

SECTION 22 01 00
PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all labor, materials, tools, and services for a complete installation of equipment and systems contained in contract documents.
- B. Principal features of work included are:
 - 1. Plumbing system.
 - 2. Medical gas system.
 - 3. Seismic bracing and anchorage for equipment, and piping.

1.2 RELATED WORK

- A. Electrical power and interlock and control wiring and conduit.
- B. Laboratory equipment.
- C. Field painting of equipment, and piping.

1.3 INNOVATION MEMORANDUMS

- A. The owner has obtained purchase agreements for select equipment and materials. These purchase agreements are documented as Innovation Memorandums and are to be included as part of this project.
- B. Innovation Memorandum No. 6: All plumbing fixtures and related products to be purchased from Ferguson Enterprises. Refer to Section 22 43 13.
- C. Innovation Memorandum No. 7: All piping, valves, pipe fittings and related products to be purchased from Ferguson Enterprises. Refer to Sections 22 11 16, 22 11 19, 22 13 16, 22 13 19, and 22 15 13.

1.4 GENERAL

- A. The contract documents form a guide for a complete system. Provide all items necessary to provide a complete system but not specifically mentioned, such as hangers, transitions, offsets, and drains.
- B. Layouts indicated on drawings are diagrammatical only. Coordinate exact location of equipment, ductwork, and piping to eliminate conflict with other divisions. Designer reserves right to make reasonable changes in location of equipment, ductwork, and piping prior to construction.
- C. Should Contractor find during progress of work that in his judgment existing conditions make desirable a modification, report such item promptly to Designer for instructions. Do not make deviations from contract documents without review of Designer.
- D. Supervise all work with a competent mechanic specifically qualified in mechanical discipline.
- E. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.
- F. All piping and valves to be purchased from Ferguson Enterprises. Contact Bettina Dawson office (615) 316-1848 cell (615) 812-6500 or email HCA@Ferguson.com.

1.5 PERMITS

- A. Secure and pay for permits, licenses, and inspections for work under this Division, including water and sewage connections.

1.6 CODES

- A. Comply with all pertinent local, state, and national codes.

1.7 STANDARDS

- A. Comply with all pertinent standards. This list is provided as a convenience to Contractor and is not to be considered all inclusive.
 - 1. American Gas Association (AGA).
 - 2. CISPI Standard 301.
 - 3. ASTM A 74.

1.8 SUBMITTALS

- A. Submit for review complete brochures and shop drawings for materials and equipment proposed.
 - 1. Brochures: Submit complete descriptions, illustrations and specification data for materials and equipment proposed. Clearly indicate proposed items when other items are shown on same sheet. Submit samples on request and/or set up for inspection. Samples will be returned to Contractor.
 - 2. Submittals shall be submitted in line by line format. Each submittal shall be provided with a cover letter and supporting documentation indicating how the submittal meets each line of the referenced specification section. All discrepancies between the construction documents and the submitted product shall be clearly identified for engineer evaluation.
 - 3. If a product other than the basis of design is rejected by the engineer for any reason, the Contractor shall provide the basis of design product at no additional cost to the Owner.
 - 4. Shop Drawings:
 - a. Complete equipment and piping systems in equipment rooms.
 - b. Complete equipment and piping systems in entire building.
 - c. Owner furnished equipment rough-in layouts.
 - d. Laboratory equipment rough-in layouts.
 - e. Firestop systems.
 - 5. Seismic Certification: Submit letter of certification from each equipment manufacturer verifying that equipment is designed to withstand horizontal forces using a "cp" factor of 0.75 applied in any direction.

1.9 PROJECT MAINTENANCE MANUALS

- A. Prior to final acceptance of project, provide Owner with bound maintenance manuals.

1.10 PROJECT TECHNICAL INSTRUCTION


- A. Prior to final inspection of project, provide technical instruction to Owner as follows:
 - 1. Field Instruction: Provide explanation of how systems and equipment are to operate during each season and during emergencies.
 - 2. Field Demonstration: Demonstrate operation and routine maintenance for systems and equipment.
 - 3. Videotape: Provide videotape or DVD of field instruction and demonstration to Owner at completion.

1.11 CONSTRUCTION RECORD DOCUMENTS

- A. Provide construction record documents. Keep at the project one set of drawings and daily record changes at the time they are made. Give drawings to Owner at project completion.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide materials and equipment of domestic manufacturer bearing the U.L. label when such label is available.
- B. Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF® International.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate locations of equipment, and piping to eliminate conflict with other divisions.
- B. Carefully examine contract documents to be thoroughly familiar with items which require plumbing or mechanical connections and coordination.
- C. Provide proper chases and openings. Place sleeves and supports prior to pouring concrete or installation of masonry.

3.2 CUTTING AND PATCHING

- A. Repair or replace routine damage caused by cutting in performance of contract.
- B. Correct unnecessary damage caused due to installation of plumbing work.
- C. Perform repairs with materials that match existing in accordance with the appropriate section of these specifications.

3.3 FLASHING, COUNTERFLASHING, AND SEALING

- A. Flash, counterflash, and seal piping at penetrations of roofs and outside walls.

3.4 TRENCHING, EXCAVATION AND BACKFILLING

- A. Excavate to a depth at least 6" below bottom of pipe and a minimum of 36" above top of pipe. Fill below pipe, around pipe, and minimum of 12" above pipe with sand or Class "B" crushed stone tamped firm and even. Provide topsoil for final layer of dirt (12" minimum). Provide 6" spacing between pipes and between pipe and trench sides. Hand-grade with batterboards placed every 25'. Backfill by hand. Do not use rock or stone above sand or Class "B" crushed stone.

3.5 CONNECTION TO EQUIPMENT

- A. Rough-in and connect to sterilizers, lab equipment, and Owner furnished equipment and provide a shutoff valve and union at each connection. Operating valves and/or controls for this equipment will be provided as an integral part of the equipment. Do not rough-in until shop drawings showing rough-in locations have been reviewed by Designer.

3.6 IDENTIFICATION

- A. Identify exposed or accessible piping with stenciling contents indicating pipe contents and direction of flow on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- B. Contractor's option to identify exposed or accessible piping with snap-on or strap-on type markers. Color code markers in accordance with ANSI. Indicate pipe contents and direction of flow on marker. Install markers on piping not more than 20 feet apart, at valves, at access panels, and at least once above each space.
- C. Include design operating pressures in psig for compressed air services.
- D. Sanitary waste, storm and buried lines need not be marked.
- E. Identify all equipment with engraved brass, aluminum, or stainless steel nameplates or tags. Use equipment names and numbers appearing in schedules on drawings. Fasten nameplates to equipment using screws. Glue or adhesive is not acceptable. Fasten tags to equipment using brass, aluminum or stainless steel chains.

- F. Identify each valve with engraved brass, aluminum, or stainless steel identification tag indicating valve service and sequential identification number. Attach tag to valve handle with brass, aluminum or stainless steel chain. Provide two bound manuals to Owner listing each valve sequentially and indicating valve manufacturer, style, size, service, normal position, and specific location for each valve.

3.7 CLEANING

- A. Repair damaged factory finishes covering all bare places and scratches.
- B. Cleaning Domestic Water System: Flush domestic water system progressively by opening building outlets and permitting flow to continue from each until water runs clear. Sterilize system in accordance with requirements of State Department of Public Health by the following method or other method acceptable to local authorities:
 - 1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling lines slowly and applying sterilizing agent at a rate of 50 ppm of chlorine as determined by residual chlorine tests at ends of lines. Open and close all valves while the system is being chlorinated.
 - 2. After sterilizing agent has been applied and left standing for 24 hours, test for residual chlorine at ends of lines. If less than 25 ppm is indicated, repeat sterilizing process.
 - 3. After standing for 24 hours and tests show at least 25 ppm of residual chlorine, flush out system until all traces of chemical used are removed.

3.8 TESTING

- A. Test all installed equipment and systems and demonstrate proper operation. Correct and retest work found defective when tested.
- B. Thoroughly check piping system for leaks. Do not add any leak-stop compounds to the system. Make repairs to piping system with new materials. Peening, doping, or caulking of joints or holes is not acceptable.
- C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at a water pressure of 125 psig for two hours without leaks.
- D. Test drainage and venting system with necessary openings plugged to permit system to be filled with water and subjected to a minimum water pressure of 10 feet head at top of system. System to hold water for two hours without a water level drop greater than 4" in a 4" standpipe and without visible leakage. Test system in sections if minimum head can be maintained in each section.
- E. Conduct air or smoke test if in opinion of Designer reasonable cause exists to suspect leakage or low quality workmanship.
- F. Test gas piping and compressed air piping with Nitrogen at 100 psi for two hours without leaks.
- G. Test flush valves for proper operation.

END OF SECTION

SECTION 22 05 47

SEISMIC RESTRAINT OF PLUMBING EQUIPMENT AND SUSPENDED UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide engineered seismic restraint systems for suspended and base mounted Water Distribution Piping, Domestic Water Piping and Valves, Domestic Water Pumps, Heaters, Sanitary Waste and Vent, Medical Gas Pumps, Compressors, and Manifolds and Piping utilities compliant with the 2018 International Building Code (IBC) with local building code amendments.
- B. All equipment manufacturers shall submit, as part of the equipment submittal, compliance certifications. Contractor to provide equipment anchorage details specific to each unit provided.
- C. At seismic restraint installation locations, provide vertical support systems engineered to accommodate dead load plus seismic force reactions.

1.2 RELATED SPECIFICATION SECTIONS

- A. Water Distribution Piping 22 11 13, Domestic Water Piping and Valves 22 11 16.
- B. Domestic Water Pumps 22 11 23 and Heaters.
- C. Sanitary Waste and Vent 22 13 16, Rainwater Leaders 22 14 16.
- D. Medical Gas Pumps 22 60 05, Compressors and Manifolds and Piping 22 60 06.

1.3 REFERENCES

- A. Publications, codes and standards listed below form a part of this specification to the extent referenced.
 - 1. 2018 International Building Code (IBC)
 - a. Chapter 16 - Structural Design
 - b. Chapter 17 – Structural Tests And Special Inspections
 - 2. ASCE 7-16, Chapter 13, Minimum Design Loads For Buildings and Other Structures, American Society of Civil Engineers (ASCE).
 - 3. ACI 318, Building Code Requirements for Structural Concrete, American Concrete Institute (ACI).

1.4 COMPONENT IMPORTANCE FACTOR

- A. In order to identify systems requiring seismic restraint and to define those from which restraints may be excluded, utility components are assigned an ASCE 7 Importance Factor (Ip) on the basis of the following:
- B. Ip = 1.5
 - 1. Seismic Use Group III Occupancy Category IV, essential facilities required for post-earthquake recovery – all “Designated Seismic Systems” per IBC Chapter 17 required for the continued operation of the facility.
 - 2. Life-safety component which is required to function after a seismic event including fire protection sprinkler systems.
 - 3. Components that contain hazardous or flammable materials.
- C. Ip = 1.0: All other components.

