division 26, Electrical Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.03 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Oregon:
   a. OAR - Oregon Administrative Rules
   b. OESC - Oregon Electrical Specialty Code
   c. OFC - Oregon Fire Code
   d. OMSC - Oregon Mechanical Specialty Code
   e. OPSC - Oregon Plumbing Specialty Code
   f. OSSC - Oregon Structural Specialty Code
   g. OEESC - Oregon Energy Efficiency Specialty Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act
2. ADA - Americans with Disabilities Act
3. ANSI - American National Standards Institute
4. APWA - American Public Works Association
5. ASCE - American Society of Civil Engineers
6. ASCE 41-17 - Seismic Evaluation and Retrofit of Existing Buildings
7. ASHRAE Guideline 0, the Commissioning Process
8. ASTM - ASTM International
9. CFR - Code of Federal Regulations
10. EPA - Environmental Protection Agency
11. ETL - Electrical Testing Laboratories
12. FCC - Federal Communications Commission
13. FM - FM Global
14. IBC - International Building Code
15. IEC - International Electrotechnical Commission
16. IEEE - Institute of Electrical and Electronics Engineers
17. IES - Illuminating Engineering Society
18. ISO - International Organization for Standardization
19. MSS - Manufacturers Standardization Society
20. NEC - National Electric Code
21. NECA - National Electrical Contractors Association
22. NEMA - National Electrical Manufacturers Association
23. NETA - National Electrical Testing Association
24. NFPA - National Fire Protection Association
25. OSHA - Occupational Safety and Health Administration
26. UL - Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

1.04 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not

discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals. Electric motors are supplied and installed by Division 23 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.
9. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

10. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
    a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
11. Samples: Provide samples when requested by individual Sections.
12. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
    b. Resubmit for review until review indicates no exception taken or "make corrections as noted".
13. Operation and Maintenance Manuals, Owner's Instructions:
    a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
        3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
        4) Include product certificates of warranties and guarantees.
        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        6) Include commissioning reports.
        7) Include copy of startup and test reports specific to each piece of equipment.
        8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
    b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
    c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
14. Record Drawings:
    a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location

of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.

b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.
C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
F. Provide products that are UL listed.

1.06 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.07 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.02 STANDARDS OF MATERIALS AND WORKMANSHIP
A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.
B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

PART 3 - EXECUTION

3.01 ACCESSIBILITY AND INSTALLATION
A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
D. Firestopping:
    1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
        a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
E. Plenums:
    1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
F. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
G. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.02 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.

B. General:

1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
3. Provide stamped shop drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
4. Provide stamped shop drawings from licensed Structural Engineer, licensed in the state of Oregon, of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.03 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Prior to covering walls.
2. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.04 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
2. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
   a. Organize work to minimize duration of power interruption.
   b. Coordinate utility service outages with utility company.

3.05 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
    1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
    2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
    3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
    4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
    5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.06 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.07 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
    1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
    2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
    3. Protect bus duct and similar items until in service.

3.08 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

3.09 CLEANING

A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
    1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
    2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
    3. See individual equipment Specifications for other painting.
    4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
    5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
    6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
    1. It is the intent of these documents to provide necessary information and adjustments to electrical system required to meet code, and accommodate installation of new work.
    2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.
    3. Examination:
        a. Demolition drawings are based on casual field observation and existing record documents.
            1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.

2) Verify location and number of electrical outlets, luminaires, panels, etc. in field.

b. Report discrepancies to Architect before disturbing existing installation.
1) Promptly notify Owner if utilities are found which are not shown on Drawings.

4. Execution:
a. Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring, equipment, and luminaires, as encountered in removed or remodeled areas in existing construction affected by this work.
c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.
d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass inaccessible junction boxes and abandoned outlets.
e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.
f. Extend circuiting and devices in existing walls to be furred out.
g. Remove abandoned wiring to source of supply.
h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
i. 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.
j. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
k. Existing lighting which is to remain, leave luminaires in proper working order.
l. Repair adjacent construction and finishes damaged during demolition work.
m. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

3.13 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
a. Cleaning
b. Operation and Maintenance Manuals
c. Record Drawings
d. Warranty and Guaranty Certificates

3.14 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

END OF SECTION

26 05 09
EQUIPMENT WIRING

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.
  2. Equipment grounding.

1.02 RELATED SECTIONS
- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition:
  1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MATERIALS
- A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

2.02 GENERAL
- A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
  1. 3/4 HP and Under: 120 volt, 1 phase.
  2. 1 HP and Less than 5 HP Loads: 480 volt or 208 volt, 3 phase.
- B. Safety Switches: Provide as required by OESC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.01 EXAMINATION
- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
  1. Division 11, Equipment
  2. Division 22, Plumbing

3. Division 23, HVAC, Heating, Ventilating and Air Conditioning

3.02 INSTALLATION

A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.
B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
D. Install motor starters and controllers for equipment furnished by others.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 01, General Requirements.

