

SECTION 220513 - COMMON REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

- A. All Division 22 sections.

1.2 WORK SEQUENCE

- A. Install piping, equipment and accessories as construction progresses so cutting and patching of new construction will not be required. See also paragraph "Sequencing and Scheduling" herein.

1.3 SUBMITTALS

- A. Provide submittals in accordance with Section 013300 - Submittal Procedures.
- B. Submittal data containing manufacturer's data shall be sent to the Architect, Engineer and Owner for review.
- C. Electronic submittal data shall be assembled in Adobe Acrobat's Portable Data Format (PDF) for review.
- D. Electronic submittal data shall be assembled in one (1) complete PDF file and shall include an index sheet (TOC) listing each submittal item by specification number and its content. Each file shall also be organized with "Bookmarks" of each section. Submittals that do not have each submittal item referenced by "Bookmarks" shall be rejected.
- E. All electronic submittal data for a trade shall be submitted at one time except as noted herein.
- F. Data not submitted shall have a statement explaining why the data was not submitted.
- G. Submittals not conforming to any of the above requirements shall be rejected.
- H. The contractor shall go to each specification section to determine all technical information/data required and organize information/data using tabs for major headings as follows:
 - 1. Section 220519 - Meters and Gages for Plumbing Piping
 - a. Stem type thermometers.
 - 2. Section 220523 - General Duty Valves for Plumbing Piping
 - a. Ball valves.
 - b. Check valves.
 - 3. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment
 - a. Upper attachments
 - b. Pipe attachment (hangers and clamps)
 - c. Metal Framing Channel
 - d. Pipe Positioning Systems
 - e. Insulation Shields
 - f. Roof Mounted Pipe Supports
 - 4. Section 220553- Identification for Plumbing Piping and Equipment
 - a. Pipe markers.
 - 5. Section 220716 - Plumbing Piping and Equipment Insulation
 - a. Insulation
 - b. Jackets and Accessories
 - c. Proof of Contractor's three years experience
 - 6. Section 221116 - Domestic Water Piping
 - a. Single sheet indicating piping system and application and the pipe material intended to be used. Do not submit data sheets on piping.
 - 7. Section 221119 - Domestic Water Piping Specialties
 - a. Dielectric Connections
 - b. Solder
 - c. Wall hydrants.

- d. Water hammer arresters.
 - e. Trap primers
- 8. Section 221316 - Sanitary Waste and Vent Piping
 - a. Single sheet indicating piping system and application and the pipe material intended to be used. Do not submit data sheets on piping.
- 9. Section 221319 - Sanitary Waste Piping Specialties
 - a. Floor drains.
 - b. Cleanouts.
 - c. Flashing
- 10. Section 221423 - Facility Natural Gas Piping
 - a. Single sheet indicating piping system and application and the pipe material intended to be used. Do not submit data sheets on piping.
 - b. Valves.
- 11. Section 223300 - Electric, Domestic Water Heaters
 - a. Electric water heaters
 - b. Recirculating pumps
 - c. Hot water temperature maintenance system
 - d. Mixing valves
- 12. Section 224000 - Plumbing Fixtures
 - a. Plumbing Fixtures
- I. Manufacturer's data sheets shall be marked to clearly indicate the manufacturer, model number, size, color, accessories, required clearances, field connection details, weight loading, electrical characteristics, capacities, etc. being submitted. Submittals shall only include the products relevant to this specific project. Submittals shall not include other products produced by the manufacturer which are not specified on this project. Submittals containing several products on the same sheet shall have an arrow or other marker to identify the specific product submitted. Also, submittals for a single product that have options shall have an arrow or other marker to identify that the specified options are being provided. Submittals that include products not specified for this project, or that include several products on one sheet without being marked, or that do not show options selected shall be rejected. Variations from specifications shall be explained. Submittal preparer's name and telephone number shall be listed on the index sheet.
- J. Piping Submittals: Submittal data required for piping systems shall consist of a single sheet of paper with the type of piping systems on this project, and the corresponding piping the contractor intends to provide. For example: "Domestic Cold Water Piping Above Grade – Type 'L' copper", "Process Drain Piping Below Grade – ASTM A74, service weight hub and spigot Cast Iron." Contractor shall not submit manufacture's data sheets on piping.
- K. Review, Corrections, or Comments made on the Submittals do not relieve the Contractor from compliance with the requirements of the Drawings, Specifications and Addenda (Contract Documents). By entering into this Contract, the Contractor agrees that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept and that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and use. Review of shop drawing will be general only for basic conformance with the design concept. The review of such drawings, schedules or cuts shall not relieve the Contractor from the responsibility for correcting all errors of any sort contained in the submittals. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting proper fabrication processes, construction methods and installation techniques; coordinating this work with that of all other trades; and performing all work in a safe, workmanlike and satisfactory manner.

- L. Below are the submittal item codes that will be used when reviewing the submittal data. These codes show up on the "Submittal Review" sheet. Only one copy of the submittal review sheet is returned upon completion of the review for each trade.
1. RNE - Reviewed, No Exceptions Noted
 - a. Indicates the information provided has been reviewed and no exceptions are taken. Contractor must still comply with the contract documents.
 - b. No corrective action required at this time.
 2. FNC - Furnish with Noted Corrections
 - a. Indicates the contractor shall ensure that all necessary or noted corrections are incorporated into equipment furnished to the project.
 - b. Contractor shall incorporate items requested in review comments, but re-submittal not required.
 3. RES - Revise and Resubmit
 - a. Indicates item is not presently acceptable as submitted, but may be accepted provided additional information and/or changes are made.
 - b. Contractor shall revise and resubmit item to Engineer with additional information indicating compliance with Contract Documents prior to proceeding with work.
 4. PSD - Provide Submittal Data
 - a. Indicates submittal data was not provided for this item or section.
 - b. Contractor shall provide submittal data meeting the explicit requirements of the plans, specifications, and all addenda.
- M. Shop drawings and data submittals for materials requiring extra long delivery time shall be submitted for approval as soon as possible after execution of contract. All items shall be submitted for approval in a timely manner (prior to other submittals if necessary) so they may be properly incorporated in the building's structure. Allow a minimum of three weeks for review. No substitutions of materials or extensions of contract time will be allowed for Contractors failure to submit or order such materials sufficiently in advance of the work. See Architectural specification section for additional requirements for submittals.

1.4 REGULATORY REQUIREMENTS

- A. All work installed under Division 22 shall conform to the current adopted Edition of Building/Mechanical Codes and their appropriate amendments:
1. Life Safety Code, NFPA 101
 2. International Building Code with Georgia Amendments
 3. International Plumbing Code with Georgia Amendments
 4. Standard for Health Care Facilities, NFPA 99
 5. International Gas Code with Georgia Amendments
 6. National Fuel Gas Code, NFPA-54
 7. Installation of Sprinkler Systems, NFPA 13
 8. City of McDonough and Henry County Codes
 9. Requirements of the State of Georgia Fire Marshall's Office.
 10. ASME Boiler and Pressure Vessel Code, Section 1, 4, and 9.
 11. GA State Minimum Standard Energy Code.
 12. ASME A17.1, Safety Code for Elevators and Escalators.
- B. Obtain and pay for all permits, and request inspections from all authorities having jurisdiction, in a timely manner.
- C. Materials and Equipment included in Underwriter's Label Service shall bear that label. Electrical equipment shall be UL approved as installed, and bear the UL label, unless noted otherwise herein.

- D. Where requirements of these specifications differ from specified codes and ordinances, conform to the more stringent requirements.

1.5 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions. Shift or relocate equipment or systems to avoid conflicts with other trades. Modifications to the work required to accommodate project conditions encountered in the field shall be made at no additional cost to the contract.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.
- C. Install items so that there are no obstructions (e.g., pipes, conduits, etc.) blocking service panels of the equipment, or preventing the removal of the equipment.

1.6 SEQUENCING AND SCHEDULING

- A. Contractor shall coordinate work so as to avoid conflicts with other work in progress.
- B. Work shall progress in a manner that will not interfere with other trades. The Division 22 Contractor shall have coordination meetings with all other Contractors to ensure that all systems installed in "share areas" (e.g. ceiling plenums, mechanical rooms, etc.) are coordinated and installed to ensure proper fit and access. All costs required for the coordination of the work between trades shall be borne solely by the Contractor.
- C. Contractor shall provide confirmation letters from the factory (not from the contractor) to the Owner that long lead items have been ordered. Long lead items are defined as items having longer than six week fabrication schedules. See Division 1 - Summary for additional requirements.
- D. Phasing: Contractor shall conform to phasing plans as stated in the Architectural contract documents.

1.7 ACCEPTABLE PRODUCTS

- A. Basis of Design: Model numbers indicated herein or shown on the drawings are the Basis of Design and are based on the most recent literature provided to the Engineer from the Manufacturer's Representative. The Contractor may substitute equal and approved equipment from the basis of design manufacturer or manufacturers listed in this specification (or set forth in an addendum) provided said equipment has all features which are inherent with the "Basis of Design" equipment, meets all requirements of the plans and specifications, has like electrical characteristics (e.g., same voltage, phase, ampacity/fusing/circuit breaker requirements, single or multiple points of connection as indicated on the electrical drawings), and will properly fit in the available spaces in the building. If the Contractor chooses to provide equipment which meets all of the aforementioned requirements, but has different characteristics, from that shown on the Contract Electrical Drawings, he shall bear all costs associated with that substitution. Electrical costs include, but are not limited to materials (breakers, fuses, disconnects, wiring, conduits, panels, starters, contactors, and the like) installation costs and re-engineering. All electrical connections shall be coordinated with the Engineer and with the electrical subcontractor. Other costs may include, but are not limited to, additional structural support for heavier equipment than basis of design.
- B. Prior Approval: Substitutions of specified items and prior approvals of other manufacturers will not be considered.
- C. Acceptable Products: Where a manufacturer has been listed as being acceptable in the various specification sections (or addenda) hereinafter for a certain product, it shall be understood that the manufacturer has been approved as being capable of producing this product. This does not necessarily constitute approval of their standard product. The manufacturer's product shall still comply with all of the requirements and standards of this specification and not necessarily their standard specification, to the extent that it might require

special custom manufacture to meet the requirements and standards of this specification, the requirements of the drawings and the inherent features of the "Basis of Design". Submitted products, not complying with the explicit requirement of these specifications and drawings and with the features of the "Basis of Design" will be rejected even if their manufacturer is listed in the specifications.

1.8 DRAWINGS

- A. General: Both the drawings and specifications shall be considered supplemental to one another so that materials and labor required by one but not the other shall be supplied and installed as though specifically called for by both. Where drawings and specification conflict, Contractor shall conform to the more stringent or costly of the two requirements.
- B. Scaling: The drawings are diagrammatic only and show generally the location of the equipment and pipes but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication of work from the drawings shall be at the Contractor's risk.
- C. Existing Conditions: It shall be the Contractor's responsibility to visit the site prior to bidding the project and prior to beginning work to make himself familiar with existing conditions.

1.9 SPACE CONDITIONS AND SERVICE CLEARANCE

- A. All equipment and materials shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. All equipment normally requiring service shall be made readily accessible by not locating it above (behind, etc.) piping, ductwork, conduit or other systems. Contractor shall also provide access by means of access panels, doors, etc. to be provided under this section of specifications where required or specified. Provide sufficient space to allow service (e.g. filter removal) of all new equipment. Coordinate with all trades to ensure accessibility and service of all equipment. Equipment located above lift out ceilings shall be considered to be accessible. Equipment located above hard (unremovable) ceilings shall be considered to be inaccessible and access panels shall be provided as specified herein.
- B. The contractor shall be responsible for verifying that the particular manufacturer's equipment that he chooses will fit in the available space, and shall verify (prior to submitting equipment) that the service clearances that the manufacturer requires are available, and shall not submit equipment that will not allow the manufacturer's service clearances. During construction, the contractor shall install the equipment such that the manufacturer's service clearances are provided by reading the installation instructions. The contractors shall bear all costs associated with providing equipment that requires service clearances different from the basis of design equipment. If the manufacturer's service clearances are not provided, the contractor shall remove the equipment and provide equipment with service clearances equal to the basis of design equipment. The contractor shall submit a detailed sketch and description of any modifications to install the particular manufacturer's equipment that he chooses, to demonstrate that the equipment will fit and have the manufacturer's service clearances. The sketch is not submitted for review or approval or for confirmation that it is correct, only to certify that the contractor has completely considered the installation of substitute equipment.