1.5 SUBMITTALS

- A. Equipment Certification.
 - 1. Equipment manufacturer to provide certificate of compliance for 2018 IBC proxying on line capability for the project use group and seismic design category. Provide certifications for the following equipment: Components with hazardous contents, built up

or field assembled plumbing equipment, fire suppression control panels, pre action control panels, and auxiliary or remote power supplies, and above ground storage tanks. Equipment manufacturer certification to be based on shake table or three dimensional shock testing or experience data as required by ASCE/SEI 7-16.

2. The following equipment is considered rugged and does not require a certificate of compliance: pumps, valves, motors, air compressors, and underground tanks.
- B. Contractor to identify and convey each overhead deck condition to which seismic attachments will be made. Information to include type and density of concrete, concrete thickness, size and gage of metal deck and any point load limitations or restrictions.
- C. Provide Seismic Design Force calculations per ASCE 7-16, Formulas 13.3-1 thru 13.3-3 stamped by a registered design professional qualified civil or structural engineer licensed to practice in the State where project is located. For multi-story projects, provide calculated Seismic Design Force for each floor.
- D. Submit seismic restraint layouts stamped by a registered design professional qualified civil or structural engineer licensed to practice in the State where project is located. Seismic restraint layouts to show:
 1. All vertical support and seismic brace locations.
 2. All anchorage connections to structure. Anchor brand, type, quantity and size.
 3. Vertical support and brace reaction point load at all connections to structure. For review by engineer of record in checking suitability of the building structure to accommodate imposed loads.
 4. Plan set sheets showing appropriate installation details reflecting actual job site conditions.
- E. Include cover sheet with Seismic Restraint Bracing Legend delineating:
 1. Maximum Allowable Size or Utility Weight (Lbs/Lf).
 2. Minimum Vertical Support Rod Diameter.
 3. Support Rod Total Vertical Load.
 4. Maximum Allowable Transverse Brace Spacing.
 5. Transverse Brace Reaction.
 6. Maximum Allowable Longitudinal Brace Spacing.
 7. Longitudinal Brace Reaction.
 8. Minimum Required Seismic Restraint Brace Arm Assembly.
 9. Minimum Required Seismic Restraint Anchorage To Overhead Structure.
 10. Installation Detail Drawing References.

1.6 QUALITY ASSURANCE

- A. Registered design professional completing seismic submittal to check suitability of structure to accommodate applied seismic loads.
- B. Registered design professional completing seismic submittal is to provide a "Statement of Special Inspections" in conformance with 2018 IBC, Chapter 17.
- C. Each contractor responsible for the construction of a "Designated Seismic System" shall submit to the building official and owner prior to the commencement of work on the system or component a written "statement of responsibility" per IBC Chapter 17.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Seismic restraint hardware and engineering by International Seismic Application Technology (ISAT), Mason Industries, Tolco, or approved equal.

- B. Vertical support and seismic restraint anchorages to utilize Cast-In Place Deck Inserts, or Post Installed Anchors. All deck inserts or post installed anchors to have a valid ICC ESR evaluation report (or equal) substantiating the insert or anchor capacity.
- C. Vertical support and seismic restraint connections to structural steel are to utilize fixed Beam Clamp connections or Welded or bolted connections.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Roof mounted equipment: All roof mounted equipment is to be positively attached to roof support curb or isolators by bolting or welding. All support curbs to resist compressive, shear, tension, and rotational loads (including seismic loads) and translate these loads to building structure. The design of all support curbs shall be performed by an engineer licensed in the project state. Curb design to minimize rotational loads to structure and be positively attached to building structure by bolting or welding.
- B. For conditions not covered within pre-engineered drawings, the required engineering is to be performed by a registered Engineer.
- C. Manufacturer shall provide field installation training prior to commencement of install.
- D. Field relocation of any seismic installation points away from that shown on the furnished shop drawing layouts shall be coordinated with registered design professional who completed seismic submittal.
- E. Consult registered design professional who completed seismic submittal when field conditions prohibit compliance with the supplied installation details.
- F. In order to satisfy ASCE 7 minimum yield strength requirements, the allowable brace spacing for non-ductile systems (eg. cast iron, plastic and glass pipe) shall be no more than half that for ductile systems.

3.2 EQUIPMENT CONNECTIONS

- A. Where seismic bracing is allowed to be omitted due to size or proximity to overhead deck, all terminations to fixed equipment, panels, etc. or to other portions of the system requiring seismic restraint are to utilize flexible connectors.
- B. Where seismic bracing is allowed by code to be omitted due to size or proximity to overhead deck, contractor shall be responsible for assuring that damaging impact or vertical support failure cannot occur.

3.3 SPECIAL INSPECTION

- A. Special Inspection Requirements: All Designated Seismic Systems are subject to Special Inspection per IBC Chapter 17.
- B. Special inspection for mechanical components shall be provided as follows:
 - 1. For all Designated Seismic Systems within seismic design categories D, E or F.
 - 2. Periodic special inspection during the installation for flammable, combustible or highly toxic piping systems and their associated mechanical units in Seismic Design Categories C, D, E or F.
 - 3. Periodic special inspection during the installation of vibration isolation systems where the construction documents indicate a maximum clearance (air gap) between the equipment support frame and restraint less than or equal to 1/4 inch.
- C. Install identification tags at all seismic brace locations. Tags to include the following information:
 - 1. Specific seismic forces (g-force) the location was designed to resist.
 - 2. Maximum brace reaction at connection to structure.
 - 3. For single hung items, the maximum pipe/conduit size the brace location was designed to accommodate.

4. For trapeze supported items, the maximum weight (lbs/lf) the brace location was designed to accommodate.
 5. For suspended equipment, the maximum unit operating weight (lbs) the brace location was designed to accommodate.
 6. Location identifier cross matched to that on plan set layout.
 7. Company name of installing contractor.
- D. Upon completion of construction a Quality Assurance Representative of registered design professional who completed seismic submittal shall review the installation of the seismic-force-resisting system and provide documentation indicating general conformance to seismic restraint layout drawing.

END OF SECTION

SECTION 22 07 19
PLUMBING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contractor shall provide all necessary labor, materials, tools, and equipment to perform work required on the drawings and specified herein.
- B. Certain equipment and/or systems to be factory insulated by manufacturer. Factory insulation materials to be as specified in applicable sections of the specifications.
- C. All pipe fittings, valves, and strainers in insulated pipe systems to be insulated.
- D. Thermal resistance "R" values used herein are expressed in units of "Hour, Degrees F., Sq. Ft./BTU per Inch of Thickness" on a flat surface at a mean temperature of 75 degrees F.
- E. Note that where electric cable wrap is called for, insulation is to be applied over cable.
- F. "Contractor's Option" referred to in Materials below indicates optional materials which may be used as equals.

1.2 DEFINITIONS

- A. "Exposed" equipment, and piping are areas which will be visible without removing ceilings or opening access panels.
- B. Outdoors is considered exposed to the weather.
- C. Underground is buried, whereas in a trench below grade is considered concealed.

1.3 CERTIFICATION/QUALITY ASSURANCE

- A. Products shall meet applicable national, state, and local building codes and be U.L. (or other recognized testing lab) listed for intended service.
- B. All insulations, jackets, adhesives, coatings, sealers, and tapes shall have a flame spread rating of 25 or less and smoke development rating of 50 or less when tested in accordance with ASTM E-84, NFPA 225, U.L. 723, and further must meet the requirements of NFPA 90-A and applicable building, and plumbing, codes.
- C. All insulation materials shall be delivered and stored in manufacturers' containers and kept free from dirt, water, chemical, and mechanical damage.
- D. Insulation shall be applied in a workmanlike manner by experienced, qualified tradesmen.
- E. Insulation shall not be applied until all pressure testing has been completed, inspected, and released for insulation application.
- F. Surfaces shall be clean and dry.
- G. Insulation joints shall be butted firmly together and all jackets and tapes shall be smoothly and securely installed.
- H. Insulation for duct, pipe, and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D-1692.

1.4 APPLICABLE CODES AND STANDARDS

- A. ASTM E-84.
- B. U.L. 723.
- C. International Energy Conservation Code.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PIPE AND EQUIPMENT

- A. Materials for Pipe and Equipment: Provide factory pre-molded or shop or site mitered segment type insulation for pipe, pipe fittings, and valves. Fitting insulation to be of same thickness and material as adjoining pipe insulation. All insulation and related materials such as tape and mastic to meet applicable building code requirements for fire and smoke development.
 - 1. Flexible Tubular: Provide 25/50 rated, closed-cell, flexible tubular rubber type pipe insulation. Product to have continuous operational temperature limit of 200 degrees F. and a minimum "R" value of 3.7 per inch ($K=0.27$) at 75 degrees F mean temperature. Product to be Armstrong AP Armaflex or approved equal pipe insulation. Use flexible tubular for the following services:
 - a. Horizontal runs of waste lines carrying cold condensate from air conditioning equipment: 1" thick.
 - 2. Fiberglass: Provide factory-formed, factory-jacketed fiberglass piping insulation. Product to be Manville "Micro-Lok 650" with "Type AP-T" jacketing or equivalent product manufactured by CertainTeed, Knauf, or Owens-Corning. Product to have continuous operational temperature limit of 850 degrees F and a minimum "R" value of 4.3 per inch ($K=0.23$) at 75 degrees F mean temperature. Jacket to be fiberglass reinforced kraft paper with aluminum foil and pressure sensitive closure system. Vapor-barrier mastic for application to below ambient pipe insulation shall be fungus resistant per ASTM D 5590 with 0 growth rating; Water based; Permeance per ASTM E 96, Procedure B, 0.013 perm or less at 43-mil dry film thickness suitable for indoor and jacketed outdoor use. Products: Foster 30-80 AF. Color: White. A breather mastic for application to above ambient pipe insulation (fittings, tees, valves, etc) shall be water based Foster 46-50 mastic or Childers CP-10 / CP-11. Use fiberglass piping insulation for the following services:
 - a. Domestic hot water supply without recirculating system: 1-1/4" and under - 1" thick; 1-1/2" and greater - 1" thick.
 - b. Domestic hot water supply and recirculating return piping: All sizes – 1" thick.
 - c. Domestic cold water piping: 1/2" thick.
 - d. Horizontal rainwater leaders, overflow leaders, and roof drain bodies: 1" thick.

2.2 MATERIALS FOR FITTINGS, VALVES, AND SPECIAL COVERINGS

- A. Provide coverings and finishes for specific items hereinafter specified.
 - 1. Use pre-molded insulation fabricated by the manufacturer of insulation material or shop or site mitered segment type insulation for all pipe fittings, elbows, tees, valves, and couplings.
 - 2. Contractor's option to provide factory pre-molded one-piece PVC insulated fitting covers, pre-cut fiberglass insulation inserts, and necessary installation materials for all pipe fittings. Materials to be equal to Manville Zeston white, U.V. resistant, 25/50 rated, 20 mil thickness insulated PVC fitting covers and insulation inserts.
- B. For any service, when below grade direct buried, cover straight pipe and fitting insulation with equivalent of Pittsburgh Corning "Pittwrap", Foster C.I. Wrap 50 mil or "Pittwrap SS11" jacketing. Valves in systems operating above 60 degrees F. and installed in valve boxes shall not be insulated; however, the valves shall be painted with a rust resistant product equivalent to Rustoleum.
- C. For flexible tubular pipe and fitting insulation when exposed-to-view inside building or exposed to the weather, finish with two coats of paint, custom color blended to match surrounding surfaces.