3.04 SYSTEMS STARTUP

A. Adjust for proper operation within manufacturer's published tolerances.
B. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION

26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Lugs and Pads
  2. Wires and Cables
  3. Splices
  4. Connectors

1.02 RELATED SECTIONS
- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
  1. Cable insulation test reports in project closeout documentation.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Lugs and Pads:
  1. Anderson
  2. Ilsco
  3. Panduit
  4. Thomas & Betts
  5. 3M
  6. Or approved equivalent.
- B. Wires and Cables:
  1. General
     a. General Cable
     b. Okonite
     c. Southwire
     d. Or approved equivalent.
- C. Splices:
  1. Branch Circuit Splices:
     a. Ideal
     b. 3M Scotchlok
     c. Uraseal, Inc.
     d. Or approved equivalent.
- D. Connectors:

1. Anderson Power Products
2. Burndy
3. Ilsco
4. 3M
5. Thomas & Betts
6. Or approved equivalent.

2.02 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.
B. Copper Pads: Drilled and tapped for multiple conductor terminals.
C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.03 WIRES AND CABLES

A. Building Wires:
    1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.
    2. Aluminum conductors are not permitted unless written approval is received from the Engineer.
B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.
C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green
Isolated Ground	Green w/yellow trace

D. MC Cable: Not allowed.
E. AC Cable (Armored Cable): Not allowed.
F. NMB Cable: Not allowed.

2.04 SPLICES

A. Branch Circuits: Twist on, high temperature, grounding type wing nuts.
    1. Ideal Industries Wing-Nut Twist-On Connectors.
    2. 3M Scotchlok Twist-On Wire Connectors.

2.05 CONNECTORS

A. Split bolt connectors not allowed.
B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer instructions and OSSC.
B. Field Quality Control:

1. Test conductor insulation on feeders of 100 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. Notify Architect if insulation resistance is less than 1 megohm.
2. Inspect and test in accordance with NETA Standard ATS, except Section 4.
3. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.02 LUGS AND PADS

A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.
B. Use torque wrench to tighten per manufacturer's directions.

3.03 WIRES AND CABLES

A. General:
    1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F).
    2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
    3. Install conductors with care to avoid damage to insulation.
    4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
    5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
    6. Conductor Size and Quantity:
        a. Install no conductors smaller than 12 AWG unless otherwise shown.
        b. Provide required conductors for a fully operable system.
        c. Power Circuits: No. 12 AWG minimum, except as follows:
            1) No. 10 AWG for 15A, 120V circuits longer than 100 ft.
            2) No. 8 AWG for 15A, 120V circuits longer than 150 ft.
            3) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
            4) No. 8 AWG for 20A, 120V circuits longer than 100 ft.
        d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.
    7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits and all 277V circuits.
B. Conductors in Cabinets:
    1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
    2. Tie and bundle feeder conductors in wireways of panelboards.
    3. Hold conductors away from sharp metal edges.
C. Homeruns:
    1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.
E. Exposed cable is not allowed.
F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag

engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

3.04 SPLICES

A. Make splices complete and promptly after wire installation. Provide single wire pigtails for luminaire and device connections. Wire nuts may be used for luminaire wire connections to single wire circuit conductor pigtails.
B. Make splices for No. 8 and larger wires with mechanically applied pressure type connectors. Make all taped joints with Scotch 33+ or equal, applied in half-lap layers without stretching to deform. Uraseal splice kits are also acceptable through 250 KCMIL.
C. Remove insulation with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. Leave all conductors nick-free.

3.05 CONNECTORS

A. Install to assure a solid and safe connection.
B. Select hand twist connectors for wire size and install tightly on conductors.
C. Install compression connectors using methods and tools recommended by the manufacturer.
D. Do not install stranded conductors under screw terminals unless compression lugs are installed.
E. Do not connect wiring without UL listed connectors that are listed for the purposes.

END OF SECTION

26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:
   1. Anchors, Threaded Rod and Fasteners
   2. Support Channel, Hangers and Supports
   3. Rooftop Conduit Supports

B. Providing independent support for existing light fixtures currently supported within suspended ceiling systems throughout the building.

1.02 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

A. Submittals not required for this Section.

1.05 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:
   1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
   2. Support systems to be supplied by a single manufacturer.
   3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
      a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

1.06 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.07 PERFORMANCE REQUIREMENTS

A. General: Provide conduit and equipment hangers and supports in accordance with the following:
   1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
   2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of Oregon.
   1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
   2. Equipment and piping support frame anchorage to supporting slab or structure.