1.10 MOISTURE INTEGRITY

- A. Roof: All roof penetrations shall be watertight and comply with the roof manufacturer's requirements and recommendations so as to be covered by the roof "Bond". All roof penetrations shall be made inside roof curbs (conforming to the requirements of Division 22 - Hangers & Supports for Plumbing Piping & Equipment). Pitch pockets are not acceptable.
- B. Wall: All wall penetrations shall be sealed and caulked watertight.

1.11 NOISE AND VIBRATION

- A. When in operation, all systems included in this section of specifications shall be free from objectionable or abnormal noise and vibration. See Division 22 - Hangers & Supports for Plumbing Piping & Equipment of the specifications for specific vibration isolation requirements.

1.12 PROTECTION OF MATERIALS AND EQUIPMENT

- A. Delivery, Storage and Handling: Deliver products to site in factory-fabricated protective containers, with (where appropriate) factory-installed shipping skids and lifting lugs. Store in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- B. During Construction: Pipe openings shall be closed with caps or plugs. All equipment and material shall be stored in accordance with manufacturer's recommendations. No equipment, piping, or materials shall be stored inside or outside the building unless it is properly protected from the weather. The Engineer reserves the right to reject any items furnished under Division 22 which have been damaged or are not in "like-new" condition.
- C. Suspended Equipment and Suspended Piping: Installation of suspended materials in areas where the roof is not "dried in" is only acceptable if the Contractor wraps suspended equipment and piping on three sides with a minimum 4 mil thickness polyethylene taped to the bottom of the equipment and piping. Polyethylene covering is required to protect from the weather, water, dirt, roof tar, concrete, etc.
- D. Non-Suspended Equipment and Piping: Contractor is required to wrap equipment and piping that is not suspended with two layers of 4 mil polyethylene.
- E. Prior to Final Construction Review: All materials and equipment shall be cleaned. Chipped or scraped paint shall be retouched to match. All dents and sags in equipment casings shall be straightened or replaced.
- F. Equipment Painting: Equipment which has been damaged beyond the point of retouching or has been retouched not to match the original finish shall be repainted in accordance with the Architectural painting section.

1.13 ELECTRICAL

- A. General: Motors, controls, relays and switches required for proper operation of equipment covered under this section shall be furnished and installed under this division of the specifications.
- B. Wiring: All control and interlock wiring shall be furnished and installed under Divisions 22 - Plumbing. Power wiring through the disconnect and starter and to the motor shall be furnished and installed under Division 26. All control wiring and conduit shall conform to the material and installation requirements of Division 26.
- C. Electrical Connections: Voltage, phase, ampacity and connection arrangement (e.g. single or multiple point) of each item of electrically driven equipment provided under this section of specifications shall conform to that shown on the Electrical drawings. Two speed motor winding arrangement shall match the starter type specified by Division 26.
- D. Electrical Characteristics: The horsepower, voltages and phases shown on the drawings and specified herein, are the estimated power requirements of all equipment furnished herein and is the basis of the design shown on the electrical drawings. If the Contractor provides equipment from the "Basis of Design" manufacturer or from other approved manufacturers with larger horsepower, different voltages, different phases or ampacity, he shall coordinate with other trades to provide any additional wiring, circuitry, starters, breakers, transformers, etc., as required at no additional cost to the Contract.

1.14 PAINTING

- A. All bare steel piping, pipe hangers, supports and miscellaneous metal exposed to view provided under this section of specifications, shall be cleaned and painted under the Architectural painting section of the specifications. Supports, hangers and accessories exposed to view shall not be electroplated, in order to allow them to be painted. All bare steel piping, pipe hangers, supports and miscellaneous metal on the roof shall be cleaned and painted under the Architectural Painting Section of the specifications. In the event that there is no Architectural painting section, painting shall be done under this division of the specifications in accordance with the requirement of ANSI A13.1.81.

1.15 CLEANING

- A. The Contractor shall maintain the site reasonably clean and free of excessive debris and leftover materials at all times. All trash and debris shall be hauled from the job site on a daily basis for disposal. Prior to testing and adjusting, equipment shall be clean and free of any construction debris and litter.
- B. Contractor shall meet all contractual requirements as related to site cleanliness including dust control.

1.16 HAZARDOUS MATERIAL ALERT FOR NEW MATERIALS

- A. Contract Materials which are scheduled to be incorporated into the work under this Contract shall first either be certified by the Manufacturer to be free of hazardous materials or be inspected and tested by accredited laboratories and certified to be free of hazardous material content (e.g. Asbestos, PCBs, lead, etc.) in accordance with OSHA, EPA and AHERA Rules (and 1982 School Rules).

1.17 ACCESS PANELS

- A. Some plumbing systems may be made inaccessible by the installation of "hard" ceilings or by walls above the ceiling. See the finish schedule and the floor plans (architectural drawings) for the location of all "hard" ceilings and walls which extend above the ceiling. Provide access panels in these ceilings or walls (and any other locations where plumbing items are made inaccessible by ceilings or walls) for access to plumbing equipment and items requiring access above these ceilings.
- B. For all access panels in gyp board and masonry, provide in accordance with Division 8 - Access Doors and Frames.
- C. For all access panels in masonry, construction shall be as follows: Panels shall be sized as required for proper access and removal of the equipment but as a minimum shall be 18" x 18". Access panels shall have concealed continuous hinge, flush (not recessed) door, 14 gauge galvanized steel frame with prime coated finish, with pre-drilled anchor holes in corners, 1/4 turn flush mounted screwdriver operated latch(es) (on maximum 8" centers) and 14 gauge steel door with prime coated finish and rounded corners. Entire panel shall be painted to match ceiling or wall. Provide fire-rated access panel where required. Access panels shall be manufactured by Venco Products, Inc., Elmdor or Cesco.

1.18 GENERAL DEMOLITION

- A. General: Demolition shall include the wrecking and removal of certain plumbing components. See drawings for extent of demolition.
- B. Disposal: All equipment shall be carefully removed during demolition. Equipment not retained shall become property of the Contractor and shall be lawfully removed from site. With regards to the salvage value of property that is to be demolished, Owner shall not be responsible for condition of or loss of, or damage to such property after award of contract.
- C. Existing work to remain shall be protected by temporary covers, supports, etc. during demolition work. Should any item that is to remain be damaged during demolition work, it shall be repaired to its original condition or replaced with new.

- D. Provide weather protection for all interior portions of the building during demolition work. Where existing wall mounted or roof top or other equipment is being removed and expose the building to the elements, have materials and workmen ready to install adequate temporary covering of the exposed area.

1.19 STRUCTURAL COORDINATION

- A. The party responsible for the installation of the system furnished under Division 22 shall provide the General Contractor with the weight of all plumbing equipment and piping and the exact location. General Contractor shall then insure all structural members are properly sized and all plumbing penetrations are properly framed to support the full perimeter of the equipment. See also paragraph "Acceptable Products".

1.20 CONTRACTOR REQUESTS FOR ELECTRONIC COPIES OF CAD DRAWINGS

- A. Electronic copies of CAD drawings will not be available.

END OF SECTION 220513

SECTION 220514 - CLOSEOUT DOCUMENTS FOR PLUMBING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing closeout document requirements which are specifically applicable to all Division 22 Sections, in addition to the requirements of Division 1 - General Requirements.
- B. Plumbing Closeout document requirements.
- C. Record Document Submittals "As-Built".
- D. Contractor Guarantee.
- E. Manufacturer Warranties.
- F. Operating Instructions and Training.
- G. Operation and Maintenance (O&M) Manuals.
- H. O&M Instruction Form.
- I. Maintenance, Inspections, and Service.
- J. Manufacturer's Field Services and Factory Start-up

1.2 RELATED WORK

- A. All Division 22 sections.

1.3 RECORD DOCUMENT SUBMITTALS

- A. The contractor shall be required to maintain a clean, undamaged set of blue or black line white prints of contract drawings and shop drawings.
- B. The contractor shall mark the set to show the actual installation where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
 - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
 - 2. Mark new information that is important but was not shown on Contract Drawings or Shop Drawings.
 - 3. Note related Change Order numbers where applicable.
 - 4. Organize record drawing sheets into manageable sets, bind them with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.
 - 5. "As-builts" shall be submitted to the architect/engineer for review of the plumbing systems as installed upon completion of the work. Changes on "as-builts" are to be shown using standard engineering drafting practices. Freehand drawn changes will not be accepted.

1.4 CONTRACTOR GUARANTEE

- A. All equipment and materials furnished (and/or installed under this section) and all work performed under this section of specifications, shall be guaranteed to be free of defective materials and workmanship for a period of one year (unless a longer period is specified elsewhere) after date of substantial completion. Upon notice of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.

1.5 MANUFACTURER'S WARRANTIES

- A. Provide as a minimum a one (1) year manufacturer's equipment warranty against defective components for each piece of equipment and its components installed under their respective specification section prior to final inspection in accordance with each of the trades listed below. Equipment warranties shall commence on the date of Substantial Completion as established in the Certificate of Substantial Completion issued by the Architect. Contractor shall note that there may be more than one certificate of Substantial Completion and date of Substantial Completion for this contract. Any parts which fail during the first year shall be replaced by the Contractor at no additional cost to the Owner.
- B. Plumbing: Each piece of equipment and its components furnished shall carry a minimum one (1) year warranty for replacement of parts and the labor required to complete such warranty work. Equipment and parts requiring warranties longer than one (1) year are listed below.
 - 1. Section 223300 – Electric, Domestic Water Heaters:
 - a. Electric Water Heaters (80 Gallons and Smaller): 3 year heater and parts
 - 2. Section 224000 – Plumbing Fixtures:
 - a. Flush Valves: 3 year parts only
 - b. Water Coolers: 5 year refrigeration system

1.6 OPERATING INSTRUCTIONS AND TRAINING

- A. Instructions: Instruct operating personnel as required (but a minimum of 16 hours) in operation and maintenance of all systems included in this Division (22) of the specifications. In addition, there shall be a quantity of dedicated instruction for certain specific pieces of equipment as specified in the individual specification sections herein. Provide signed O & M Instruction Verification Form as specified in later paragraph certifying instructions have been received.
- B. Training: See each specification section for specific training requirements.

1.7 OPERATING AND MAINTENANCE (O&M) MANUALS

- A. Operating and maintenance manuals shall comply with Division 1 - Operation and Maintenance Data.
- B. One bound and indexed Operating and Maintenance Manuals and one electronic copy (PDF format) shall be prepared by the Contractor and be submitted for approval prior to delivery to operating personnel. Binder shall be 3-ring commercial grade, complete with inside storage pockets, sheet protectors, spine and front cover labels.
- C. Each Manual shall contain the following information, data, and drawings. The exact format and order of the following information shall comply with Division 1's requirements. If no Division 1 requirement exists, format and order shall be as listed below.
 - 1. List of Contents. Insert under clear front cover of binder.
 - 2. Health Department Potable Water Systems Certificate.
 - 3. Contractors one (1) year guarantee.
 - 4. Manufacturer's equipment warranties (provide a warranty for each piece of equipment).
 - 5. Copy of O & M Instruction Form showing Contractor has instructed designated personnel in the proper operation of all Division 22 systems.
 - 6. Installation, operating and maintenance instructions for each item of equipment. Provide trouble shooting checklist guide.
 - 7. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.
 - 8. Copy of approved submittals, shop drawings showing layouts and construction details.
 - 9. Video inspection of sanitary waste piping along with inspection firm report and written description of contractor corrections to address issues in the report.