- D. When specifically approved by designer, when it is impossible to completely insulate pipe, fittings, or valves with specified insulation, Armstrong Armaflex insulation tape may be used to prevent condensate drip on small piping. Use of cork insulation tape is prohibited.

PART 3 - EXECUTION

3.1 GENERAL

- A. No insulation shall be cut where a hanger is located. If hangers have been installed by pipefitter tradesmen which violates this strict requirement, notify Designer immediately.
- B. Piping systems shall be tested and found free of all leaks prior to installation of insulation covering.
- C. All surfaces shall be clean and dry when covering is applied. Covering to be dry when installed and during application of any finish, unless such finish specifically requires a wetted surface for application.
- D. All adhesives, cements, and mastics shall be compatible with materials applied and shall not attack materials in either wet or dry state.
- E. Install insulation using professional insulators who have adequate experience and ability.
- F. Exposed-to-view insulation shall have a well tailored appearance.
- G. Treat insulated pipe in equipment rooms and where exposed to normal view, so surfaces may be painted with water base latex paint. Use of mastics, adhesives, or jacketing which cause "bleeding" is prohibited.

3.2 INSTALLATION OF PIPE AND EQUIPMENT COVERING

- A. Where fiberglass or flexible tubular insulation is used on piping sized 2" and larger, insert a section of foamglass insulation at hanger or support points between pipe and metal shield for full length of shield to prevent crushing of insulation. Insulation thickness to be same as adjoining insulation. Where insulation passes through pipe hangers and across trapeze supports, 12" long metal saddles shall be used. On cold pipe, vapor barrier should be carried through the hanger and sealed.
- B. Apply flexible tubular insulation to pipe and fittings using the slip-on method with all joints tightly fitted and sealed with Armstrong 520 adhesive or approved equal. Seal butt joints, miter joints and torn or damaged insulation with adhesive.
- C. Apply PVC insulated fitting covers and precut insulation inserts as follows:
 - 1. Installation for hot systems:
 - a. Place the precut fiberglass insert around the fitting, positioning the points of the insert on the inside radius of the elbow.
 - b. Butt the ends of the fiberglass insert against the ends of the pipe covering. Tuck and fold the insulation so that it covers all bare surfaces. Keep the fiberglass fluffed up to the thickness of the adjacent pipe insulation to assure maximum thermal efficiency.
 - c. Insert two stainless steel serrated tacks approximately 1/4" from one of the lap edges of the fitting cover. Then snap the cover in place over the fiberglass insulation.
 - d. After the fitting cover is in position, push the tacks into the overlapping throat seam. Apply color-matched, pressure-sensitive tape to the butt joints.
 - 2. Installation for cold systems:
 - a. Position, tuck, and fold the fiberglass insulation insert as described above in steps (a) and (b) for hot systems.
 - b. Apply a vapor barrier mastic around the edges of the adjoining pipe insulation. Apply the mastic along the inside of the fitting cover throat overlap seam.
 - c. Place the fitting cover over the insulation, lapping the mastic-covered edge over the other side of the throat seam.

- d. Apply color-matched, pressure-sensitive tape over the circumferential joints. The tape should extend over the adjacent pipe insulation and overlap itself by at least 2" on the downward side of the lap.

END OF SECTION

SECTION 22 11 16
DOMESTIC WATER PIPING AND VALVES

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

- A. Submit pipe, valves, and fittings and have approved before starting installation. Pipe, valves, and fittings to be new, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.
- C. Provide seismic support and bracing of all piping systems in accordance with Seismic Specification Section 22 05 47 Seismic Restraint of Plumbing Equipment and Suspended Utilities.
- D. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Ferguson Enterprises
Contact: Bettina Dawson
office (615) 316-1920
email: HCA@Ferguson.com

2.2 COPPER PIPES

- A. Type "L" hard-drawn seamless copper tubing, ASTM B-88: Domestic hot and cold water.
- B. Type "K" hard-drawn seamless copper tubing:
 - 1. Domestic water lines located under slab.
 - 2. Exterior domestic water lines 2-1/2" and smaller underground.
 - 3. Provide rolled, soft drawn type "K" seamless copper tubing for under slab and below grade where length of run between fittings exceeds maximum hard-drawn lengths.
- C. Viega ProPress Couplings and Fittings (Or Approved Substitutions):
 - 1. As a deductive alternate, the contractor may submit cost savings to use Viega ProPress couplings and fittings for connection of hot and cold potable water piping for sizes up to and including 4 inch pipes.
 - 2. Copper shall conform to ASME B16.51. ProPress fittings 1/2-inch thru 4-inch for use with ASTM B88 type L copper tube. ProPress fittings shall have an EPDM sealing element and Smart Connect (SC) feature.
 - 3. Tube ends shall be cut on a right angle (square) to the tube. Tube ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the tube end with a clean rag. Visually examine the fitting sealing element to ensure there is no damage, and it is properly seated into the fitting. Insert tube fully into the fitting. Make a mark with a felt tip pen on the tube wall at the face of the fitting. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint. ProPress fittings 1/2-inch thru 4-inch shall be installed using Rigid ProPress Tools. ProPress fittings shall be installed according to the most current edition of the Viega installation guidelines. Installers shall attend a Viega ProPress installation training class.
 - 4. After ProPress fittings have been installed a "step test" shall be followed. Pressurize the system with air, or dry nitrogen between 5 psi and 45 psi, or with water between 15 psi and 85 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, walk the system and check for un-pressed fittings. When you identify the un-pressed fitting/s ensure the tube is fully inserted into the fitting, and the tube is properly

marked prior to pressing the joint. After appropriate repairs have been made, retest the system per local code, or specification requirements.

5. Pricing for the deductive alternate shall include the manufacturer's and contractor's 5 year parts, labor, and consequential damages warranty due to a defect in either labor, workmanship, or parts. The warranty cost should be reflected in the deduct price.
- D. Copper Pipe Fittings:
 1. Provide sweat fittings, ASTM B-62, dimensions conforming to ANSI B16.22, wrought copper, with sweep patterns for copper tubing smaller than 4".
 2. Provide brazed fittings, ASTM B-88, dimensions conforming to ANSI B16.50, wrought copper, with sweep patterns for copper tubing, 4" and larger.
 3. Dielectric connection: Provide Epco Sales, lead free dielectric couplers at junction of steel pipe and equipment with copper piping systems. Use of steel or cast iron fittings in copper piping systems prohibited. T-drill branch tee connections shall not be allowed for domestic water piping.
- E. Unions to be brass ground joint, 250-pound working pressure.
- F. Nipples used in conjunction with copper pipe to be brass.

2.3 AQUATHERM GREEN PIPE- NOT APPLICABLE

2.4 VALVES:

- A. Valves are specified by Manufacturer and Model Numbers to establish quality levels unless otherwise noted. Milwaukee, Nibco or Apollo are considered equal manufacturers. Provide clamp lock hand lever operators on valves less than 8 inches. All valves shall meet NSF-61 requirements.
 1. Gate Valves:
 - a. NA
 2. Globe Valves:
 - a. NA
 3. Ball Valves: Ball valves for copper water piping systems 2" O.D. and smaller to be equal to Apollo "3" S-585-66LF, solder ends, and for 2-5/8" thru 3-1/8" O.D. to be equal to Nibco T T-585-66LF, threaded ends. Valves to have bronze body, chromium plated bronze ball, PTFE seats, stuffing box ring and seals, and quarter turn on-off. Provide memory stops for valves used for balancing service. Valves to be rated for 400-psi WOG at 200 degrees F. Install threaded end valves with lead free brass adapters.
 4. Butterfly Valves: NOT APPLICABLE
 5. Check Valves:
 - a. Check valves for copper water piping systems to be swing type, Class 125, bronze body, screwed ends, Nibco T-413-Y-LF.
 6. Flow balancing valves for domestic hot water service shall be Bell & Gossett lead free Circuit Setter Plus or approved equal. Valve shall provide flow balancing, flow measuring, and positive shutoff service. Provide valve with memory stop, capped differential pressure readout ports with internal check valves and preformed insulation. Valve construction to be bronze body and brass ball rated for 200 psig at 250 degrees F.

2.5 STRAINERS

- A. Provide cleanable "Y" type strainers in pump suction lines. Strainers to have iron body with screwed bronze or bolted iron cap. Strainer baskets to be brass. Water strainers to be Monel 20 mesh screen. Strainers to be line size complete with blow-down hose bibbs. When Suction Diffusers are specified for end suction pumps, strainers are not required. Strainers to be as follows:
 1. Flanged 125# - Watts LFS 77F-D1-125.
 2. Solder joint 125# - Nibco S 413-Y-LF.

2.6 HANGERS

- A. Seismic application: The use of single-sided or friction type C-clamps with retention straps for hanging pipe is expressly prohibited on the project unless authorized by seismic bracing design engineer. Refer to Section 22 05 47 for requirements.
- B. Copper piping 1/2" O.D. thru 4" O.D., with no longitudinal movement to be Grinnell Figure 260, MSS SP-69 Type 1, adjustable clevis hanger with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
- C. Non-insulated copper tubing 1/2" O.D. thru 4" O.D. with no longitudinal movement to be Grinnell Figure CT-99C, MSS SP-69 TYPE 9, plastic coated adjustable tubing ring hanger.
- D. Insulated copper piping 1/2" O.D. thru 2-1/8" O.D. with longitudinal movement to be Grinnell Figure 171, MSS SP-69 TYPE 41, pipe roll complete with Figure 167, MSS SP-69 TYPE 40, galvanized steel insulation protection shield sized for maximum 10' span on 4 psi compressive strength insulation.
- E. Support copper pipe risers by Grinnell Figure CT-121C, MSS SP-69 TYPE 8, plastic coated riser clamps at floor penetrations.
- F. Support three or more parallel lines by trapeze hangers utilizing Unistrut channel or equal in bottom mounting arrangement with rod hanging support.
- G. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- H. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- I. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with following tables.

COPPER TUBING SUPPORTS	
SIZE (IN.)	DISTANCE BETWEEN SUPPORTS (FT.)
5/8	6
7/8 - 1-1/8	8
1-3/8 - 2-1/8	10
2-5/8 - 5-1/8	12
6-1/8 - 8-1/8	14

- J. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- K. See Insulation Section for requirements at pipe hangers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. The firestop system shall have been tested and approved in accordance with ASTM E119 and U.L. 1479 (ASTM E814) and classified for up to 2 hours fire rating. Firestop system shall be type detailed on drawings or intumescent type capable of expanding up to 8 times its original volume. Firestop system to be 3M, Hilti, Nelson, Johns Manville, or Specified Technologies. Firestop system shall be installed in strict accordance with published U.L. approved

installation instructions. Piping to pass through the fire-rated partition insulated or non-insulated as specified and detailed. Submit U.L. approved installation drawing for each type of penetration prior to construction.

3.3 NON-RATED PARTITIONS

- A. Piping to pass through the walls insulated or non-insulated as specified. Wall should be finished to fit neatly around the piping. Firestopping is not required at non-rated partitions.