3. Independent support of existing light fixtures currently supported in suspended ceiling systems, in accordance with requirements of ASCE 41-17.

C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
E. Provide seismic restraint hangers and supports for conduit and equipment.
F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Anchors, Threaded Rod and Fasteners:
   1. Anchor It
   2. Epcon System
   3. Hilti-Hit System
   4. Power Fast System
   5. Or approved equivalent.
B. Support Channel, Hangers and Supports:
   1. B-Line
   2. Kindorf
   3. Superstrut
   4. Unistrut
   5. Or approved equivalent.
C. Rooftop Conduit Supports:
   1. Cooper B-Line Dura-Block Rooftop Support Base
   2. Or approved equivalent.

2.02 ANCHORS, THREADED ROD AND FASTENERS

A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Concrete Structural Elements: Use precast inserts.
   3. Steel Structural Elements: Use beam clamps.
   4. Concrete Surfaces: Use self-drilling anchors.
   5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
   6. Solid Masonry Walls: Use expansion anchors.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood Elements: Use wood screws.
D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.
F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.03 SUPPORT CHANNEL, HANGERS AND SUPPORTS

A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

1. Channel Material: Carbon steel.
2. Coating: Hot dip galvanized.

B. Pipe Straps: Two-hole galvanized or malleable iron.
C. Luminaire Chain: 90 lb. test with steel hooks.
D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.
   1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.04 ROOFTOP CONDUIT SUPPORTS

A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load
B. Capacity of 500 pounds per linear foot of support.
C. UV resistant.
D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gauge strut galvanized per ASTM A653 for bridge series.
E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduit supports.
F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.
G. Provide load distribution plates when required for heavy loads.
H. Finish: Black with safety yellow striping.
I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals
   1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
   2. Finishes:
      a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other

substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.02 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
D. Do not use supports or fastening devices to support other than one particular item.
E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
F. Provide seismic bracing per OSSC requirements.
G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
H. Use spring lock washers under fastener nuts for strut.
I. Cutting and Drilling
    1. Do not drill or cut structural members without prior permission from Architect.

3.03 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
C. Install vertical support members for equipment, straight and parallel to building walls.
D. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
E. Provide independent supports to structural member for materials or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
F. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
G. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
H. Do not use supports or fastening devices to support other than one particular item.
I. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by OESC.
J. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by OESC.
K. Support flexible conduits within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by OESC.
L. Maximum distance between supports for flexible conduits not to exceed 48-inches spacing unless otherwise required by OESC.
M. Maximum distance between supports for rigid PVC conduits unless otherwise required by OESC is as follows:

1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
3. 2-1/2-inch and 3-inch conduit, 5-feet apart.
4. 4-inch and 5-inch conduit, 6-feet apart.
5. 6-inch conduit, 7-feet apart.

N. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by OESC.
O. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.
P. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
Q. Provide seismic bracing per OSSC requirements.

3.04 ROOFTOP CONDUIT SUPPORTS INSTALLATION

A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad) under rooftop support to disperse concentrated loads and add further membrane protection.
B. Do not use supports that will void roof warranty.
C. Install supports per manufacturer's instructions and recommendations.
D. Use properly sized clamps to suit conduit sizes.
E. Install supports for rooftop raceways to raise raceways a minimum of 7/8-inches above the roof structure unless otherwise noted.

END OF SECTION

26 05 33
RACEWAYS

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Rigid Metal Conduit (RMC)
  2. Electrical Metallic Tubing (EMT)
  3. Flexible Metal Conduit (FMC)
  4. Liquidtight Flexible Metal Conduit (LFMC)
  5. Conduit Fittings
- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.02 RELATED SECTIONS
- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
  1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.07 DEFINITIONS
- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Rigid Metal Conduit (RMC):
  1. Allied Tube & Conduit
  2. Beck Manufacturing Inc.
  3. Picoma
  4. Wheatland Tube Company
  5. Or approved equivalent.
- B. Electrical Metallic Tubing (EMT):
  1. Allied Tube & Conduit
  2. Beck Manufacturing WL
  3. Picoma
  4. Wheatland Tube Company
  5. Or approved equivalent.