1.8 MAINTENANCE AND SERVICE

- A. Maintenance: The Contractor shall provide any necessary services for all systems installed under these contract specifications for one year from date of substantial completion.
- B. Parts and Labor: Provide repair parts and all labor during maintenance periods.

1.9 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. After the potable water piping systems (hot, cold, and recirculating) have been completed, these piping systems shall be flushed to remove foreign materials from piping. The piping systems shall then be adequately disinfected as per federal specifications BB-C-120.
- B. Subsequent to the disinfection, water samples shall be sent to the local health department (LHD) for testing. LHD approval shall be obtained before the system is put into service.
- C. Repeat disinfection and/or flushing until the samples are approved by the local health department. Provide health department approved certificate in O&M manuals. All cost associated with disinfection and sample testing shall be borne by the Contractor.

1.10 MANUFACTURER'S FIELD SERVICES AND FACTORY START-UP

- A. Refer to each specification section for additional requirements the manufacturer shall provide under the provisions of this specification.
- B. Upon completion of the equipment installation the Contractor shall obtain the services of the factory authorized and trained representative at no additional cost to the owner to perform a start-up of the piece of installed equipment. The factory authorized and trained representative shall submit a certificate or letter stating the equipment has been successfully started, adjusted, and tested in accordance with the manufacturer's recommendations. Contractor shall refer to each specification section to determine which equipment/systems require start-up by factory authorized personnel. Some representative equipment/systems which require start-up are listed below.
 - 1. Water Heater

1.11 O & M INSTRUCTION FORM

- A. Contractor shall provide instruction to operating personnel for the minimum hours specified in each specification section.

- B. Contractor shall coordinate a schedule of startup/operation and maintenance instruction meetings between the Owner's representatives, various subcontractors, and manufacturer's representatives. Submit the following completed form. Some representative systems and equipment are included in the form below, but contractor shall customize the form based on the specific systems and equipment on this project.

OPERATIONAL INSTRUCTION VERIFICATION FORM

Operation and maintenance procedures for major systems and equipment were thoroughly explained to the Representatives as follows:

Equipment Item	Date Instruction Received	Owner's Representative Name (printed)	Owner Representative Initial or Signature
PLUMBING			
Water Heating System			
"I certify that the operation and maintenance procedures of all the major systems have been thoroughly explained to the Owner's Representative."			
Company:			
Name:			
Title:			
Signature:			
Date:			

END OF SECTION 220514

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following meters and gauges for plumbing systems:
 - 1. Stem type thermometers.
 - 2. Separable socket wells.

1.2 SUBMITTALS

- A. Product data shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment. For each type of product herein, include performance curves.
- B. Shop Drawings: Schedule for thermometers indicating manufacturer's number, scale range, and location for each. Identify the specific ranges for the equipment used on this project for thermometers. Submittals showing thermometers and gauges with multiple sizes, ranges, materials, etc., without showing specific sizes, ranges, materials, etc., for this project will be rejected.
- C. Operation and maintenance data shall be submitted under provisions of Division 22 - Closeout Documents for Plumbing.

PART 2 - PRODUCTS

2.1 STEM TYPE THERMOMETERS

- A. General: Adjustable angle industrial type constructed of brass or cast aluminum (no plastic allowed) case, rattle-proof glass window, black scale graduations and red reading mercury tube. Stem to be constructed of brass or stainless steel, with 3/4" thread for use with separable socket well. Scale to be 7" long with 3-1/2" long stem.
- B. Ranges:
 - 1. Domestic Hot Water: 30° to 240°F in 2° divisions.
- C. Manufacturers: Stem type thermometers shall be manufactured by Ashcroft, Terrice, Weksler, Weiss, Palmer or Moeller.

2.2 SEPARABLE SOCKET WELLS

- A. Provide for all thermometers and control bulbs mounted in piping. Wells shall be constructed of brass or stainless steel, be furnished complete with screwed cap and shall have lagging extension. Wells shall be suitable for 3-1/2" stems. Where wells are installed in straight runs of pipe smaller than 2-1/2", increase pipe size to 2-1/2" for minimum 4" either side of well. Wells shall be installed at 45 degrees or greater above horizontal and be filled with SAE 10 W oil.

PART 3 - EXECUTION

3.1 INSTALLATIONS

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. All thermometers shall be installed in accessible locations in accordance with manufactures instructions.

3.2 CONNECTIONS

- A. Install thermometers adjacent to machines and equipment to allow service and maintenance for thermometers, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of thermometers to proper angle for best visibility.

END OF SECTION 220519

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following general-duty valves:
 - 1. Ball valves.
 - 2. Check valves.

1.2 SUBMITTALS

- A. Product data for each type of valve indicated shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment. Provide certification that products comply with NSF 61 Annex G.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
 - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.
- C. NSF Compliance: NSF-372 Annex G for valve materials for potable-water service.

1.4 STORAGE

- A. 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.

PART 2 - PRODUCTS

2.1 SHUT OFF VALVES

- A. Shut off valves for the (domestic) hot water, recirculating hot water and cold water systems shall be:
 - 1. Ball Valves: 2" and smaller; 400 psi WOG; standard port, 2-pc. bronze construction, blow-out proof stem, solder or threaded ends as applicable. Provide chrome plated forged brass ball. Provide teflon (TFE) packing and packing nut to allow stem leakage correction. "O" ring seals are not allowed. Valve shall conform with MSS-SP110. Provide a stem extension on insulated piping. Length of extension shall be a minimum of 2-1/4". If stem extension is not factory installed, contractor shall field install stem extension.
 - a. Nibco: S-FP-600A-LF
 - b. Watts: ---
 - c. Apollo Valves: 70LF-200-01, 70LF-100-01
 - d. Milwaukee: UPBA400/UPBA450

2.2 CHECK VALVES

- A. Check Valves 2" to 12": 200 psi WOG; horizontal swing 2" and smaller; regrinding type, renewable discs, Y-pattern, solder ends.
 - 1. 2" and Smaller:
 - a. Nibco: S-413-LF or T-413-LF
 - b. Apollo Valves: 161S-LF or 161T-LF
 - c. Watts: --
 - d. Milwaukee: UP1509

2.3 BALL VALVE WITH TAMPER SWITCH

- A. 2" and Smaller: Bronze body, U.L. listed - F.M. approved, Full Port Ball Valve. NIBCO T-505-4 or equal by Crane or Milwaukee. Tamper switch shall be built in to the valves; U.L. Listed - F.M. Approved.
 - 1. Switch designed for installation on indicator valves with cased aluminum housing with red finish; U.L. Listed - F.M. Approved. Notifier, Simplex or equal.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install Swing Check Valves in horizontal position with hinge pin level.
- F. Install valves with stems upright or horizontal, not inverted.
- G. All valves, manually operated, 6-inches and larger located 12 feet or more above the finished floor elevation in the mechanical room shall be installed with their spindles horizontal and provided with chain wheels. Chains shall loop within four (4) feet of the finished floor. Provide holding clips to secure chains when the valve is not being used.
- H. Use ball valves for shutoff and to isolate equipment, to isolate systems and vertical risers.

3.2 JOINT CONSTRUCTION

- A. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.3 ADJUSTING

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

END OF SECTION 220523

SECTION 220529 - HANGERS & SUPPORTS FOR PLUMBING PIPING & EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following hangers, supports and accessories for mechanical system piping and equipment:
 - 1. Coatings
 - 2. Upper attachments
 - 3. Pipe attachment (hangers and clamps)
 - 4. Metal Framing Channel
 - 5. Hanger Rods
 - 6. Pipe Positioning Systems
 - 7. Insulation Shields
 - 8. Concrete Equipment Bases
 - 9. Flashings
 - 10. Sleeves
 - 11. Roof Mounted Pipe Supports

1.2 PERFORMANCE REQUIREMENTS

- A. All supports utilized under Division 22 shall meet the sizing criteria specified herein. No support shall be loaded to more than 20% of its yield strength (thereby providing a safety factor of 5). All support sizes specified herein (for hanger rods, trapeze hangers, pipe attachments, etc.) are minimum sizes required. Contractor shall utilize larger size supports where actual loads dictate a larger support.

1.3 SUBMITTALS

- A. Submit product data under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Submit product data on roof equipment curbs and supports, upper attachments, pipe attachments, lower pipe supports, metal framing channel, pipe positioning systems, and vibration isolators.

1.4 WELDING REQUIREMENTS

- A. Welding Requirements: All welding performed to support Mechanical piping and equipment shall comply with AWS D1.1, "Structural Welding Code - Steel". Welders shall be qualified per AWS and welding certificates shall be posted at the jobsite.

1.5 COATINGS

- A. All supports for piping and equipment, hangers and accessories, including but not limited to bolts, nuts, washers, rods, beam clamps, etc., shall be galvanized, except as indicated in the following paragraphs.
- B. Hangers and supports in direct contact with copper piping shall be copper plated.

PART 2 - PRODUCTS

2.1 UPPER ATTACHMENT

- A. Poured in Place Concrete: Contractor may install concrete inserts or drill concrete anchors. Inserts shall be:
 - 1. B-Line: B 2500
 - 2. C&P: 75
 - 3. Anvil: 281
 - 4. Erico/Michigan: 355
 - 5. PHD: 950, 951

- B. Concrete Anchors: Anchors shall be expansion "drop-in" type with an actual load less than 1/3 the manufacturers listed allowable working load for tension in 2,000 psi concrete. Anchors shall be installed in drilled holes per manufacturer's recommendations. Approved manufacturers:
 - 1. Hilti: 5490000
 - 2. Red Head: RM-Multi-Set II
 - 3. Rawl: 6300 Drop-In
- C. Steel Beams:
 - 1. Piping 2" and smaller: Malleable Iron C-Clamp with Lock Nut.
 - a. B-Line: B 3033 or B3034
 - b. C&P: 192
 - c. Anvil: 94
 - d. Erico/Michigan: 280
 - e. PHD: 350 or 360
 - f. FNW: 7203 or 7204
- D. Steel Bar Joist: Malleable Iron C-Clamp with Lock Nut.
 - 1. B-Line: B 3033 or B3034
 - 2. C&P: 192
 - 3. Anvil: 94
 - 4. Erico/Michigan: 280
 - 5. PHD: 350 or 360
 - 6. FNW: 7203 or 7204

2.2 PIPE ATTACHMENT

- A. PVC and cast iron pipe hangers: Size sanitary waste, and vent pipe hangers to fit piping inside the insulation.
 - 1. B-Line: B3100
 - 2. C&P: 100
 - 3. Anvil: 260
 - 4. Erico/Michigan: 400, 401
 - 5. PHD: 450, 451
- B. Copper tubing hangers: Size hot, cold and recirculating water pipe hangers to fit piping inside insulation.
 - 1. B-Line: B3170CT
 - 2. C&P: 800CT
 - 3. Anvil: CT-69
 - 4. Erico/Michigan: 101
 - 5. PHD: 152
- C. Steel Pipe Hangers: Size steel pipe hangers to fit the piping.
 - 1. For Pipe Sizes 2" and Smaller:
 - a. B-Line: B3170
 - b. C&P: 800
 - c. Anvil: 70
 - d. Erico/Michigan: 100
 - e. PHD: 151
- D. Vertical supports shall be:
 - 1. Offset pipe clamp:
 - a. B-Line: B3148
 - b. C&P: 179
 - c. Anvil: 103
 - d. Erico/Michigan: 700
 - e. PHD: 535

2. Riser clamp:
 - a. Steel:
 - 1) B-Line: B-3373
 - 2) C&P: 126
 - 3) Anvil: 2612
 - 4) PHD: 500, 551
 - 5) Erico/Michigan: 510
 - b. Copper:
 - 1) B-Line: 3373CT
 - 2) C&P: 126CT
 - 3) Anvil: CT121
 - 4) PHD: 552
 - 5) Erico/Michigan: 511

2.3 METAL FRAMING CHANNEL

- A. Where possible and practical, piping shall be supported with trapeze hangers consisting of a metal framing system of channel, fittings, and hardware as defined in the Metal Framing Manufacturer's Association Standard Publication MFMA-1. Length of trapeze supports shall not exceed 4 feet unless contractor performs and submits calculations which indicate the channel is within the manufacturer's recommendations with a safety factor of 30% added to the load.
- B. Vertical Pipe Supports: Where shown on the drawings, vertical routed piping shall be supported and/or stabilized by steel channel meeting the requirements for channel as specified herein.
- C. Channel shall be constructed of 12-gauge steel. Nominal width shall be 1-5/8" x 1-5/8" with a 9/16" wide and 7/8" long slot face opening, with slots on 2" centers. Channel shall be pre-galvanized in accordance with ASTM A 653 G90, or have a factory applied electro-deposited epoxy finish.
- D. Pipe clamps shall be sized as follows:
 1. Non-insulated Steel Piping: Sized to fit piping.
 2. Insulated Piping: Sized to fit outside of insulation.
 3. Copper Piping: Sized to fit outside of piping plus elastomeric isolation material.
- E. Approved Manufacturers: B-Line Model B22SH, Elcen, Unistrut, and Superstrut by Midland-Ross.