3.4 PIPE SLEEVES

- A. Pipe sleeves shall be provided at non-rated partitions and floor penetrations. Pipe sleeves to be Schedule 40 or 18 gage steel. Sleeves to extend 1-1/2" in excess of partition depth on each side. Sleeves penetrating floors in wet areas, including all mechanical rooms, shall extend a minimum of 1 inch above the floor.
 - 1. Piping requiring sleeves: Copper pipes thru masonry walls
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. Pipes not to be hung or supported by pumps. No torque to be applied to pumps by connecting pipes. After final pipe adjustments and initial operation of the pumps, this Contractor to recheck alignment of pumps and realign as required.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. Ream pipe after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods of open end closure.
- I. Threads to be right-hand, pipe standard, clean cut, full depth, and tapered. Joints to be made tight without caulking. Approved pipe joint lubricant to be used, applied in thin layer to the male thread only.
- J. Install copper fittings with suitable flux and 95/5 lead free solder. Type K copper pipe to be joined by means of suitable flux and silver or phos-copper.
- K. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- L. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- M. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.5 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.6 VALVE ACCESS

- A. Locate all shutoff and control valves for easy access and operation. Where valves must necessarily be located in enclosed spaces, they shall be provided with access panels of sufficient size for operation. Furnish these access panels to proper trades for installation.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER BACKFLOW PREVENTERS, TRAP PRIMERS, AND SHOCK ABSORBERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section includes requirements for:
 - 1. Backflow preventers.
 - 2. Shock absorbers.
 - 3. Trap primers.
 - 4. Equipment connection backflow device.
 - 5. Vacuum breakers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All products to be purchased from Ferguson Enterprises. Contact Bettina Dawson office (615) 316-1920 or email HCA@Ferguson.com.
- B. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.

2.2 BACKFLOW PREVENTERS

- A. Acceptable Manufacturer: Wilkins.
- B. Product must meet NSF-61.
- C. Provide completely automatic, unit, fitted with tight closing shut-off valves and test cocks at each end.
- D. Construct such that all parts are replaceable without removing unit from line.
- E. Design such that total pressure drop through complete backflow preventer does not exceed 12 PSI at rated flow. Certified U.S.C. flow curves shall be provided for each device as part of the submittal package.

2.3 SHOCK ABSORBERS

- A. Acceptable Manufacturer: Sioux Chief.
- B. Refer to drawings for placement and size of shock absorbers.
- C. Access Covers: Minimum size 12" x 12" located for access to shock absorbers.

2.4 TRAP PRIMERS

- A. Acceptable Manufacturer: Precision Plumbing Products.
- B. Construct trap primer valve of all bronze, chrome plated with removable operating parts, integral vacuum breaker, and gasketed access cover.
- C. Access Covers: Minimum size 12" x 12" located for access to trap primers.

2.5 EQUIPMENT CONNECTION BACKFLOW DEVICE

- A. Acceptable manufactures: McCann Engineering ASSE 1022 Backflow Preventer.
- B. Must meet ASSE 1022
- C. Provide the above referenced backflow device if beverage equipment does not have integral backflow device.

2.6 VACUUM BREAKERS

- A. Wilkins model 420

PART 3 - EXECUTION

3.1 INSTALLATION AND TESTING

- A. Backflow Preventers:
 - 1. Pipe relief through fixed air gap and discharge to sewer.
 - 2. Install adjacent to wall and/or floor utilizing stand-off brackets, angle frame, and/or concrete piers.
 - 3. Test unit for leaks and pressure drop. Clean and/or replace soiled strainer media.
 - 4. Provide dual parallel reduced pressure backflow preventers on the main domestic water entrance to the facility.
 - 5. Provide a reduced pressure backflow preventer on the domestic hot and cold water lines feeding the laboratory.
 - 6. Provide backflow prevention vacuum breaker on any water line feeding any piece of equipment which could cause back siphonage such as mechanical equipment, trap primer lines, etc.
- B. Shock Absorbers:
 - 1. Install shock absorbers above ceiling, outside wall so access and maintenance can be performed without disturbing walls and non-liftouts ceilings.
 - 2. Install shock absorbers on all flush valves, solenoid valves and quick closing devices.
 - 3. Test and certify shock absorbers by plumbing and drainage institute.
- C. Trap Primers: Trap primers to have approval of plumbing and drainage institute.
- D. Equipment Connection Backflow device: Provide on all water lines feeding coffeemakers, ice machines and beverage dispensers.
- E. Vacuum Breakers: Provide on water lines feeding equipment to protect against back siphonage of contaminated water.

END OF SECTION

SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL AND PRODUCTS

1.1 HOT WATER RECIRCULATING PUMP

- A. Acceptable Manufacturers: Taco, Paco, or Bell and Gossett.
- B. Model number, capacity, and electrical characteristics as scheduled on drawings.
- C. Provide in-line pump with all bronze construction, flange connections, hardened steel shaft, bronze impeller, and mechanical seal.
- D. Provide flexible coupled motor with thermal overload protection Support motor from pump casing.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Install in accordance with manufacturers' published installation instructions.

2.2 START-UP AND TEST

- A. Start-up pump, verify integrity of connection, electrical phasing.
- B. Test pumps in operation under design load conditions.

END OF SECTION

SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 WORK INCLUDED



- A. Submit pipe and fittings and have approved before starting installation. Pipe and fittings to be new, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.
- C. Provide seismic support and bracing of all piping systems in accordance with Seismic Specification Section 22 05 47 Seismic Restraint of Plumbing Equipment and Suspended Utilities.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, draining tube, drawn temper. Waste, vent and drainage piping 1-1/2 and smaller.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B 16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASME B 88, Type L, water tube, drawn temper.
- D. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- F. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.2 CAST IRON SOIL PIPE

- A. Standard weight cast iron soil pipe with drainage fittings:
 - 1. Waste, drainage, and vent lines 2" and larger. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF® International.
 - 2. Drain lines under concrete or other paving and under buildings, including to a distance of not less than 5'-0" from building. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF® International.
 - 3. Manufacturers: Charlotte Pipe and Foundry, Tyler Pipe, AB&I Foundry.
 - 4. Joints in cast iron soil pipe may be hub and spigot with neoprene compression gaskets conforming to ASTM C564 or "No-hub". No-hub shall not be permitted on underground systems. No-hub couplings shall be standard CISPI 310 couplings manufactured with 300 series stainless steel and neoprene rubber sleeve.

2.3 PVC PIPE

- A. Schedule 40 PVC DWV pipe, ASTM D-2665 solid wall Type 1, Grade 1.
 - 1. Schedule 40 DWV waste and drainage piping below grade ONLY. PVC piping not permitted within Boiler Room or Kitchen.
- B. TYPE PSM SDR-35 PVC sewer pipe with gasket slip joints, ASTM D-3034.
 - 1. Outside gravity, underground sanitary sewer drainage, from 5'-0" outside building to connection to local sewer.
- C. Fittings to match piping system. Fittings to have manufacturer's trademark permanently identified in accordance with MSS-SP-25. Supplier to include with submittal data certification that fittings and flanges have met requirements.
- D. Joints for piping to be made with tetrahydrofuron solvent cement. Joints to be in accordance with manufacturer's recommendations.
- E. Pipe, fittings, and cement to all be supplied by single manufacturer for entire project.
- F. All solvent cements shall be low emitting VOC at 510 g/L or less.

2.4 HANGERS

- A. Seismic application: The use of single-sided or friction type C-clamps with retention straps for hanging pipe is expressly prohibited on the project unless authorized by the seismic bracing design engineer refer to Specification Section 22 05 47 for requirements.
- B. Non-insulated cast iron soil pipe thru 8" to be Grinnell Figure 104, MSS SP-69 TYPE 6, adjustable swivel ring, split ring type, and pipe 10" thru 15" Grinnell Figure 260, MSS SP-69 TYPE 1, adjustable clevis hanger.
- C. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- D. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- E. Attention is called to pipe spring isolation specified to be furnished by this Contractor.
- F. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with the following:
 - 1. Cast Iron Supports: Support each fitting, at intervals of not more than 5 feet, and at least at each joint.
- G. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. The firestop system shall have been tested and approved in accordance with ASTM E119 and U.L. 1479 (ASTM E814) and classified for up to 2 hours fire rating. Firestop system shall be type detailed on drawings or intumescent type capable of expanding up to 8 times its original volume. Firestop system to be 3M, Hilti, Nelson, Johns Manville, or Specified Technologies. Firestop system shall be installed in strict accordance with published U.L. approved installation instructions. Piping to pass through the fire-rated partition insulated or non-

insulated as specified and detailed. Submit U.L. approved installation drawing for each type of penetration prior to construction.

3.3 NON-RATED PARTITIONS

- A. Piping to pass through the walls insulated or non-insulated as specified. Wall should be finished to fit neatly around the piping. Firestopping is not required at non-rated partitions.
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. Pipes not to be hung or supported by pumps. No torque to be applied to pumps by connecting pipes. After final pipe adjustments and initial operation of the pumps, this Contractor to recheck alignment of pumps and realign as required.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. Ream pipe after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods of open end closure.
- I. Threads to be right-hand, pipe standard, clean cut, full depth, and tapered. Joints to be made tight without caulking. Approved pipe joint lubricant to be used, applied in thin layer to the male thread only.
- J. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- K. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- L. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.4 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.5 GRADES AND ELEVATIONS

- A. Uniformly grade sanitary drainage lines to elevations shown. If no elevations are given, pitch sewers not less than 1/8" per foot.

END OF SECTION

SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section includes requirements for:
 - 1. Cleanouts.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cleanouts and grease interceptors to be purchased from Ferguson Enterprises. Contact Bettina Dawson office (615) 316-1920 or email HCA@Ferguson.com.

2.2 CLEANOUTS

- A. Acceptable Manufacturer: Zurn. The following model numbers listed are Zurn.
- B. Exterior: ZN-1402-HD cast iron cutoff ferrule with round nickel bronze scoriated frame and cover, secured.
- C. Finished Concrete Floor: ZN-1400-HD inside caulk round nickel bronze scoriated frame and cover.
- D. Resilient Tile Floor: ZN-1400-X inside caulk round nickel bronze scoriated frame and cover, secured.
- E. Wall: Z-1446 cast iron cleanout with bronze plug and round stainless steel cover.
- F. Access Covers: Minimum size 12" x 12" located for access to valves, shock absorbers, trap primers, wall cleanouts, etc.
- G. Furnish cleanouts occurring in waterproof floors with clamping devices.

PART 3 - EXECUTION

3.1 INSTALLATION AND TESTING

- A. Cleanouts:
 - 1. Locate line size cleanouts, except 4" largest required, at base of all soil and waste stacks, at all changes in direction and in straight runs. Ensure spacing in straight runs does not exceed 50 feet inside building and 100 feet outside the building.
 - 2. Extend inaccessible cleanouts up through floor and/or wall provided easy accessibility cannot be obtained otherwise.

END OF SECTION

SECTION 22 14 16
RAINWATER LEADERS


PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

- A. Submit pipe and fittings and have approved before starting installation. Pipe, and fittings to be new, manufactured domestically, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.
- C. Provide seismic support and bracing of all piping systems in accordance with seismic details shown on drawings.