C. Flexible Metal Conduit (FMC):
    1. AFC Cable Systems Inc.
    2. Electri-Flex Company
    3. International Metal Hose
    4. Or approved equivalent.
D. Liquidtight Flexible Metal Conduit (LFMC):
    1. AFC Cable Systems Inc.
    2. Electri-Flex Company
    3. International Metal Hose
    4. Or approved equivalent.
E. Conduit Fittings:
    1. Bushings:
        a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
            1) Thomas & Betts 1222 Series
            2) O-Z Gedney B Series
            3) Or approved Equivalent.
    2. Raceway Connectors and Couplings:
        a. Thomas & Betts Series
        b. O-Z Gedney Series
        c. Or approved Equivalent.
    3. Expansion/Deflection Fittings:
        a. EMT: O-Z Gedney Type TX
        b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
        c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
        d. Or approved equivalent.

2.02 RIGID METAL CONDUIT (RMC)

A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
    1. Fittings: NEMA FB2.10.

2.03 ELECTRICAL METALLIC TUBING (EMT)

A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
B. Fittings: NEMA FB 1; steel, compression type.

2.04 FLEXIBLE METAL CONDUIT (FMC)

A. Description: UL 1, Interlocked steel construction.
B. Fittings: NEMA FB 2.20.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.
B. Fittings: NEMA FB 2.20.

2.06 CONDUIT FITTINGS

A. Bushings:
    1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.
    2. Insulated grounding type for threaded raceway connectors.
B. Raceway Connectors and Couplings:
    1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.

2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.
B. Conduit Size:
   1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.
C. Provide two pull strings/tapes in empty conduits. Types:
   1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
   2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
   3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
D. Elbows: Use fiberglass or PVC coated RMC for underground installations.
E. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.
F. Verify that field measurements are as shown on drawings.
G. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.
H. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
   1. Where shown on the structural drawings.
   2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
I. Verify routing and termination locations of conduit prior to rough-in.
J. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
K. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
L. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.
M. Conduit Supports:
   1. Arrange supports to prevent misalignment during wiring installation.
   2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
   3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   4. Do not attach conduit to ceiling support wires.

N. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
O. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
P. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
Q. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.
R. Keep emergency system wiring independent of other wiring systems per NEC 700.
S. Arrange conduit to maintain headroom and present neat appearance.
T. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
U. Exposed conduits are permitted only in following areas:
    1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
    2. Existing walls that are concrete or block construction.
    3. Where specifically noted on Drawings.
    4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
V. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
W. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
X. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
Y. Maintain adequate clearance between conduit and piping.
Z. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.
AA. Cut conduit square using saw or pipecutter; deburr cut ends.
AB. Bring conduit to shoulder of fittings; fasten securely.
AC. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.
AD. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
AE. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.
AF. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
AG. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
AH. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.
AI. Feeders: Do not combine or change feeder runs.
AJ. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
AK. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.02 RIGID METAL CONDUIT (RMC) INSTALLATION

A. Outdoor Locations Above Grade: RMC.
B. Damp Locations: RMC.
C. In areas exposed to mechanical damage: RMC.
D. For security conduits installed exposed and subject to tampering: RMC.

3.03 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Dry Locations:
    1. Concealed: EMT.

2. Exposed: EMT.

B. Dry, Protected: EMT.

3.04 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.

B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.

B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.06 CONDUIT FITTINGS INSTALLATION

A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.

B. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

C. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

D. Use threaded type fittings in wet locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

E. Use PVC coated, threaded type fittings in corrosive environments.

F. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

G. Condulets and Conduit Bodies:

1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.

H. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.

I. Expansion Joints:

1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.
2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
4. Verify expansion/deflection requirements with Structural Engineer prior to installation.

J. Seismic Joints:

1. No conduits cast in concrete allowed to cross seismic joint.
2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to

installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.

3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.

K. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION

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IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY
- A. Work Included:
  1. Equipment Nameplates
  2. Device Labels

1.02 RELATED SECTIONS
- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS
- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS
- A. Submittals not required for this Section.

1.05 QUALITY ASSURANCE
- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
  1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
  2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
  3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.06 WARRANTY
- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
- A. Equipment Nameplates:
  1. B & I Nameplates
  2. Intellicum
  3. JBR Associates
  4. Or approved equivalent.
- B. Device Labels:
  1. Kroy
  2. Brady
  3. Or approved equivalent.

2.02 EQUIPMENT NAMEPLATES
- A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.
- B. Color:

1. Normal (Utility): White letters on black background.

C. Letter Size:
1. Use 1/2-inch letters minimum for identifying major equipment and loads.

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:
1. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.

2.03 DEVICE LABELS

A. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate designations used on Drawings with equipment nameplates and device labels.

B. Install nameplates and labels parallel to equipment lines.

C. Where changes are made in existing panels, distribution boards, etc., provide new labeling and typewritten schedules to accurately reflect the changes.

3.02 EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.

3.03 DEVICE LABELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Degrease and clean surfaces to receive labels.

END OF SECTION