2.4 HANGER RODS

- A. Steel Hanger Rods: Continuous threaded rod. Size as indicated in individual piping specification sections.
- B. Rods supporting trapeze hangers shall be 1/2" unless actual loads dictate a larger rod. Rods supporting mechanical equipment shall be sized in accordance with the manufacturer's installation instructions. If no size is given, rod size shall be minimum 3/8", unless actual load dictates a larger rod. No support shall be loaded to more than 20% of its yield strength (thereby providing a safety factor of 5).
- C. Rod couplings shall be:
 1. B-Line: B3220
 2. C&P: 167
 3. Anvil: 136, 136R
 4. Erico/Michigan: 26
 5. PHD: 100, 105

2.5 PIPE POSITIONING SYSTEMS

- A. Definition: A combination of straps, brackets and clips designed to correctly locate pipes in walls relative to fixtures or equipment.

- B. Metal Components: Metal components of the system must be pre-galvanized steel ASTM A446 Grade A or better. Metal parts in contact with copper pipe shall be copper plated steel ASTM A611 Grade C or better. All metal components must be stamped with the manufacturer's name and part number and the UPC certification mark.
- C. Plastic Components: Plastic components shall be made of polypropylene or Lexan 141 with a flame-retardant rating UL94V2 or better. All plastic parts must be stamped with the manufacturer's name and part number.
- D. Manufacturers: B-Line Rufflin®, Holdrite Corp by Hubbard or equal by Erico/Michigan.

2.6 INSULATION SHIELD

- A. Provide insulation shields at all pipe hangers installed on the exterior of the insulation and at all pipe clamps and trapeze supports. Shields shall be fabricated from minimum 18-gauge galvanized steel. Shields at pipe hangers shall be 12" long with a 180-degree arc. Shields at pipe clamps shall cover entire pipe. Contractor may utilize the following shields:
 - 1. B-Line: B3151
 - 2. C&P: 265P
 - 3. Anvil: 167
 - 4. Erico/Michigan: 121
 - 5. PHD: 170

2.7 EQUIPMENT BASES

- A. Bases shall be 3,000 psi concrete and provided in accordance with Division 3, Section Cast-In-Place Concrete.
- B. Bases shall be rectangular, unless otherwise indicated, with vertical side 6 inches from centerline of anchor bolts or 4 inches from edge of equipment, whichever provides larger dimension. Provide 1 inch chamfer on edges and corners. Provide 6 inch x 6 inch 10/10 WWF reinforcing wire at mid-depth of slabs, 6-inch deep or less, or at 1/3 and 2/3 depth of slabs thicker than 6 inches. Provide 1" clearance from adjacent walls for pumps. All equipment shall be anchor bolted to the concrete pad unless noted otherwise. Base height shall be as follows:
 - 1. Water Heaters - 4 inches

2.8 FLASHING

- A. Vents Thru Roof: Provide flashing as detailed on Architectural drawings.

2.9 SLEEVES

- A. Pipe Sleeves: Pipe sleeves thru floors shall be fabricated from schedule 10 (minimum) steel pipe, and shall extend 1 inch above floor. Pipe sleeves thru walls shall be fabricated from Schedule 10 (minimum) steel pipe and shall be flush with both sides of walls, unless noted otherwise on drawings. Sleeves on copper piping through slab on grade shall be Schedule 40 PVC (minimum). Omit sleeves on sanitary waste and vent and storm drain pipe penetrations thru slabs on grade.

2.10 ROOF MOUNTED PIPE SUPPORTS (NON-PENETRATING TYPE)

- A. Piping Supports on Roof: Where noted specifically on the drawings, piping shall be supported on the roof by a pre-manufactured engineered system designed for mounting atop the roof without penetrating the roof. Piping support shall consist of polycarbonate resin bases with UV stabilizers, stainless steel threaded rod vertical supports, self-lubricating roller system. Support shall conform to detail on drawings, and shall be Series RAH as manufactured by Miro or equal by Pate, Mapa Products, Curbs Plus, Roof Top Blox, PHP or RPS.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support spacing requirements are specified in Sections specifying piping systems and equipment.
- B. Use galvanized hangers and supports for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Hanger Shield Installation: Install shield in pipe hanger or shield for insulated piping.
- D. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 - Plumbing Fixtures for plumbing fixtures.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2½" and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

3.3 CONCRETE EQUIPMENT BASES AND SUPPORTS

- A. Provide equipment bases of concrete. To reduce vibration to adjacent walls, bases shall not be placed within 1/4" of adjacent walls. Obtain templates, anchor bolts, and accessories for mounting and anchoring equipment. Provide concrete bases at least 6" beyond the footprint of the equipment that the contractor provides, or as shown on the plans, whichever is larger.

3.4 PIPE HANGER ADJUSTING

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

3.5 PAINTING

- A. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Painting Section.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.
- C. In areas that are to be painted and also are exposed to view in public areas, supports for piping and equipment, hangers and accessories including but not limited to bolts, nuts, washers, rod, angle iron, beam clamps, etc. shall be plain steel with a coat of rust inhibiting primer. Primer shall be applied prior to installation of supports. Supports, hangers and accessories exposed to view shall not be galvanized or electroplated, in order to allow them to be painted in accordance with the Architectural painting section. Areas that are to be painted but that are not exposed to view to the public, such as mechanical rooms, shall be galvanized as required above.

3.6 SLEEVES AND PENETRATIONS

- A. Provide pipe sleeves for all piping and conduit penetrations through floors and walls.
- B. Set sleeves in position during construction of walls or floors prior to placement of brick, concrete block or cast-in-place concrete.
- C. Piping and Conduit Penetrations through Rated Walls or Floors: Firestopping methods and materials shall be in accordance with Division 7 - Penetration Firestopping. Assembly shall meet the wall or floor rating as specified by the Architect. See Architectural drawings for rating requirements. Sleeve's size and material shall be coordinated with Division 7 - Penetration Firestopping.
- D. Piping and Conduit Penetrations through Non-rated Walls or Floors: Pack space between pipe or conduit and sleeve with fiberglass batts and with a minimum of 1 inch thick, non-sagging caulking material on one side. Caulk material is not required to be fire rated, but shall comply with Division 7 - Penetration Firestopping.
- E. Install chrome plated steel escutcheons at finished surfaces for piping.
- F. Division 22 Contractor shall furnish the General Contractor with the clear opening dimensions and elevations and locations of all penetrations through walls and floors, so that the General Contractor may provide appropriate wall and floor openings for these penetrating items. Penetrating items include, but are not limited to, piping. Clear opening dimensions and elevations and locations shall be furnished in a timely manner to allow General Contractor to frame openings during wall and floor construction, and to prevent the need for removing new work. Contractor is warned that the project may contain shear walls which require steel reinforcing/framing around perimeter that must be installed during the construction of the wall, and which cannot be installed after the wall is constructed without significant demolition of the wall and reconstruction of the wall. Coordinate with General Contractor to determine location of shear walls.

3.7 SUSPENDED EQUIPMENT AND PIPING SUPPORTS

- A. Provide steel drop rod supports or angle iron supports, secured (spot welded or clamped in bar joist areas) to building main structural components for all suspended equipment and piping. Supplemental angle iron framing shall be provided where required between bar joists and shall be minimum 3 x 3 x 1/4 for equipment and large piping (4" and larger), and minimum 2 x 2 x 1/4 for small equipment and small piping. 1-5/8 x 1-5/8 x 12-gauge channel may be used to span bar joist in lieu of 2 x 2 x 1/4 angle provided that previous paragraph "Performance Requirements" are met. Contractor shall note that supplemental angle sizes are minimum. Contractor shall provide larger size supplemental angle iron framing as appropriate to safely and appropriately support equipment. Provide vibration isolation where specified. Coordinate all equipment and pipe supports with steel fabricator/erector and do not overload any building structural members or supplemental framing members. Provide securely tightened lock nuts on all drop rod supports and connections.

END OF SECTION 220529

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SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 - 1. Equipment markers.
 - 2. Pipe markers.

1.2 SUBMITTALS

- A. Product data for each type of product included herein shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT MARKERS

- A. Markers shall be Contractor fabricated to have equipment "tag" or number (e.g., WH-1, RP-2, etc.) on marker.
- B. Designation:
 - 1. Equipment tag shall be etched in 1/2" maximum, 1/4" minimum height letters and mounted on or adjacent to device cover or attached to the item of equipment. For items above ceiling, marker shall be attached to ceiling on t-bar grid in location approved by Owner.
 - 2. Type: White core black bakelike secured with epoxy glue or screws, unless otherwise noted.

2.2 IDENTIFICATION OF PIPING

- A. Piping shall be labeled with pre-tension pre-coiled semi-rigid plastic snap-on pipe markers equal to Seton "Setmark" pipe markers or by Brimer or Brady, or self adhesive plastic pipe markers with pressure sensitive, permanent type self-adhesive back, or field stenciled if pre-made marker is not manufactured. Provide arrow identifying direction and system description as listed below. Background and letter colors shall be in conformance with latest version of ANSI/ASME A13.1. The following piping systems shall be provided with pipe markers.
 - 1. Domestic cold water
 - 2. Domestic hot water
 - 3. Domestic hot water return
 - 4. Gas
- B. Height of letters shall be as follows:
 - 1. Outside Diameter (Outside insulation on insulated piping)
 - a. 1/2" - 1-1/4": Letter height shall be 1/2"
 - b. 1-1/2" to 2": Letter height shall be 3/4"
 - c. 2-1/2" to 6": Letter height shall be 1-1/4"

2.3 VALVE LOCATORS/MARKERS

- A. Where valves are installed above lift out ceiling tiles, markers shall be permanently installed on the ceiling grid immediately below the valves. Markers shall be in ANSI/ASME 13.1 standard colors, round acrylic with adhesive backing. Seton ceiling markers are basis of design.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 22 Sections.

3.2 EQUIPMENT IDENTIFICATION

- A. Install equipment markers with permanent adhesive on or near each major item of plumbing equipment.
 - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - 2. Data: Equipment "tag".
 - 3. Locate markers where accessible and visible.