PART 2 - PRODUCTS

2.1 CAST IRON SOIL PIPE

- A. Standard weight cast iron soil pipe with drainage fittings:
 - 1. Storm water piping.
 - 2. Rainwater leaders inside building.
 - 3. Drain lines under concrete or other paving and under buildings, including to a distance of not less than 5'-0" from building.
 - 4. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute  and listed by NSF[®] International.

2.2 PVC PIPE

- A. Schedule 40 PVC pipe, ASTM D-1785 Type 1, Grade 1, 200-psi test:
 - 1. Storm water piping below grade.
- B. Fittings to match piping system. Fittings to have manufacturer's trademark permanently identified in accordance with MSS-SP-25. Supplier to include with submittal data certification that fittings and flanges have met requirements.
- C. Joints for piping to be made with tetrahydrofuron solvent cement. Joints to be in accordance with manufacturer's recommendations.
- D. Pipe, fittings, and cement to all be supplied by single manufacturer for entire project.
- E. All solvent cements shall be low emitting VOC at 510 g/L or less.

2.3 HANGERS

- A. Seismic application: The use of C-clamps for hanging pipe is expressly prohibited on the project.
- B. Non-insulated cast iron soil pipe thru 8" to be Grinnell Figure 104, MSS SP-69 TYPE 6, adjustable swivel ring, split ring type, and pipe 10" thru 15" Grinnell Figure 260, MSS SP-69 TYPE 1, adjustable clevis hanger.
- C. Adequately size hangers on insulated piping for insulation to pass continuously through hangers. Insulated piping to be supported outside insulation covering.
- D. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- E. Attention is called to pipe spring isolation specified to be furnished by this Contractor.
- F. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with the following:

1. Cast Iron Supports: Support each fitting, at intervals of not more than 5 feet, and at least at each joint
- G. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- H. See Insulation Section for requirements at pipe hangers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.
- B. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.
- C. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- D. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- E. Pipes not to be hung or supported by pumps. No torque to be applied to pumps by connecting pipes. After final pipe adjustments and initial operation of the pumps, this Contractor to recheck alignment of pumps and realign as required.
- F. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.
- G. Unless otherwise shown on drawings, lines to be installed to drain to sumps or sewer.
- H. Ream pipe after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods of open end closure.
- I. Threads to be right-hand, pipe standard, clean cut, full depth, and tapered. Joints to be made tight without caulking. Approved pipe joint lubricant to be used, applied in thin layer to the male thread only.
- J. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- K. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- L. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. The firestop system shall have been tested and approved in accordance with ASTM E119 and U.L. 1479 (ASTM E814) and classified for up to 2 hours fire rating. Firestop system shall be type detailed on drawings or intumescent type capable of expanding up to 8 times its original volume. Firestop system to be 3M, Hilti, Nelson, Johns Manville, or Specified Technologies. Firestop system shall be installed in strict accordance with published U.L. approved installation instructions. Piping to pass through the fire-rated partition insulated or non-insulated as specified and detailed. Submit U.L. approved installation drawing for each type of penetration prior to construction.

3.3 NON-RATED PARTITIONS

- A. Piping to pass through the walls insulated or non-insulated as specified. Wall should be finished to fit neatly around the piping. Firestopping is not required at non-rated partitions.

3.4 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No water piping permitted in transformer, electrical, or elevator equipment rooms.

3.5 GRADES AND ELEVATIONS

- A. Uniformly grade storm drainage lines to elevations shown. If no elevations are given, pitch sewers not less than 1/8" per foot.

END OF SECTION

SECTION 22 15 13
GENERAL SERVICE NATURAL GAS PIPING AND VALVES

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS

- A. Submit pipe, valves, and fittings and have approved before starting installation. Pipe, valves, and fittings to be new, and marked clearly with manufacturers' name, weight, and classification or working pressure.
- B. Piping to run approximately as shown on drawings or as structural and architectural conditions permit.
- C. Provide seismic support and bracing of all piping systems in accordance with Seismic Specification Section 22 05 47.
- D. All piping is to be installed, inspected and tested prior to operation in strict conformance with NFPA 54. Inspection and Testing is to be witnessed by general contractor's field superintendent with documentation of appropriate measures, test results, parties witnessing and completing work close out documentation provided to Owner.

PART 2 - PRODUCTS

2.1 STEEL PIPES

- A. Butt welded, electric resistance welded, or seamless black steel pipe, ANSI B 36.10, ASTM A-53, Grade "B" or "A", Schedule 40 for piping 10" and smaller, 0.375 wall thickness for piping 12" thru 24" diameter, for the following services:
 - 1. Gas piping.
 - 2. Mill wrap all uninsulated underground steel pipe with Republic X-Tru-Coat or equal.

2.2 STEEL PIPE FITTINGS

- A. Flanges, fittings, unions and other products recognized as regularly available products to be marked in accordance with MSS SP-25. Markings on products of small size or shape may be omitted in the sequence allowed by MSS SP-25, except manufacturers' name or trademark.
- B. Fittings 2-1/2" and larger to be standard weight, carbon steel, butt welding fittings conforming to ASTM A-234 and ANSI B16.9.
- C. Branch connections from mains or headers 2-1/2" or larger to be welded tees. Stub-in welded piping is not acceptable.
- D. Fittings 2" and smaller to be threaded, Class 150, standard, malleable iron fittings, conforming to ANSI B16.3 and ASTM A-197
- E. Contractor's option to use welded steel for pipe sizes 1-1/2" and 2" in size.
- F. Flanges to be 150 lb. carbon steel conforming to ASTM A-105, ASTM A-181, and ANSI B16.5.
- G. Unions to be Class 150 malleable iron with bronze-to-iron ground joint conforming to ANSI B16.39, ANSI B1.20.1, and ASTM A-197
- H. Bolting materials to be semi-finished carbon steel bolts and hex nuts conforming to ASTM A-307. Threads and dimensions to be in accordance with ANSI B1.1 and B18.2.
- I. Thread lubricant to be Crane "Formular 425" or equal. Approved Teflon tape may be used at Contractor's option.
- J. Gaskets to be 1/8" thick "Cranite", "Sepco" or equal.

2.3 VALVES

- A. Valves are specified by NIBCO and Apollo model numbers to establish quality levels unless otherwise noted. Provide clamp lock hand lever operators on valves less than 8 inches. Provide hand wheel and closed housing worm gear on valves 8 inches and larger unless indicated otherwise below. Provide chain operators for all equipment room and powerhouse valves 4 inch and larger which are located over 6 feet 6 inches above the finish floor.
- B. Gate Valves:
 - 1. Gate valves for 2-1/2" and larger steel piping systems to be Class 125, cast iron body, bronze mounted, flanged ends, NIBCO F-617-0. Valves to have solid wedge disc, outside stem and yoke with rising stem, and bolted bonnet.
 - 2. Gate valves for 2" and smaller steel piping systems to be Class 125, bronze body, screwed ends, NIBCO T-111. Valve to have solid disc, rising stem, and union bonnet.
- C. Ball Valves:
 - 1. Ball valves for copper water piping systems to be Apollo Figure 70-100 threaded ends with bronze body chromium plated bronze ball, Teflon seats, stuffing box ring, and seals, and quarter turn on-off. Provide memory stops for valves used for balancing service. Valves to be rated for 400-psi WOG at 200 degrees F. Install threaded end valves with brass adapters.
- D. Plug Valves: Plug valves shall be lubricated cylindrical plug valves constructed of ASTM A-126, grade B semi-steel and rated for 150 psig working pressure. Square head shall move from fully opened to fully closed with quarter turn of plug. Plug shall float in lubricant. Teflon head seat gasket shall be backed by lubricant reservoir. Valves 2" and smaller shall have screwed ends, 2-1/2" and larger to be flanged. Provide one wrench per valve size and mount on rack in equipment room. Homestead #611 (or Norstrom/Rockwell) for valves 2" and smaller, Homestead #612 for valves 2-1/2" through 6", Homestead #612-GW for valves 8" and larger. Valves to be factory pre-lubricated with Homestead #204. Provide two high pressure lubricant guns with 17-1/2" long extension hose equivalent to Homestead Type "B" and two cartons of Homestead #204 gun stick lubricant suited for clean water service between minus 30 degrees F and 400 degrees F. Wall mount lubricant guns on a red colored painted wood panel and locate panel in main equipment room near pumps.

2.4 GAS SHUTOFF VALVES

- A. Shutoff valves shall be provided at each piece of equipment and shall be Class 125 gas line cocks with cast iron body, bronze plug and washer, and iron nut, Crane Figure 324.

2.5 HANGERS

- A. Seismic application: The use of C-clamps for hanging pipe is expressly prohibited on the project.
- B. Non-insulated steel piping 1/2" thru 24" with no longitudinal movement to be Grinnell Figure 260, MSS SP-69 Type 1, adjustable clevis hanger.
- C. Support steel pipe risers by Grinnell Figure 261, MSS SP-69 TYPE 8, riser clamps at floor slab penetrations.
- D. Provide concrete inserts, Grinnell Figure 282, MSS SP-69 TYPE 18, universal concrete insert, for attaching hangers to building structure. Inserts to be adequately sized and correctly positioned to support piping, valves, etc., when full of water and system is in operation.
- E. Attention is called to pipe spring isolation specified to be furnished by this Contractor.
- F. Support all piping by heavy steel, adjustable hangers, or brackets suitably fastened to structural portion of building. Place hangers in accordance with following table:

STEEL PIPE SUPPORTS	
SIZE (IN.)	DISTANCE BETWEEN SUPPORTS (FT.)
3/4 - 1-1/4	8
1-1/2 - 2-1/2	10
3	12
4 - 6	14
8 - 12	16
14 - 24	20

- G. Perforated metal, strap iron, or band iron hangers are not permitted. Offsets in hangers are not allowed. Pipe risers to be supported at regular intervals in pipe shafts within the limits of good practice.
- H. Support horizontal piping across roof in accordance with Specification Section.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Install piping as shown on coordinated shop drawings not to interfere with opening of doors or other moving parts. Do not install piping near or directly over any portion of electrical equipment.

3.2 FIRE-RATED PARTITIONS

- A. Provide permanent firestop system at all piping penetrations of fire-rated walls and floors. Review details on drawing as well as this specification for permissible firestop systems. The firestop system shall have been tested and approved in accordance with ASTM E119 and U.L. 1479 (ASTM E814) and classified for up to 2 hours fire rating. Firestop system shall be type detailed on drawings or intumescent type capable of expanding up to 8 times its original volume. Firestop system to be 3M, Hilti, Nelson, Johns Manville, or Specified Technologies. Firestop system shall be installed in strict accordance with published U.L. approved installation instructions. Piping to pass through the fire-rated partition insulated or non-insulated as specified and detailed. Submit U.L. approved installation drawing for each type of penetration prior to construction.

3.3 NON-RATED PARTITIONS

- A. Piping to pass through the walls insulated or non-insulated as specified. Wall should be finished to fit neatly around the piping. Firestopping is not required at non-rated partitions.

3.4 PIPING PROJECTING THROUGH FINISHED SYSTEMS

- A. Provide chromium-plated escutcheon plates for exposed uninsulated pipes projecting through floors or walls in finished spaces. Mechanical rooms and janitor closets are not considered "finished" spaces.

3.5 QUALITY AND ADJUSTMENT

- A. Hang piping so equipment, flanges, and connections do not bear weight of piping.
- B. Adequately support vertical lines at their bases or by a suitable hanger placed in horizontal line near riser or by a base fitting set on pedestal.
- C. Run piping in straight lines; riser lines to be plumb with such offsets only as indicated or necessary. No sagging of lines permitted.

3.6 PIPING IN TRANSFORMER, ELECTRICAL, AND ELEVATOR EQUIPMENT ROOMS

- A. Refer to drawings. No piping permitted in transformer, electrical, or elevator equipment rooms.

3.7 METHODS AND ASSEMBLY

- A. Ream pipe after cutting to full bore. Remove foreign matter from inside of pipe before installing. Keep installed piping free from dirt and scale and protect open ends from foreign matter. Use temporary plugs or other approved methods of open end closure.
- B. Threads to be right-hand, pipe standard, clean cut, full depth, and tapered. Joints to be made tight without caulking. Approved pipe joint lubricant to be used, applied in thin layer to the male thread only.
- C. Piping to have sufficient number of flanges or unions for convenient installation and removal of piping and equipment.
- D. Remake or replace defective, leaking, or otherwise unsatisfactory joints or material. Peening, caulking, or doping of piping is not permitted.
- E. Install piping to prevent stresses and strains to piping and hangers from expansion or contraction. Provision for proper loops, offsets, or expansion joints to be responsibility of Contractor. Make provision for servicing and removal of equipment without dismantling piping.
- F. Pressure test as required by Section 23 01 00. Coordinate witnessing of testing with general contractor and/or commissioning agent.

3.8 VALVE ACCESS

- A. Locate all shutoff and control valves for easy access and operation. Where valves must necessarily be located in enclosed spaces, they shall be provided with access panels of sufficient size for operation. Furnish these access panels to proper trades for installation.

END OF SECTION

SECTION 22 34 00
FUEL - FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a factory package, direct natural, gas fired, forced draft, ASME type domestic water heater.
- B. Condensing type, gas fired domestic water heater, size and style as listed on plan schedule

1.2 RELATED WORK

- A. Section 23 51 23, Prefabricated Gas Vent Pipe.
- B. AL 29 4C as required by manufacturer.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Unit manufactured by Rinnai or approved equal. Model number, capacity, accessories scheduled on drawings are basis of design.
- B. Burners to be stainless steel and 100% safety shutoff controls, spark ignition, combustion blower unit, gas-air mixer, pilot flame rod, regulators, pressure switches, relief door, low water cutoff, high limit control, panel-mounted temperature and pressure gauges.
- C. ASME temperature and pressure relief valve.
- D. Fiberglass insulation with steel jacket to meet latest ASHRAE standards.
- E. Operating instructions and written warranties.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify location and clearance requirements.
- B. Installation in accordance with manufacturers' recommendations and project drawings.
- C. Furnish and install a Hesco Model HGD II-S, gas safety alarm monitor, 120/1/60, equipped with Power-ON indicator light, alarm indicator light, automatic audio alarm shut off, terminal strip with 24-volt contacts, 12-volt contacts, and 9-volt contacts to allow interface to remote alarm light, remote alarm bell, exhaust fan, or electric gas valve in the event hazardous gases reach alarm levels listed below.
- D. The HGD II-S shall be calibrated at the factory with carbon monoxide, and shall be sensitive to the following gases at the levels listed below:

Gas	Alarm Level
Carbon Monoxide	300 PPM
Propane (L.P.)	5,250 PPM
Natural/Methane Gas	12,500 PPM

- E. The HGD II-S shall be equipped with a built-in manual reset switch that will not allow the unit to be reset while hazardous gases are present in the equipment room at the above listed levels.

END OF SECTION

SECTION 22 43 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 MANUFACTURERS

- A. Provide plumbing fixtures and drains as listed on drawings and described herein. Fixture numbers are per HCA standard per purchase agreement for all products. All products to be purchased from Ferguson Enterprises. Contact Bettina Dawson office (615) 316-1920 or email HCA@ferguson.com.
- B. All drainage products to be Zurn no exceptions. All drains installed above slab to be complete with clamping device.
- C. Stainless steel sinks shall be Elkay no exceptions.
- D. Flush valves shall be Zurn-AV no exceptions.
- E. Pressure balancing shower valves shall be Symmons
- F. Commercial or public faucets shall be Zurn no exceptions.
- G. Gooseneck faucets shall be Zurn no exceptions. All gooseneck water supply spouts for lavatories and sinks shall discharge a minimum of 5" above the rim of the specified fixture. All gooseneck faucets shall be furnished with plain end spouts; aerators shall not be accepted. An in-line flow control device to limit flow to 1.5 GPM maximum shall be installed on all gooseneck faucets, including gooseneck sensor faucets unless otherwise called for on specific fixtures.
- H. Fixture supplies, stops, and traps to be commercial grade Proflo. Traps to be 17 gauge with wall flange. Supplies to be flexible stainless steel supply lines and stops to be Proflo quarter turn compression stops.
- I. Water closet seats shall be Proflo, no exceptions.
- J. Thermostatic master mixing valves shall be Symmons, Powers, or Leonard.
- K. China or enamel fixtures to be white in color
- L. All wall-mounted lavatories shall be capable of supporting a minimum vertical load of 250 pounds. Install wall-mounted lavatories with floor-anchored carriers which fit in standard stud walls.
- M. All water supply spouts for lavatories and sinks shall discharge a minimum of 1" above the rim of the specified fixture.
- N. Where blade handles are specified, they shall not be less than 3-1/2", or more than 4-1/2" in length, except that handles of clinical sinks shall not be less than 6" long.
- O. All products used for dispensing potable drinking water must be lead free and meet the requirements of NSF 61 and NSF 372 test standards via third party testing and certification.
- P. Vendura Solid Surface Shower receptacles no exceptions. Fixture color to be Bone per HCA design team

PART 2 - PRODUCTS

2.1 FIXTURES

- P101 Water Closet - Public, Floor Mounted, Barrier-Free, 1.28 Gallon:
 Zurn Z5665-BWL1 Floor Mt water closet 1.28gpf Bowl
 Zurn Z-6000-AV-HET 1.28gpf flush valve
 Proflo PFTSCOF2000WH Comm Elongated OF Closet seat
- P107 Water Closet - Ligature Resistant, Exposed Flush Valve:
 Whitehall WH2142-ADA-T-0023 ADA water closet, top spud, integral seat. Whitehall
 WH2802-SLPT-ADA-1.6 flush valve cover with hydraulic flush valve

- P304 Lavatory, Wall Hung, Patient, Barrier-Free, Gooseneck:
 Zurn Z5344 White 20x18 4cc wall mount lavatory
 Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade hdl, plain end spout
 Proflo PFGD101 1-1/4x6 CP 17ga offset grid drain
 Proflo PFPTB400 1-1/4" 17ga P trap
 Proflo PFXQAC32C ¼ turn angle stop (2)
 Proflo PFX146324 20" Flex SS riser (2)
 Proflo PFE7 ½" CP escutcheon (2)
 Proflo PF203WH Trap wrap kit
 Zurn ZZ1231 wall carrier
- P309 Ligature Resistant Single-Station Lavatory:
 Bradley HSL-1-BIR-TMA-TC-AL-BRKT-S-chrome single station, solid surface, infrared controls, thermostatic mixing valve, SS trap cover and chrome P-trap.
 Proflo PFXQAC32C ¼ turn angle stop (2)
 Proflo PFX146324 20" Flex SS riser (2)
 Proflo PFE7 ½" CP escutcheon (2)
- P312 Lavatory, Wall Hung, Patient, Barrier-Free, Gooseneck:
 Zurn Z5344 White 20x18 4cc wall mount lavatory
 Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade hdl, plain end spout
 Zurn Z9AWA112WH 1-1/2 acid waste grid drain
 Zurn Z9ABT112 1-1/2 STD acid waste bottle trap
 Proflo PFXQAC32C ¼ turn angle stop (2)
 Proflo PFX146324 20" Flex SS riser (2)
 Proflo PFE7 ½" CP escutcheon (2)
 Proflo PF203WH Trap wrap kit
 Zurn ZZ1231 wall carrier
- P313 Lavatory, Wall Hung, Bariatric, Barrier-Free, Gooseneck:
 Willoughby BHS3123 ada bariatric wall mount lavatory with drain
 Zurn Z812A4-XL-FC1.5 CP 1.5gpm, GN wrist blade hdl, plain end spout
 Proflo PFPTB400 1-1/4" 17ga P trap
 Proflo PFXQAC32C ¼ turn angle stop (2)
 Proflo PFX146324 20" Flex SS riser (2)
 Proflo PFE7 ½" CP escutcheon (2)
 Zurn ZZ1224 wall carrier
- P402 Single Compartment Sink, Gooseneck Faucet: Barrier free
 Elkay LRAD1919-55-3 stainless sink
 Zurn Z831B4-XL-FC gooseneck, wrist blades
 Proflo PFWTST wide top grid drain
 Proflo PFXQAC32C ¼ turn angle valve (2)
 Proflo PFX146324 20" flex riser (2)
 Proflo PFE7 ½" CP escutcheon (2)
 Proflo PFPTB403 1-1/2 17 ga P trap
- P410 Single Compartment, Lab
 Elkay DLR-1919-10-3 stainless sink
 Zurn Z831B4-XL-FC gooseneck, wrist blades
 Proflo PFWTST wide top grid drain
 Zurn ZZ9ZBT112 1-1/2"Std AR bottle trap
 Proflo PFXQAC32C ¼ turn angle valve (2)
 Proflo PFX146324 20" flex riser (2)
 Proflo PFE7 ½" CP escutcheon (2)