3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
 - 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pre-tensioned pipe markers. Use size to ensure a tight fit.
 - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Stenciled Pipe Marker Option: Stenciled markers may be provided where manufactured pipe markers are not available. Install stenciled pipe markers with painted, color-coded bands or rectangles complying with ASME A13.1 on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe markers and color bands as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 4. Near major equipment items and other points of origination and termination.
 - 5. At 25 feet intervals on all straight runs of pipe.
 - 6. On both sides of walls or floors where pipe passes through walls or floors.

3.4 ADJUSTING

- A. Relocate plumbing identification materials and devices that have become visually blocked by other work.

3.5 CLEANING

- A. Clean faces of plumbing identification devices to an "as new" condition immediately prior to Architect's Final Certification.

END OF SECTION 220553

SECTION 220716 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing insulation for equipment, and pipe, including the following:
 - 1. Insulation materials
 - 2. Fitting materials.
 - 3. Insulation finish materials
 - 4. Accessories

1.2 SUBMITTALS

- A. Product data shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment for each type of product indicated; identify thermal conductivity, thickness, and jackets (both factory and field applied, if any). Provide a sheet that identifies each system (e.g., cold water piping, etc.), and the submitted material, thickness, and finish for each system.
- B. Submit proof of three years' minimum experience in insulation installation.

1.3 QUALITY ASSURANCE

- A. Insulation and related materials shall meet the requirements of NFPA-90A.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing products per ASTM E 84. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Applicator: Company specializing in insulation application with three years' minimum experience.

1.4 GENERAL INSULATION NOTES

- A. Any equipment which is factory insulated, and which has sweating/condensation forming on the equipment while operating under design conditions, shall be replaced or field insulated by the contractor until the condensation is eliminated.
- B. Piping is considered concealed for purposes of this Specification Section when located above ceilings or in chases.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Certain Teed, Owens-Corning, Johns Manville, Armacell, IMCOA, Nomaco, Knauf, Pittsburg Corning, The Dow Chemical Company, Foster, Childers and Hi-Therm.
- B. Substitutions: Under provisions of Division 22 Section "Common Requirements for Plumbing Equipment."

2.2 INSULATION MATERIALS

- A. I1: Glass fiber insulation; ANSI/ASTM C547; 'k' value of 0.24 at 75 degrees F. Jacket shall be factory applied all service jacket with self sealing lap (ASJ-SSL). Provide ASJ tape where insulation butts. ASJ jacket shall be continuous. Provide insulation shield on exterior of insulation at all hangers.

- B. I3: Blanket Insulation: Glass fiber blanket insulation minimum 3/4 lb. density, installed R3.5 per inch, with FSK facing. Wrap blanket insulation around piping, being careful not to compress it more than 25% at the corners, butting insulation and overlapping facing jacket 2" minimum at all joints. Two-inch (2") thick insulation shall have a minimum R5.3 at 25% compression. Staple the overlap with outward clinching staples a maximum of 3" on centers. Seal all joints with pressure sensitive FSK tape. Seal all penetrations, such as at supports, and all terminations of insulation with pressure sensitive FSK tape. Blanket insulation used on storm drain system, blanket shall cover roof drain body, vertical pipe from roof drain body to horizontal piping and all horizontal piping.

2.3 FITTING INSULATION MATERIALS

- A. Type P1: Precut fiberglass insulation fitting inserts covered with PVC fitting covers. PVC fitting covers shall have a flame spread of 25 or less and a smoke development of 50 or less. Nominal 0.75 lb. density, K factor maximum 0.32 at 75°F for temperatures -20°F to 450°F.

2.4 INSULATION FINISH MATERIALS

- A. F2: Pre-molded PVC jacket, maximum permeance of 0.09. PVC jacketing shall be minimum 0.02" thick (20 mils).
- B. F4: 0.016" Aluminum jacketing and 0.024" aluminum fitting covers with joints sealed water tight with sealant, Foster Elastolar 95-44, Childers Chil Byl CP-76, or prior approved equal, installed over white vapor barrier mastic (Type F3) with 10 x 10 glass or polyester cloth reinforcing membrane to develop 37 mil dry film thickness.
- C. F6: 0.010" Aluminum jacketing with joints sealed watertight with sealant, Foster Elastolar 95-44, Childers Chil Byl CP-76 or prior approved equal.

2.5 ACCESSORIES

- A. Metal Jacket Bands: 1/2-inch wide; 0.015-inch thick aluminum.
- B. Adhesives: Compatible with insulation materials, jackets and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- C. Insulation Shields: Provided in accordance with Division 22 - Hangers & Supports for Plumbing Piping & Equipment.
- D. Mastics: Materials shall be compatible with insulation materials, jackets, and substrates.
- E. Tapes: FSK foil face, vapor retardant type tape matching factory applied jacket with acrylic adhesive; complying with ASTM C1136 and UL listed. Width shall be three inches; thickness shall be 6.5 mils.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 COORDINATION

- A. Coordinate with contractor to confirm (based on contractor's preference) which sections of piping will be welded and which sections of piping shall be grooved. See Part 3 - "Execution" herein for additional insulation requirements specific to grooved piping system.
- B. Coordinate with trade installing piping to verify all piping has been pressure tested prior to application of insulation.

3.3 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation, fitting materials, finish materials and accessories in accordance with manufacturer's installation requirements and recommendations.

- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of equipment, and piping including fittings, valves, and specialties.
- C. Install insulation with longitudinal seams at top and bottom of horizontal runs. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- D. Keep insulation materials dry during application and finishing.
- E. Install insulation with least number of joints practical.
- F. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- G. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- H. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- I. Continue insulation with vapor barrier through penetrations.
- J. On insulated piping with vapor barrier, insulate fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- K. On insulated piping without vapor barrier and piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation with mastic at such locations.
- L. For above ambient service, do not install insulation to vibration control devices, testing agency labels, nameplates or cleanouts ASME stamps, etc.

3.4 INSULATION SCHEDULE

Service/Location	INSULATION			FINISH	
	Pipe	Fitting	Thicknes s	Pipe	Fitting
PIPING:					
Hot, Cold & Recirculating Water Piping:					
Above Ceilings & Inside Exterior Walls	I1	P1	1"	--	--
Interior Walls & Chases	I1	P1	1"	--	--
Exposed	I1	P1	1"	F2	F2

END OF SECTION 220716

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes domestic water piping within 5'-0" of the building.

1.2 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment.

1.3 QUALITY ASSURANCE

- A. All piping and fittings shall be new and of domestic (USA) manufacturer. The ASTM number and schedule shall be stamped on each length of piping.
- B. Potable water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked "NSF-pw".

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Store and protect products under provisions of Division 22 - Common Requirements for Plumbing Equipment.

PART 2 - PRODUCTS

2.1 COLD WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Piping Sizes 3" and Smaller:
 - 1. Copper Tubing: ASTM B88 Type "K" hard drawn. Fitting: ANSI/ASME B16.9 pressure pattern wrought copper. Joints: AWS A5.8, BCUP silver braze. Use solder as specified herein.

2.2 120°F HOT, COLD AND RECIRCULATING WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88 type 'L' hard drawn. Fitting: ANSI/ASME B16.9 pressure pattern wrought copper. Joints 2" and smaller: ANSI/ASTM B32 Lead free solder, having a composition of 95.5% tin, 4% copper and 0.5% silver. Joints over 2": Braze using AWS A.58 BCUP – 4 silver (minimum 5.8%) filler metal. "Backing" with solder (melting temperature less than 1,100°F) is prohibited.
- B. On piping 2" and larger, the Contractor has the option of using grooved couplings and grooved fittings as manufactured by Victaulic, Anvil and Grinnell.
 - 1. Mechanical Couplings: 2"-8" for copper tubing consisting of ductile iron cast housings, complete with a synthetic rubber gasket of a pressure-responsive design, with plated nuts and bolts to secure unit together. Couplings shall be manufactured to connect copper tubing sized tube and fittings. (Flaring of tube and fitting ends to IPS dimensions is not allowed.)
 - 2. Coupling Housings: Ductile iron conforming to ASTM A-536, Grade 65-45-12, coated with copper colored alkyd enamel. Housings shall be cast with offsetting, angle-pattern bolt pads to provide rigidity.
 - 3. Coupling Gaskets: Gasket shall be Grade "EHP" EPDM compound designed for operating temperatures from -30 deg F to +250 deg F.
 - 4. Victaulic Style 607 or equal by prior approved manufacturers. Installation ready rigid coupling for direct stab installation without field disassembly.
 - 5. Installation ready fittings for copper systems manufactured by Victaulic or prior approved manufacturers are acceptable.

6. A factory-trained representative (direct employee) shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, product installation, and shall periodically visit the job site to review installed products. Contractor shall remove and replace any improperly installed products at contractor's expense.
7. All grooved end components shall be of a single manufacturer.
- C. In lieu of manufactured copper tee fittings, the Contractor has the option of using mechanically formed tee connections. Mechanically formed tees shall conform to the following:
 1. Mechanically extracted collars shall be formed in a continuous operation consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be fully adjustable as to ensure proper tolerance and complete uniformity of the joint.
 2. The branch shall be notched to conform with the inner curve of the run tube and dimpled to ensure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the mainline tube. Dimples shall be in line with the run of the tube and visible through the braze. All joints shall be brazed with BCUP-2 braze. The method shall be provided by T-drill®.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 EXCAVATION

- A. Excavate trenches to the elevation required by the pipe. Trench shall not be undercut unless the trench bottom is in rock or hard strata, cinders, organic soils or injurious materials. Under cut shall be a minimum of 6" below the invert of the piping and shall be refilled with inorganic soil or sand tamped in place.
- B. Contractor shall furnish all labor, materials, and equipment to keep the excavation free of water either from surface sources or from underground sources or from both. When underground water is encountered, undercut the trench 6" and backfill with graded aggregate base type C (crush and run gravel). The selections of the equipment and method of the removal of the water shall be the responsibility of the Contractor. The Contractor shall be and is responsible for all damage incurred in handling water conditions. The present provision supersedes and replaces all other provisions relating to the removal of water from the site.
- C. After piping has been tested, inspected and approved, trenches shall be backfilled to the first 12 inches over the pipe in 4 inch lifts and hand tamped.
- D. After the first 12 inches, lifts shall not exceed 8 inches. The backfill in all trenches shall be compacted to 95% of the maximum dry density determined by the standard Proctor Compaction Test (ASTD D 698). Field density shall be taken at the rate of 1 for each 50 feet of trench for each 2 feet of fill. Cost of test shall be borne by the contractor.

3.3 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- E. Install unions downstream of valves and at equipment or apparatus connections.

3.4 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball valves for piping 2" and smaller.
 - 2. Hot-Water-Piping, Balancing Duty: Balancing valves.
 - 3. Drain Duty: Hose-end drain valves.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping 2" and smaller.

3.5 PIPING INSTALLATION

- A. Drawings show the general arrangement, layout and location, of piping, appurtenances, etc., but do not show all required fittings and offsets that may be necessary to connect piping to equipment, etc., offset around obstructions, and to coordinate with other trades. Fabricate and install piping, appurtenances, etc., based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades, existing building conditions, etc., for space available and relative location of piping, appurtenances, etc. Pipe, appurtenances, etc., locations shown on drawings shall be altered by Contractor where required to avoid interference and clearance difficulties.
- B. Provide chrome plated escutcheon plates for all piping penetrations through walls exposed to view.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Route piping in orderly manner and maintain gradient.
- E. Install piping to conserve building space and not interfere with use of space.
- F. Group piping whenever practical at common elevations.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation of insulation and access to valves and fittings.
- I. Slope water piping and arrange to drain at low points.
- J. Establish elevations of buried piping outside the building to ensure not less than 2 feet of cover.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply two coats of galvanized paint to welding.
- L. Mitered Fittings and Tapped Pipes: Mitered fittings and tapped pipes are not allowed. All changes in direction and pipe branches shall be accomplished by the use of fittings.
- M. Pipe Routing: Pipes shall be run level (except as required for grading) plumb and parallel with the building structure unless otherwise indicated on the drawings.
- N. Spacing Pipe: Maintain 4" minimum clearance between parallel runs of piping after insulating, space permitting.
- O. Coring: On new construction, pre-cast sleeves in all masonry and concrete walls, floor and ceiling slab. For a limited number of openings, contractor may core drill openings in masonry and concrete walls and floor slabs where sleeves were inadvertently not installed as the wall or floor slab was constructed. On existing construction, sleeve openings must be core drilled.
- P. Grooved: Where specified herein, piping shall be grooved in accordance with ANSI/AWWA C-606, CSA B-242, and the manufacturers published specifications. Provide lubricant furnished or approved by the manufacturer. Lubricate the gasket exterior thoroughly (including lips).

- Q. Install PVC sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 - Common Requirements for Plumbing Equipment.
- R. Install water-pressure regulators downstream from shutoff valves. Water pressure regulators are specified in Division 22 - Domestic Water Piping Specialties.

3.6 JOINT CONSTRUCTION

- A. General: Joints shall be determined by the equipment connections or by the valve or fitting specified herein.
- B. Threaded: All threads shall be National Pipe Thread. Apply a commercial grade compound to the male threads only. Ream cut ends and remove all burrs.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- E. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2144. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 22 - Hangers and Supports for Plumbing Piping and Equipment.
- B. Install supports according to Division 22 - Hangers and Supports for Plumbing Piping and Equipment.
- C. Support vertical piping and tubing at base and at each floor.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. 3/4" and Smaller: 60 inches with 3/8-inch rod.
 - 2. 1" and 1-1/4": 72 inches with 3/8-inch rod.
 - 3. 1-1/2" and 2": 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials. Flush water piping prior to placing in service.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 4. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
 6. Prepare reports for tests and required corrective action.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING AND DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. After all of the domestic potable water piping systems work has been completed, these systems shall be cleaned and disinfected
- B. Clean and disinfect domestic potable water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system in accordance with the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction.
 - e. Repeat procedures if biological examination shows contamination.

- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Dielectric Connections
 - 2. Solder
 - 3. Wall hydrants.
 - 4. Roof hydrants.
 - 5. Water hammer arresters.
 - 6. Trap primers

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated it shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals shall be submitted under provisions of Division 22 - Closeout Documents for Plumbing.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 61 Annex G.

PART 2 - PRODUCTS

2.1 DIELECTRIC CONNECTIONS

- A. Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Provide at connection of ferrous and Non-ferrous materials.

2.2 SOLDER

- A. Solder shall be lead free having composition of 95.5% tin, 4% copper and 0.4% silver. Solder shall have a tensile strength of 6,900 psi at 70 degrees F. Solder shall conform to ASTM B-32 and shall be applied in conformance with ASTM B-828. Flux shall conform to ASTM B-813.

2.3 WALL HYDRANT

- A. Wall Hydrant shall be freeze proof concealed box type, automatic draining with ASSE 1052 approved high flow double check backflow preventer, 3/4" inlet and outlet. Hardened stainless steel operating stem and one-piece valve plunger to control both flow and drain functions. Exterior door and fascia finish to be rough brass. Provide loose key with each hydrant. Provide with a 5-year warranty. Woodford B67 or equal by Josam, J.R. Smith, Wade, Zurn, Watts, Mifab or Prier.

2.4 ROOF HYDRANT

- A. Roof hydrants shall be Woodford model SRH-MS freeze-proof roof hydrant with ASSE 1052 double check backflow preventor, hydrant support and under deck flange or approved equal by MAPA or Josam.

2.5 WATER HAMMER ARRESTORS

- A. PDI –“A”:
 - 1. Josam: ----
 - 2. Smith: 5205
 - 3. Zurn: 1250XL-A

4. Sioux-Chief: 652-A
5. Equals by Watts, Mifab or Precision Plumbing Products are acceptable.

2.6 TRAP PRIMERS

- A. Flush Valve Type Trap Primer Assembly: Vacuum breaker trap primer with water deflector, 3/8" elbow and flex-bend connection, wall flanges and fittings to connect to 2" NPT pipe. All exposed surfaces shall be chrome plated Sloan VBF-72-A1 or Zurn Z-6000-TPO or equal by Delany.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install wall hydrants approximately 24" above finish grade unless noted otherwise.
- D. Install water hammer arresters in water piping as indicated on drawings.
- E. Install trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 - Grounding and Bonding for Electrical Systems.
- C. Connect wiring according to Division 26 - Low-Voltage Electrical Power Conductors and Cables.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes waste, and vent piping within 5'-0" of the building.

1.2 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Cellular core/foam core piping is not allowed.

1.3 QUALITY ASSURANCE

- A. All piping and fittings shall be new and of domestic (USA) manufacturer. The ASTM number and schedule shall be stamped on each length of piping.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Store and protect products under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- C. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 SANITARY WASTE, AND VENT PIPING, WITHIN 5 FEET OF BUILDING - BELOW SLAB AND INSIDE WALLS AND CHASES

- A. PVC Pipe: ASTM D1785, Schedule 40. Fittings: ANSI/ASTM D2665, Drainage Pattern schedule 40 PVC. Joints ASTM D2855, Solvent Weld.
- B. Copper Pipe: ASTM B306, DWV. Fittings: ANSI/ASME B16-23, cast bronze, or ANSI/ASME B16-22, wrought copper. Joints: Lead free solder as specified herein. Acceptable for water cooler, lavatory and sink fixture arms only.

2.2 SANITARY WASTE AND VENT PIPING, ABOVE GRADE - OUTSIDE OF WALLS AND CHASES AND ABOVE CEILINGS

- A. Cast Iron Pipe: ASTM A888 and CISPI Standard 301, hubless, service weight. Fittings: Cast Iron. Joints: Heavy duty no hub couplings. Acceptable manufacturers: Clamp-All Hi-Torq 125, Husky SD-4000, Mifab MI-XHUB or Ideal Super Heavy Duty.

2.3 PROCESS DRAIN PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888 and CISPI Standard 301, hubless, service weight. Fittings: Cast Iron. Joints: Heavy duty no hub couplings. Acceptable manufacturers: Clamp-All Hi-Torq 125, Husky SD-4000, Mifab MI-XHUB or Ideal Super Heavy Duty.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate trenches to the elevation required by the pipe. Trench shall not be undercut unless the trench bottom is in rock or hard strata, cinders, organic soils or injurious materials. Under cut shall be a minimum of 6" below the invert of the piping and shall be refilled with inorganic soil or sand tamped in place.

- B. Contractor shall furnish all labor, materials, and equipment to keep the excavation free of water either from surface sources or from underground sources or from both. When underground water is encountered, undercut the trench 6" and backfill with graded aggregate base type C (crush and run gravel). The selections of the equipment and method of the removal of the water shall be the responsibility of the Contractor. The Contractor shall be and is responsible for all damage incurred in handling water conditions. The present provision supersedes and replaces all other provisions relating to the removal of water from the site.
- C. After piping has been tested, inspected and approved, trenches shall be backfilled to the first 12 inches over the pipe in 4 inch lifts and hand tamped.
- D. After the first 12 inches, lifts shall not exceed 8 inches. The backfill in all trenches shall be compacted to 95% of the maximum dry density determined by the standard Proctor Compaction Test (ASTD D 698). Field density shall be taken at the rate of 1 for each 50 feet of trench for each 2 feet of fill. Cost of test shall be borne by the contractor.

3.2 PIPING INSTALLATION

- A. Drawings show the general arrangement, layout and location, of piping, appurtenances, etc., but do not show all required fittings and offsets that may be necessary to connect piping to equipment, etc., offset around obstructions, and to coordinate with other trades. Fabricate and install piping, appurtenances, etc., based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades, existing building conditions, etc., for space available and relative location of piping, appurtenances, etc. Pipe, appurtenances, etc., locations shown on drawings shall be altered by Contractor where required to avoid interference and clearance difficulties.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Establish elevations of buried piping outside the building to ensure not less than 2 feet of cover.
- G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply two coats of galvanized paint to welding.
- H. Establish invert elevations, slopes for drainage to 1/8 inch per foot minimum (unless noted otherwise). Maintain gradients.
- I. Install bell and spigot pipe with bell end upstream.
- J. Remove burrs and all loose material from the interior of piping prior to assembly.
- K. Pipe Routing: Pipes shall be run level (except as required for grading) plumb and parallel with the building structure unless otherwise indicated on the drawings.
- L. Spacing Pipe: Maintain 4" minimum clearance between parallel runs of piping, space permitting.
- M. Coring: On new construction, pre-cast sleeves in all masonry and concrete walls, floor and ceiling slab. For a limited number of openings, contractor may core drill openings in masonry and concrete walls and floor slabs where sleeves were inadvertently not installed as the wall or floor slab was constructed. On existing construction, sleeve openings must be core drilled.
- N. Horizontal piping shall be installed in uniform alignment (i.e. STRAIGHT) and at uniform slope.
- O. Trenches in acceptable soils shall be dug to slope. If a trench is inadvertently over excavated, the trench shall be backfilled and compacted as specified in the "Excavation and Backfill" paragraph in this specification section.

- P. Trenches in unacceptable soils shall be undercut as specified in the "Excavation and Backfill" paragraph in this specification section.
- Q. Piping shall be supported the entire length on undisturbed earth or compacted backfill. Supporting piping on concrete block, brick, wood block or other similar items is unacceptable.
- R. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- S. Make changes in direction for waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used for lavatories, sinks and water coolers on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double combination wye and 1/8-bend fittings when water closets are installed back to back or side by side with common drain pipe. Sanitary tees and double sanitary tees shall not be used for water closets. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- T. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- U. Install waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Waste Piping: One-quarter inch (1/4") per foot in direction of flow for piping 2" and smaller; one-eighth inch (1/8") per foot in direction of flow for piping 3" and larger.
 - 2. Vent Piping: One-eighth inch (1/8") per foot down toward vertical fixture vent or toward vent stack.
- V. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- W. Install PVC waste drainage and vent piping according to ASTM D 2665.
- X. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- E. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 - Hangers and Supports for Plumbing Piping and Equipment.
- B. Install supports according to Division 22 - Hangers and Supports for Plumbing Piping and Equipment.

- C. Support vertical piping and tubing at base and at each floor.
- D. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. 1-1/2" and 2": 60 inches with 3/8-inch rod.
 - 2. 3": 60 inches with 1/2-inch rod.
 - 3. 4" and 5": 60 inches with 5/8-inch rod.
- E. Install supports for vertical cast-iron soil piping every 15 feet.
- F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. 1-1/2" and 2": 48 inches with 3/8-inch rod.
 - 2. 3": 48 inches with 1/2-inch rod.
 - 3. 4" and 5": 48 inches with 5/8-inch rod.
- G. Install supports for vertical PVC piping every 48 inches.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

3.6 VIDEO INSPECTION OF SANITARY WASTE PIPING

- A. Closed circuit television: Contractor shall utilize an independent third party to televise and provide video inspection of ALL waste piping 4" and larger (not including 4" piping to individual Fixtures or individual toilet batteries). Contractor shall record video inspection to color DVD and turn over a minimum of 3 copies to Architect. Video inspection shall be accomplished after all plumbing fixtures have been set and shall be complete with copies turned over to Architect prior to final inspection. Contractor shall provide a 1/8" = 1'-0" scale plan (one per DVD copy) indicating / labeling each section of piping that has been recorded. Each DVD shall be labeled indicating project name, videographer name and address, Project Architect, General Contractor, Plumbing Sub-Contractor, Date of Video, Indication of which sections of piping are included on tape with description of vantage point and direction by compass and elevation for each section. Video inspection firm shall provide a report indicating areas in question. Contractor shall make corrections to the system in accordance with the report. A minimum of three copies of the report and a description of each corrective action shall be turned over to the Architect.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

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SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following drainage piping specialties:
 - 1. Floor drains.
 - 2. Cleanouts.
 - 3. Flashing

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated shall be submitted under provisions of Section 220513.
- B. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals shall be submitted under provisions of Division 22 - Closeout Documents for Plumbing.