- P502 Clinical Sink, Floor Mounted:
Zurn Z5420 with rim guards
Zurn Z6017-AV-H
Zurn Z843D4-LVB-PE-5XT-FT-YJ
Zurn Z85500WM-XL-EVB-HK-SE-SH2-VC bedpan washer, vacuum breaker
Stern Williams #1028 universal pedestal
- P503 Scrub Sink, Sensor Faucet:
Zurn Z5468 with wall hanger/support brackets
Zurn Z6920-XL-FC1.5-ADM2-H4 gooseneck, sensor faucet plain end spout
Zurn Z8739-SW-PC CP strainer with tailpiece
Proflo PFXQAC32C ¼ turn angle valve (2)
Proflo PFX146324 20" flex riser (2)
Proflo PFE7 ½" CP escutcheon (2)
- P504 Service Sink:
Stern-Williams SB-902 (24"x 24"x12") with stainless steel caps, two tiling flanges
Proflo PFWG24S 24x24 back panels
Stern-Williams TC3 / TC3NH gasket
Zurn Z843-M1-RC-CS integral spring-loaded check stops
- P601 Shower, Tile:
Base, walls, grab bar, soap dish, fold-up seat furnished by others
Symmons SYM9605-X-PLR-231 Shower faucet w/ ADA HH spray
Zurn ZN-415-5B shower drain
- P608 Shower, 36" Solid Surface Base:
Walls, grab bar, soap dish, fold-up seat furnished by others
InPro E3636LCCDBO 36"x36" low curb shower base, center drain
Symmons SYM9605-X-PLR-231 Shower faucet w/ ADA HH spray
ProFlo PF140NC CP shower Drain
- P701 Floor Drain, Regular:
Zurn ZN-415-P-Y type B strainer, nickel bronze top, trap primer, sediment bucket
- P702 Floor Drain, 12" Mechanical Room:
Zurn ZN-541-P, nickel bronze top, sediment bucket, trap primer
- P710 Roof Drain, 15" Diameter:
Zurn ZA-100-DR, aluminum dome, adjustable drain riser extension assembly
- P711 Roof Drain, Overflow:
Zurn ZA-100-W2-DR, aluminum dome, adjustable drain riser extension assembly,
internal 2" dam
- P721 Floor Drain, Process, A.R.E. Coated:
Zurn Z-550-P-Y-AR, trap primer, sediment bucket
All components shall be A.R.E coated, interior and exterior
- P724 Downspout Nozzle
Zurn ZARB199-IP-SS
- P801 Wall Hydrant, Exterior:
Zurn Z-1310, non-freeze with vacuum breaker and stainless steel face
Install 18" above finished grade

- P802 Hose Bibb, Interior:
Zurn Z1341-P34-PC polished chrome finish with vacuum breaker
Install 18" above finished floor
- P804 Ice Machine Connection:
Oatey No. 39140 metal ice maker box with metal face plate.
Box with valve and water hammer arrestor
- P811 Drinking Fountain, Remote Chiller
Elkay EDFPB117C with stainless steel finish
Elkay ECH8 remote chiller
Elkay EACCESS12X385 access panel & bracket
Proflo PFXQAC32C ¼ turn angle valve (1)
Proflo PFX146324 20" Flex riser (1)
Proflo PFE 7 ½ OD escutcheon (1)
Proflo PFPTB400 1-1/4" 17ga P trap
- P812 Emergency Eyewash/Shower:
Bradley S19314EW shower and eyewash, manual close valves
Bradley S19-2100 thermostatic control valve
- P813 Emergency Eye Wash:
Bradley S19-460EFW countertop mount
Bradley S19-2000 thermostatic mixing valve
- P814 Wall Hydrant, Exterior, Hot/Cold:
Zurn Z-1325-VB, dual-temp, non-freeze with vacuum breaker enclosed in nickel bronze
box with hinged cover
Install 18" above finished grade
- P816 Emergency Eye Wash:
Bradley S19-44011ABC wall mount
Bradley S19-2000 thermostatic mixing valve
- P817 Decontamination Room Shower – Interior
Symmons 125-VT-FSX-R-72 Visu-temp shower faucet, with 6 FT. vinyl hose and
Attachment hooks
- P819 Roof Hydrant
Zurn ZZ1388XL34VBAC Non-freeze roof hydrant, vacuum breaker and casing guard
- P906 Reduced Pressure Backflow Preventer:
WATTS LFU009QT-S (2") with union connections, quarter-turn ball valves, strainer
and air gap
- P907 Reduced Pressure Backflow Preventer:
WATTS LFU009QT-S (1") with union connections, quarter-turn ball valves, strainer
and air gap
- P911 Trap Primer:
Precision Plumbing Products PR-500
AG500 air gap
DU-U universal distribution unit as required
Provide quarter turn service valve at inlet side and union connection on outlet side for
servicing.

P914 Shock Absorber:
Wilkins 1260XL (PDI Size A thru C)
Wilkins 1250XL (PDI Size D thru F)
Size and locate per Standard PDI-WH-201

PART 3 - EXECUTION

3.1 REQUIREMENTS

- Q. Water closets shall be installed complete with wall carriers, wax rings, bolt caps, and flush valves (or float valves).
- R. Elevated vacuum breakers, where specified, shall be installed 7'-6" above the finished floor.
- S. Countertop sinks shall be installed complete with required mounting rim or clips.
- T. After installation, all fixtures shall be cleaned and labels removed. Where fixtures are in contact with walls, floors, or countertops, caulking shall be applied. Caulking shall be General Electric white silicon sanitary sealant.
- U. Water closets identified on plans as barrier free fixtures shall have the flush valves installed per American Disabilities Act. Flush valves shall have the handle installed on the wide side of the stall. Coordinate with the architectural drawings.
- V. Non pre-fabricated showers shall have chloraloy 240 brand non-plasticized chlorinated polyethylene concealed waterproofing membrane .040 inch thick. Installation shall be per manufacturers recommendations.
- W. At each floor drain installed above slab on grade, install a 36" x 36" apron equal to chloraloy 240 brand non-plasticized chlorinated polyethylene concealed waterproofing membrane, .040 inch thick, waterproofing membrane to be installed per manufacturers recommendations.
- X. At each flush valve, solenoid valve and other quick closing devices provide shock absorber.

END OF SECTION

SECTION 22 60 05
MEDICAL GAS PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and test the following systems:
 - 1. Oxygen (O₂).
 - 2. Vacuum (V).
 - 3. Medical/clinical compressed air (A).
- B. Outlets, valve boxes, valves, alarm systems, pressure and vacuum switches, vacuum pump and miscellaneous accessories for complete systems.
- C. Oxygen manifold system.
- D. Medical air manifold system.
- E. Pressure testing, cross connection testing and final testing, including purging and analyzing.
- F. Electrical power wiring for alarms, vacuum pumps, and other electrical accessories associated with the system shall be furnished and installed under Division 26.
- G. Medical gas contractor shall furnish and install all low voltage control raceways and wiring associated with alarms and controls.

1.2 CODE COMPLIANCE/QUALITY ASSURANCE

- A. Install in compliance with the recommendations of the National Fire Protection Association (NFPA) as set forth in locally enforced editions of NFPA 99, Latest Edition, and NFPA 50.
- B. Comply with all local, state or federal codes applicable in this jurisdiction.
- C. Employ only qualified journeymen for this work. Employ a competent qualified mechanic/piping foreman, who has satisfactorily completed at least five other similar hospital installations, for this work. Provide brazers performance qualification test records for each brazer used on installation.

1.3 COORDINATION

- A. Coordinate with other trades to assure timely installations and to avoid conflicts and interference.
- B. Work closely with the metal stud partition installer and/or mason to assure that anchors, sleeves and similar items are provided in sufficient time to avoid delays; chases and openings are properly sized and prepared.
- C. Coordinate layout of medical gas systems in all spaces and identify all piping accurately.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Piping System Components:
 - 1. Beacon Medical Systems Series B.
- B. Vacuum Pump Systems:
 - 1. Allied Health Products, Chemtron Division
 - 2. Beacon Medaes
 - 3. Ingersoll-Rand
 - 4. Becker Pumps Corp. (vacuum pumps only)
 - 5. Powerex
 - 6. Amico Products

2.2 QUALIFICATION OF MANUFACTURER

A. Pipeline System Components:

1. One manufacturer shall supply the medical gas piping system(s) equipment to include outlets, valves and gauges, valve boxes, alarm boxes, oxygen manifold system, and medical air manifold system.
2. This manufacturer shall have a pipeline system engineer or product specialist available to periodically check with the contractor during installation of pipeline system equipment and provide a service organization to certify the system. The contractor may use a third party certification agency at his discretion.
3. Provide ongoing service support to the hospital after turnover to the Owner.

B. Medical Vacuum Pump:

1. Manufacturer/supplier shall have had at least fifteen (15) years experience in the manufacture of oil-less medical (clinical) vacuum pumps.
2. Provide a service organization with staffing during working days, and repair parts, within 200 miles of the facility.
3. The supplier shall supply drawings for installation operating and maintenance instructions manuals, and parts lists. The supplier shall provide both warranty and after warranty service for the total package. The service representative shall not be third party and shall be factory trained.

2.3 PIPING MATERIALS AND HANGERS

- A. Piping: All piping including vacuum shall be seamless Type K or L (ASTM B819) copper tubing, pre-cleaned for oxygen use, in accordance with NFPA 9. Piping shall be pre-cleaned, marked and plugged by supplier before shipment to job site. Any system operating above 200 psi shall have Type K tubing.
- B. Fittings: Wrought copper, brass or bronze designed expressly for brazed connection. All fittings shall comply with ANSI B16.22. Cast fittings shall not be used. T-drill branch tee connections shall not be allowed for medical gas piping.
- C. Brazing alloy: Melting point of at least 1000 degrees F.
- D. Flux: Do not use for copper-to-copper joints. Use flux for joining copper to brass or bronze. In those cases where flux is used, exercise particular care in applying the flux to avoid leaving any excess inside the completed joints.
- E. Pipe hangers shall be copper coated adjustable swivel ring, typical of B-Line B3170CT. Strut systems may be incorporated with rubber isolators, typical of B-Line Vibra Cushion or Vibra Clamp pipe clamps. The taping of pipes for isolation shall not be permitted. Medical gas piping within metal stud walls shall be supported with plastic isolators such as Pipe-Tytes System or equivalent.

2.4 HIGH PRESSURE CYLINDER MANIFOLDS

- A. Provide automatic manifold control including self-shifting to reserve bank on exhaustion of the primary service bank and automatic reset of replaced bank to reserve status. Incorporate pressure switches for the purpose of actuating designated signals when the primary service bank is exhausted. Incorporate in control unit a visible means of determining when either bank is exhausted and operation has automatically switched to "reserve in use". Visible indication shall be by red light over exhausted bank and by gauges showing remainder pressure in each bank. Continuous visible indication of electrical circuits in effective operation shall be by means of green light. Line pressure shall be shown by separate visible gauge. Manifolds shall be installed as shown on drawings.

- B. Medical Air (A) manifold: to accommodate 6 cylinders divided into 2 equal banks.
- C. Oxygen (O₂) manifold: to accommodate 12 cylinders divided into 2 equal banks.

2.5 MEDICAL VACUUM PUMPS

- A. Medical vacuum pumps shall be a factory assembled and tested duplex package, pre-wired and pre-piped on a fabricated steel base, ready for single point connection at the job site. Specifically, there is one electrical connection, single manifold discharge connection, and one vacuum connection to hospital.
- B. The vacuum pumps shall have a rated SCFM capacity at 19" HG, horsepower and electrical requirements as scheduled on the drawings.
- C. Furnish all required accessories for installing the vacuum pump (vibration dampeners, isolation pads or springs, flex connectors on incoming and exhaust lines, etc.).
- D. The control cabinet shall be a U.L. listed NEMA 12 dustproof cabinet. The cabinet shall contain the following:
 - 1. Fusible disconnect or circuit breaker switches for each pump.
 - 2. Magnetic motor starters with thermal overload protection for each pump.
 - 3. Vacuum control switches set to maintain the vacuum level between a minimum of 19 inches H.G. and a maximum setting of 25 inches H.G.
 - 4. Thermal overload reset buttons.
 - 5. Redundant control circuit transformers.
 - 6. Hand-Off-Automatic selector switch for each pump.
 - 7. Local alarm for reserve pump operation and output signal for master alarm panel.
 - 8. Automatic alternator between pumps.
 - 9. Minimum run timers to prevent short cycle.
 - 10. Local alarm for high discharge temperature and output signal for master alarm panel.
 - 11. Vacuum gauges.
- E. The warranty for the vacuum pump system shall be 18 months from start-up or 24 months from date of shipment, whichever comes first.
- F. Motors shall be drip-proof, 40 degree C rise, 3 phase, NEMA Design B type motors.
- G. Vacuum pumps shall be claw type, air-cooled type pumps. Oil supply shall be totally recirculating. Oil separator shall be capable of removing 99.9 percent of oil from the pump exhaust. Each pump shall have isolation valving, check valves, flexible connectors, and drive enclosures.
- H. Receiver tank shall be ASME rated and galvanized coated. Receiver tank shall have drain valve and isolation valve. A three-valve bypass shall be provided to permit servicing the receiver.
- I. Vacuum pumps, control cabinet and receiver shall be a complete unit, factory assembled. The system shall be factory tested prior to shipment. Manufacturer shall provide representative to assist in system start-up at the project site.