1.3 QUALITY ASSURANCE

- A. All piping and fittings shall be new and of domestic (USA) manufacturer. The ASTM number and schedule shall be stamped on each length of piping.
- B. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Store and protect products under provisions of Division 22 - Common Requirements for Plumbing Equipment.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

- A. Provide and install floor drains as shown on the drawings and as specified herein. Floor drains shall have coated cast iron bodies with cast iron double drainage flanges and bottom outlet, inside caulk connections, with strainers and special items as indicated in Schedule. **All drains shall be provided with deep seal trap.** All drains shall also have a Pro Set Trap Guard alternative trap primer device installed.
- B. Schedule (Basis of Design: Josam, equals by Watts, Sioux Chief or Mifab are acceptable)
 - 1. Floor Drain FD "A":
 - a. Josam: 30000-A
 - b. Smith: 2010A
 - c. Wade: W-1100-STD
 - d. Zurn: ZN-415-B
 - e. 7" satin finished Nikaloy top.
 - 2. Floor Drain FD "B":
 - a. Josam: 31100
 - b. Smith: 2310
 - c. Wade: W-1340

- d. Zurn: Z-525
- e. 8-1/8" cast iron top.

2.2 CLEANOUTS

- A. Provide cleanouts where shown on the drawings.
- B. All cleanouts shall be accessible and shall be installed allowing a clearance of not less than 18" for the purpose of rodding.
- C. Cleanout Schedule: (Basis of Design-Josam, equals by Watts or Mifab are acceptable):
 - 1. Location: Finished floor except on acid waste piping
 - a. Finish: Nickel bronze
 - b. Josam: 56000
 - c. Smith: 4025
 - d. Wade: W-6000
 - e. Zurn: Z-1400
 - 2. Location: Wall
 - a. Finish: Stainless steel
 - b. Josam: 58600
 - c. Smith: 4710
 - d. Wade: W-8480-R
 - e. Zurn: Z-1469
 - 3. Location: Outside
 - a. Finish: Cast iron
 - b. Josam: 58180
 - c. Smith: 4288
 - d. Zurn: Z-1449
 - 4. Notes:
 - a. Floor cleanout shall be round.
 - b. Cleanout plugs shall be ABS.
 - c. Provide wrench with each type cleanout.
 - d. For final inspection, contractor shall remove all cleanout plugs and place next to cleanout. After inspection of cleanouts, grease threads and replace plugs.
 - e. Provide a carpet marker on all cleanouts installed in carpeted floors. See Architectural Drawings for finish schedule.
 - f. Provide 18" X 18" X 6" concrete pad around outside cleanouts.

2.3 FLASHING

- A. Vents Thru Roof: Provide flashing as detailed on Architectural drawings.

2.4 CONDENSATE RECEIVER BOX

- A. 20 gauge steel box with enamel finish and 2" drain outlet. Guy Gray model T-200-LV or equal by Water Tite or Oatley.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drawings show the general arrangement, layout and location, of piping, appurtenances, etc., but do not show all required fittings and offsets that may be necessary to connect piping to equipment, etc., offset around obstructions, and to coordinate with other trades. Fabricate and install piping, appurtenances, etc., based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades, existing building conditions, etc., for space available and relative location of piping, appurtenances, etc. Pipe, appurtenances, etc., locations shown on drawings shall be altered by Contractor where required to avoid interference and clearance difficulties.

- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to 4". Use 4" for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at maximum intervals of 50 feet for piping 3" and smaller and 80 feet for 4" and larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated. The Plumbing subcontractor shall coordinate the slope of the floor to floor drains with the quarry tile subcontractor. In general the tile floor shall uniformly slope from wall to floor drain 5/8" in rooms 10' x 10' or smaller and 3/4" in rooms larger than 10' x 10'. In the case of a floor drain serving a specific piece of equipment the floor drain and tile shall be set 1/2" lower than the surrounding floor and "dish-pan" in a 30" diameter around the floor drain.
- D. Install deep-seal traps on all floor drains .
- E. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

- A. Install flashing for piping passing through roofs with counter flashing or commercially made flashing fittings, according to Division 7 - Sheet Metal Flashing and Trim and Division 7 - Roof Accessories.
- B. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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SECTION 221423 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fuel gas piping. Products include the following:
 - 1. Pipe, tube, fittings, and joining materials.
 - 2. Protective pipe and fitting coating.
 - 3. Valves.

1.2 SUBMITTALS

- A. Product Data for each type of product indicated shall be submitted under the provisions of Division 22 - Common Requirements for Plumbing Equipment.
- B. Welding certificates.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals shall be submitted under provisions of Division 22 - Closeout Documents for Plumbing.

1.3 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.
- B. Deliver products to site under provisions of Division 22 - Common Requirements for Plumbing Equipment.
- C. Store and protect products under provisions of Division 22 - Common Requirements for Plumbing Equipment.

1.5 COORDINATION

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 - Cast-in-Place Concrete.

PART 2 - PRODUCTS

2.1 NATURAL GAS PIPING, BURIED AND BEYOND 5 FEET OF BUILDING

- A. Contractor has the option of providing steel or plastic piping as follows (materials shall not be mixed):
 - 1. Steel Pipe: ASTM A53 or A120, Schedule 40 black. Fittings: ASTM A234, forged steel welding type, with factory installed ANSI/AWWA C105 polyethylene jacket. Provide double layer half-lapped 10 mil polyethylene tape on all joints. Joints: ANSI/AWS D1.1, welded.
 - 2. Plastic Pipe and Fittings: Wall thickness of plastic pipe shall meet the requirements of Standard Dimension Ratio (SDR) 11.
 - a. Polyethylene Pipe and Fittings: ASTM D 3350; Manufactured and tested in accordance with ASTM D 2513. Pipe designation shall be PE 3408, SDR 11, designed for gas distribution. System shall conform to Specification ANSI 15LE.
 - b. Fittings and Joints: ASTM D 3261; Fitting materials shall be compatible (Joints equal in strength with the pipe section) with the pipe material. Contractor shall install piping using as few joints as necessary.
 - c. Pipe Locating: No. 14 insulated tracer wire and additional 6 inch wide warning tape shall be installed 12 inches above the top of polyethylene pipe for locating buried utilities. Tracer wire and warning tape shall be protected from corrosion. The tracer wire and warning tape shall be installed continuously and shall be accessible at test stations, valve boxes, and above ground valve stations. Tracer wire shall not be welded or fastened to casings. Allow the necessary length of tracer wire at each pit, valve box, and above ground station for accessibility. Installation procedures shall be in accordance with AGA Plastic Pipe Manual for Gas Service.
 - d. Anodeless Service Line Risers: Provide polyethylene to steel pipe transition riser at all locations where piping rises to above grade. Risers shall meet ASTM D2513 Category 1 and NFPA 58. All gas carrying steel shall meet ASTM A513. All PE pipe and tubing shall meet ASTM D2513. Continental Industries, Elster Perfection or R.W. Lyall.

2.2 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53 or A120, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, Class 125 or ASTM A234, Class 125 forged steel butt weld type. Joints: Screwed for pipe two inches and under; ANSI/AWS D1.1, welded, for pipe over two inches.

2.3 PROTECTIVE COATING

- A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

2.4 PIPING SPECIALTIES

- A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.5 VALVES

- A. Shutoff Valves, 2" and Smaller: 400 psi WOG; conventional port, 2-piece construction, blow-out proof stem, threaded ends. CSA certified to ANSI/ASME B16.33.
 - 1. Nibco: T-580-70UL
 - 2. Hammond: 8204
 - 3. Milwaukee: BA-200
 - 4. Watts: FBV-3
 - 5. Kitz: 58

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for fuel piping system to verify actual locations of piping connections before equipment installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.3 PIPING INSTALLATION

- A. Drawings show the general arrangement, layout and location, of piping, appurtenances, etc., but do not show all required fittings and offsets that may be necessary to connect piping to equipment, etc., offset around obstructions, and to coordinate with other trades. Fabricate and install piping, appurtenances, etc., based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades, existing building conditions, etc., for space available and relative location of piping, appurtenances, etc. Pipe, appurtenances, etc., locations shown on drawings shall be altered by Contractor where required to avoid interference and clearance difficulties.
- B. Provide chrome plated escutcheon plates for all piping penetrations through walls exposed to view.
- C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Route piping in orderly manner and maintain gradient.
- E. Install piping to conserve building space and not interfere with use of space.
- F. Group piping whenever practical at common elevations.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance for installation and access to valves and fittings.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 feet of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply two coats of galvanized paint to welding.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Provide a plug cock wrench for every plug cock.
- M. Mitered Fittings and Tapped Pipes: Mitered fittings and tapped pipes are not allowed. All changes in direction and pipe branches shall be accomplished by the use of fittings.
- N. Pipe Routing: Pipes shall be run level (except as required for grading) plumb and parallel with the building structure unless otherwise indicated on the drawings.
- O. Spacing Pipe: Maintain 4" minimum clearance between parallel runs of piping after insulating, space permitting.
- P. Install a gas valve within 3' of the gas connection of all gas using equipment.

- Q. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.
- R. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.
- S. Connect branch piping from top or side of horizontal piping.
- T. Install unions in pipes 2" and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- U. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.
- V. Install containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4 inches outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.

3.4 JOINT CONSTRUCTION

- A. General: Joints shall be determined by the equipment connections or by the valve or fitting specified herein.
- B. Threaded: All threads shall be National Pipe Thread. Apply a commercial grade compound to the male threads only. Ream cut ends and remove all burrs.
- C. Welded: Welding procedures and welder qualifications shall be in accordance with ASME B31 Code for Pressure Piping:
 - 1. 1-1/2" and smaller: Gas weld with oxygen and acetylene.
 - 2. 2" and larger: Metallic arc weld.
- D. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 22 - Hangers and Supports for Plumbing Piping and Equipment.
- B. Install supports for horizontal steel piping on roof and outside above grade with the following requirements:
 - 1. Support shall be provided on maximum 8'-0" centers and within 18" of all elbows and tees. All supports on the roof shall have an extra piece of roofing material or walk pad under the support extending a minimum of 4" beyond support base in all directions. See Gas Pipe Support Detail on drawings.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.
- B. Install piping adjacent to appliances to allow service and maintenance.
- C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 36 inches of each appliance. Install union downstream from valve.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.
- E. Ground equipment according to Division 26 - Grounding and Bonding.
 - 1. Do not use gas pipe as grounding electrode.

- F. Connect wiring according to Division 26 - Conductors and Cables.

3.7 PAINTING

- A. All bare steel piping exposed to view provided under this section of specifications, shall be cleaned, primed and painted under Division 9 - Painting. Also, all exterior piping, including piping on the roof and equipment yard, and piping in the mechanical room shall be painted in accordance with these requirements. All gas piping shall be painted yellow unless directed otherwise by the Architect.

3.8 FIELD QUALITY CONTROL

- A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.
- B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- C. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.
- D. Verify correct pressure settings for pressure regulators.
- E. Verify that specified piping tests are complete.

END OF SECTION 221123

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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes electric water heaters and the following accessories:
 - 1. Recirculating pumps

1.2 SUBMITTALS

- A. Submit product data under provisions of Division 22 - Common Requirements for Plumbing Equipment. For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.3 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 22 - Closeout Documents for Plumbing. Data shall include but not limited to:
 - 1. Water heater data
 - 2. Circulating pump parts list
 - 3. Field quality control reports

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

1.6 WARRANTY

- A. See Division 22 - Closeout Documents for Plumbing for specific warranty information.

PART 2 - PRODUCTS

2.1 WATER HEATER

- A. Water heater WH-1 shall be constructed as follows: Water heater shall be glass lined, electric heater and shall have minimum of two elements wired for simultaneous or non-simultaneous operation, as indicated below, each with its own thermostat set to maintain delivery temperature scheduled. The tank shall be insulated with R-16 foam which meets ASHRAE 90A for heat loss efficiency. Basis of design is Bradford White. Provide with an ASME approved temperature and pressure relief valve. Equals by A. O. Smith and Lochinvar are acceptable.
 - 1. WH-1:
 - a. Tank Capacity: 50 gallon
 - b. Wattage of Elements (Non-simultaneous):
 - 1) Upper: 4500
 - 2) Lower: 4500
 - c. Voltage: 208V, 1Ø
 - d. Delivery Temperature: 110°F
 - e. Manufacturer:
 - 1) Bradford White Model No. LE350S3-3

2.2 RECIRCULATING PUMPS

- A. Recirculating pumps shall be in-line, permanently lubricated specifically designed and guaranteed for quiet operation and suitable for 125 lb. working pressure. Motors shall be drip-proof with built-in thermal overload protectors. Pumps shall have steel shaft supported by permanently lubricated, sealed ball bearings. Pumps shall have water-tight seal to prevent leakage. Manufacturer shall be B & G. Equals by Wilo, Grundfos or Taco are acceptable.
 - 1. RP-1
 - a. B & G Model No.: PL-30
 - b. GPM: 5
 - c. Head: 6
 - d. Voltage: 115
 - e. Horsepower: 1/12
- B. Aquastat shall be immersion type with brass spud. Set aquastat to start circulating pump RP-1 when the temperature in the return piping reaches 105 degrees F and stop circulating pump when the temperature in the return piping reaches 110 degrees F. Honeywell L4006A or equal by Johnson or Robertshaw.

2.3 WATER HEATER ACCESSORIES

- A. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than 3/4".

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases unless noted otherwise.
 - 1. Concrete base construction requirements are specified in Division 22 - Common Requirements for Plumbing Equipment.
- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge as shown on drawings.
- D. Install thermometer on outlet piping of water heaters. Refer to Division 22 - Meters and Gages for thermometers.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 - Grounding and Bonding.
- D. Connect wiring according to Division 26 - Conductors and Cables.

3.3 FIELD QUALITY CONTROL

- A. 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.
- B. Perform the following field tests and inspections and prepare test reports for inclusion in Operation and Maintenance Manuals:
 - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain electric water heaters. Refer to Division 22 - Closeout Documents for Plumbing for closeout requirements.

END OF SECTION 223300

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SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following conventional plumbing fixtures P-1 through P-6 and related components.

1.2 SUBMITTALS

- A. Product data shall be submitted under provisions of Division 22 - Common Requirements for Plumbing Equipment. For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.

1.3 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data under provisions of Division 22 - Closeout Documents for Plumbing. Data shall include but not limited to:
 - 1. Fixture trim exploded view and replacement parts list.
 - 2. Water cooler parts list

1.4 WARRANTIES

- A. See Division 22 - Closeout Documents for Plumbing for specific warranty information.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components-Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Provide all equipment, fittings, trim, and accessories required for a complete installation.
- B. Kohler is basis of design. Equals by Sloan, Crane and Zurn shall be acceptable. Additional acceptable manufacturers for faucets are Moen and T & S Brass.

2.2 FIXTURE SCHEDULE

- A. P-1:
 - 1. Water Closet: Elongated, Handicap with 1.28 GPF manual flush valve
 - a. Kohler: K-96057
 - b. American Standard: 3461.001
 - c. Zurn: Z5665-BWL
 - d. Sloan: ST-2029

2. Flush Valve: See Note 1
3. Seat: See Note 3
- B. P-2
 1. Lavatory: 20 x 18, Handicap
 - a. Kohler: K-2006
 - b. American Standard: 0356.015
 - c. Zurn: Z5368
 - d. Sloan: SS-3803
 2. Faucet: With ADA lever handles, See Note 7, 0.5 GPM
 - a. Kohler: K-800T20-4ANL
 - b. American Standard: 6500.140
 - c. Zurn: Z-831-R1-XL
 - d. T & S Brass: B-2992-CR
 3. Drain: 1-1/4" Offset Grid
 - a. Kohler: K-13885
 - b. American Standard: 7723.018
 - c. Zurn: Z-8746
 4. Trap: Size 1-1/4". See Notes 4 and 9
 5. Supplies: See Notes 5 and 9
 6. Carrier: See Note 6
- C. P-3
 1. Single Bowl Sink: 18 gauge stainless steel, 3 hole punching, maximum 5-1/2" deep with rear center drain punching
 - a. Just: SL-ADA-2125-A-GR
 - b. Elkay: LRAD-2521-A3
 - c. Acorn: SDADA-2522-55-3
 - d. Equal by Kohler
 2. Faucet: See Notes 7 and 8
 - a. Kohler: K-800T70-4AKL
 - b. American Standard: 6530.140
 - c. Zurn: Z-831-B1-XL
 - d. T & S Brass: B-2851-CR
 3. Drain: 1-1/2" offset grid
 - a. Just: J-ADA-35FS
 - b. McGuire: 1149WC
 - c. Zurn: Z-8750.
 4. Trap: Size 1-1/2". See Notes 4 and 9
 5. Supplies: See Notes 5 and 9
 6. Flow Control: See Note 10
- D. P-4
 1. Service Sink: Floor mounted
 - a. Fiat: TSB-3000
 - b. Stern Williams: HL-1810
 - c. Acorn: TDF-24-SSC
 2. Drain: 2" caulk connection
 - a. Kohler: K-9147
 - b. American Standard: 8303.076
 - c. Eljer: 803-0640
 3. Faucet: With 5' rubber hose and wall hook, See Note 7
 - a. Kohler: K-8928
 - b. American Standard: 8351.076

- c. Zurn: Z842L1-LSI-WHK
 - d. T & S Brass: B-0669-POL
- E. P-5
 - 1. Water Cooler: Vandal resistant electric wall hung with push button on front with stainless steel cabinet and bubbler keyed into position to prevent rotation
 - a. Elkay: VRC8S
 - b. Oasis: PGV8AC
 - c. Murdock: A171408S-UG-VR
 - d. Equal by Halsey Taylor or Murdock.
 - 2. Trap: Size 1-1/4". See Notes 4 and 9
 - 3. Supply: See Note 5
 - 4. Carrier: See Note 2
- F. P-5A
 - 1. Water Cooler: Vandal resistant electric wall hung handicap accessible with push button on front with stainless steel cabinet and bubbler keyed into position to prevent rotation. Bottle filling unit shall be sensor operated and include a 20 second automatic shut-off timer and a display count of plastic bottles saved from waste. Bottle filler shall provide 1.1 to 1.5 gpm flow rate with laminar flow to minimize splashing. Unit shall include filter. Unit shall meet ADA guidelines and shall be lead free certified to NSF/ANSI 61 and 372.
 - a. Elkay: LVRCGRN8WSK
 - b. Oasis: PGV8EBF
 - c. Murdock: A171408S-UG-VR-BF12-BCD-WF1EZ
 - d. Equal by Halsey Taylor or Murdock.
 - 2. Trap: Size 1-1/4". See Notes 4 and 9
 - 3. Supply: See Note 5
 - 4. Carrier: See Note 2
- G. P-6
 - 1. Ice Maker Connection: 20 gauge white powder coated steel box and faceplate with 1/4 turn valve and water hammer arrestor installed.
 - a. Guy Gray: 88531
 - b. Equal by Water Tite or Oatey.
- H. PLUMBING FIXTURE NOTES
 - 1. Manual flush valves shall be diaphragm type. Flush valves for standard water closets shall be Sloan 115-1.28. Flush valves for handicap water closet shall be 111-1.28. Flush valves shall have vandal proof trim, ADA handle, solid ring pipe support, 1.28 gallon flush and sweat adapter kit. Mount 24" above bowl on standard water closets and 12" above bowl for handicap water closets. On handicap fixtures, handle shall be on the wide side of the water closet. Equals by Moen and Zurn are acceptable.
 - 2. Water cooler carriers shall be Josam 17900, Smith 830, Wade W-400-AM11, Watts CA-321 or Zurn ZR-1225.
 - 3. Water closet seats shall be white, solid plastic with self-sustaining check hinge. Bemis 1955SSC, Plumbtech 421SSC, Church 295SSC, or Olsonite 10-CC-SS.
 - 4. Traps shall be 17 gauge adjustable "P" traps with cleanout and wall plate. Exposed surfaces shall be polished chrome. Manufacturers: Kohler, Eljer, EBC, McGuire, Brasscraft or Zurn. Provide tail piece pipe to equipment furnished under other sections or by Owner.
 - 5. Stops shall be angle type 1/2" copper sweat extension tube inlet x 3/8" O.D. compression riser and loose key, lock shield. Risers shall be flexible copper one-piece with insert. Exposed surfaces shall be chrome plated. Provide bell escutcheon at wall. Brass Craft SCS400AC, McGuire LF170 LK, or Zurn Z-8808-LR-LK-XL.

6. Lavatories carriers shall be concealed arm type. Josam 17100, Smith 700, Wade 520, Zurn ZR 1231 or Watts WCA-411. Anchor to floor per manufacturer's recommendations with bolts equal to Hilti "Kwik Bolt II".
7. Provide quarter turn ceramic disc cartridge, rigid connector, and lever handles on faucets.
8. Provide a 7/8" fender washer with a 1/16 nominal thickness between the sink or lavatory and the spout nut. Discard the manufacturer's standard washer.
9. Insulate water supplies, offset grid drain and 'P' Trap on lavatories and drain and 'P' trap only on water coolers with fully molded Handi Lav-Guard insulation manufactured by Truebro., P.O. Box 429, Ellington, CT 06029; Phone (203) 875-2868. Color shall be white. Equals by Skal Gard, McGuire (ProWrap), Plumberex (Pro 2000) or EBC are acceptable.
10. Flow control shall be laminar flow, pressure compensating delivering 1.5 gpm on sink faucets over inlet pressure range of 40-120 psig. Device shall be vandal resistant. OMNI series 200, T & S Brass B-199-21 or equal by Kohler.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install counter-mounting fixtures in and attached to casework.
- C. Install fixtures level and plumb according to roughing-in drawings.
- D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 1. Exception: Use ball valves if supply stops are not specified with fixture. Valves are specified in Division 22 - General-Duty Valves for Plumbing Piping.
- E. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- F. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- G. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- H. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- I. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- J. Install traps on fixture outlets. Traps shall be readily accessible for servicing and cleaning.
 1. Exception: Omit trap on fixtures with integral traps.
 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

- K. Install chrome plated escutcheons at piping penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings.
- L. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 7 - Joint Sealants.
- M. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

3.3 CONNECTIONS

- A. Wall Hung and Back Outlet Water Closets: Fixture carrier as specified with fixture.
- B. Floor Mounted Water Closets: 4" PVC stub with PVC flange and preformed wax setting ring. Provide brass mounting bolts. Offset flanges shall not be acceptable.
- C. Lavatories and Water Coolers: 1-1/4" type "M" copper arm with 1-1/4" C-PVC adapter at stack.
- D. Service Sink: 2" caulk drain as specified herein.
- E. Hot and Cold Water Supply Piping to Fixtures: Chrome plated when exposed.
- F. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- G. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

3.4 FIELD QUALITY CONTROL

- A. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- B. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- C. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- D. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.
- B. Adjust all wrist blade and lever handles to be parallel with the wall the fixture is mounted on when in the "off" position.
- C. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
 - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
 - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000