2.6 MEDICAL GAS OUTLET STATIONS

- A. Quick-Connect Recessed Wall Outlets:
 - 1. Medical Gas Outlet Stations shall be modular, Quick-Disconnect recessed type. Modular outlet stations shall be field-assembled with sequences and services indicated on the plans. Centerline spacing of multiple outlets shall be 5 inches minimum.

2. Outlet stations for medical gases shall have a stainless steel faceplate mounted on a chrome-plated, zinc die-cast cover plate. The cover plate assembly shall contain the quick-connect latch release mechanism, indexing pins for safety keying the gas-specific cover plate to the appropriate rough-in box, and color-coded gas service identification. The safety-keying index pins shall be permanently captured between the cover plate and latch assembly. Designs with index pins molded in plastic will not be accepted.
3. The latch mechanisms shall be designed for one-handed, single thrust mounting and one-handed finger tip release of secondary equipment. The outlet stations shall be capable of supporting common secondary equipment, including suction regulator and half-gallon collection bottle, without the use of slide brackets.
4. The cover plate shall attach to the primary valve assembly. The primary valve shall be threaded into the rough-in box separately from the cover plate to facilitate leak-testing around the valve. Designs which prevent this test will not be acceptable. The primary valve body shall be made of brass and shall be adjustable to compensate for variation in plaster thickness. Provide an O-ring within the valve to seal mating adapter plugs. Future replacement of the O-ring shall not require disassembly of the cover plate. The primary valve poppet shall be self-sealing in service, requiring no dust cap or cover.
5. Each rough-in box shall contain a base and tube assembly consisting of a Type K copper pigtail, flared to accept 1/4" ID, 3/8" O.D. supply line, brass block and base housing a secondary check valve per NFPA 99 (not required in vacuum), primary valve O-ring seal, check valve deflator spring (except vacuum), pressure testing cap plug, and plaster shield. The copper inlet tube shall be capable of rotating 360 degrees to adjust for field piping conditions.
6. Medical gas outlets shall be cleaned for oxygen service in accordance with CGA Pamphlet G-4.1. The assembly shall be capped and internal parts poly-bagged for shipment. The outlet assembly shall bear the label of listing under Re-examination Service of Underwriters' Laboratory.
7. Quantity and gas type shall be provided as indicated on plans.

2.7 MEDICAL GAS VALVING

A. Main and Base of Riser Valves (Valves Not in Boxes):

1. All valves and tubing shall be specially prepared for oxygen service and shall conform in all particulars to NFPA 99. All valves shall be a lockable ball-type, with Teflon seats and adjustable stem packing gland with Teflon stem seal, through 2-inch sizes. 2-1/2" to 3" valves have Teflon seats and double Teflon stem seal. 4-inch valves shall have Buna-N ball seats.
2. All ball valves rated at 400 psig, actuate from full "ON" to full "OFF" by 90 degrees turn of vinyl gripped valve handle. Factory installed copper tubing shall be extended sufficiently to help prevent valve seat damage during soldering.
3. Unless specifically noted or obviously required, main and riser valves located in other than public areas are not required to be installed in box.
4. Lock valves in the open position, and turn keys over to hospital maintenance upon completion of the project.

B. Area/Zone Valves (Valves in Boxes):

1. Zone valve boxes shall be constructed of extruded aluminum or 18 gauge sheet steel with air dried lacquer finish. The cover frame shall be made of an anodized aluminum and attached to the box by concealed screws. The finished assembly shall be substantially dust-tight. The frame assembly shall be capable of adjusting for variances in wall thickness up to one inch. The frame assembly shall contain an easily removable cover window with pull ring. The window shall conceal exposed piping and valves within the box and shall be labeled "Caution - Medical Gas Shut-Off Valves - Close Only

in Emergency". Clean viewing space shall be provided in the window to display the gas service, the area controlled by the valve, and pressure gauges on units so equipped.

2. Frames for all valve boxes shall have uniform width for balanced appearance. Manufacturer shall provide color-coded self adhesive gas service labels for compliance with NFPA 99 labeling requirements. Apply labels to each valve within the assembly for proper gas service identification according to the manufacturer's instructions.
3. Placement of the valve within the zone valve box shall be such that the removable window cannot be replaced when any valve is closed. Factory installed Type K copper pipe extensions shall extend three (3) inches outside the valve box. Design of the valve box shall be such that valves may be removed prior to brazing, without disassembly of the box, to permit field rearrangement of valves if necessary. Valves shall be ball type, cleaned for oxygen service, supplied with capped ends, and shall operate full open to closed position with 90 degree handle rotation. Provide chrome finish on valves and piping within valve boxes.
4. Gauge model zone valve assemblies shall include 1-1/2" pressure gauges reading 0-100 psig for oxygen, nitrous oxide and air; 0-300 psi for nitrogen, and 0-30" Hg for vacuum or evacuation vacuum. The gauge port shall be equipped with removable plug for pressure testing prior to final assembly of gauge.
5. All gauge model zone valve box assemblies shall read pressure downstream and vacuum upstream of the valve per NFPA 99. Valves shall be piped left to right.

2.8 MEDICAL GAS ALARM SYSTEMS

- A. Line pressure alarms shall be of modular construction where additional modules may be field expanded. The alarm assembly shall be U.L. listed requiring 115-volt supply. Internal voltage shall be stepped down to 24 or 12 volts for control circuit power. Each service (gas or vacuum) shall be provided with an audible alarm and visual red light flasher for abnormal pressure conditions. Audible alarm may be silenced by push-button, but visual alarm will continue to flash until abnormal condition is corrected. A green light for each service shall indicate normal pressure conditions. A pressure gauge or solid state readout shall display the pressure of each service.
 1. The alarm assembly shall be recessed within standard 3-5/8" stud walls. Type "K" copper pipe (1/4" I.D.) shall be provided for connection to each service.
- B. Master alarm panel shall be of modular construction where additional modules may be field expanded. The alarm assembly shall be U.L. listed requiring 115-volt supply. Internal voltage supply shall be stepped down to 24 or 12 volts for control circuit power. Each service (gas or vacuum) shall be provided with an audible alarm and a visual red light flasher for abnormal pressure conditions. Audible alarm may be canceled but visual alarm will continue until abnormal condition is corrected. Alarm signals shall be received from master pressure switches located at the supply source downstream of the main line shutoff valves.
 1. A minimum of two master alarm panels shall be installed. Reference the drawings for locations. Panels shall be wired in parallel to the pressure switches, not in series. Control wiring between switches and alarm panels shall be in 3/4" minimum EMT conduit. Wiring shall be 22-gauge shielded, twisted pair cable equal to Belden #8451 or West Penn #452 or per manufacturer requirements.
 2. Master alarm panel shall be recessed within standard 3-5/8" stud wall.
 3. The Multi-Signal Alarm Panel functions to be as follows:

FUNCTION	
O ₂	Changeover to reserve
O ₂	Reserve in use
O ₂	Reserve low
O ₂	Line pressure high
O ₂	Line pressure low
Air	Line pressure high
Air	Line pressure low
Vacuum	Line pressure low
Vacuum	Reserve pump in use
Air	Reserve in use
Air	General local alarms
Vacuum	General local alarms
Vacuum	Line pressure high

- C. Provide pressure and vacuum switches, as companion to each Master alarm of the Hi-Lo single-pole double-throw approved snap-acting type enclosed in a NEMA 4 watertight housing. Switches to be factory set to activate alarms as follows:
1. O₂--40 psi-low and 60 psi-high
 2. Air--40 psi-low and 60 psi-high
 3. Vacuum--12" Hg-low
- D. Provide monitoring gauges in accordance with NFPA 99 for nonflammable medical gases using lettered identification labels and color coding.

PART 3 - EXECUTION

3.1 IDENTIFICATION

- A. All medical gas piping to be stenciled with name of gas, direction of flow, operating pressure, and pipe size. Stenciling to be spaced not more than 20 feet intervals and at least once in each room and each story traversed by the piping system.

3.2 INSTALLATION

- A. Copper pipe, tubing, valves, and fittings shall be pre-cleaned and prepared for medical gas service in accordance with NFPA 99, except those supplied especially prepared for such service by the manufacturer and received sealed on the job.
- B. Joints in all the piping including vacuum piping, except those at equipment requiring screwed connections, shall be made with silver brazing alloy or similar high melting point (at least 1000 degrees F) brazing metal. Silver brazing material for pipes and fittings in the medical gas system shall be Stay-Silv-15 or equal to the following: Silvaloy-15, Aircosil No. 15, or Phos-Silver-15. The silver brazing alloy shall contain a minimum of 15% silver, 80% copper, and 5% phosphorus and shall not contain cadmium alloy. The silver brazing alloy shall have a minimum of 1000 degrees F. liquidus melting point and shall have an ASTM rating of "BCuP5". The use of flux is prohibited from the making of joints between copper to copper pipes and fittings. Appropriate flux similar to "Stay-Silv-Black Flux" or "Stay-Silv-White Flux" is required between dissimilar metals such as copper to brass or bronze material, when parts are heated over a prolonged period. **DURING THE BRAZING OF PIPE CONNECTIONS, THE INTERIOR OF THE PIPE SHALL BE PURGED CONTINUOUSLY WITH NITROGEN.** The outside of the tube and fittings shall be cleaned by washing with hot water after assembly.
- C. Threaded joints in piping systems shall be tinned or made up with polytetrafluorethylene (such as Teflon) tape or other thread sealants suitable for oxygen service. Sealants shall be applied to the male threads only.

- D. All piping shall be supported with pipe hangers or strut systems at intervals per NFPA 99, and NOT supported by other piping. Isolation of all copper piping from dissimilar metals shall be of a firm, positive nature. Duct tape is not acceptable as isolation material. Hanger Spacing Shall be as Follows:

Pipe Size	Hanger Spacing
1/2 inch	6 feet
3/4 inch	7 feet
1 inch	8 feet
1-1/4 inch	9 feet
1-1/2 inch and larger	10 feet

- E. Install screw joints used in shutoff valves, including station outlet valves, by tinning the male thread with soft solder. Litharge and glycerin or an approved oxygen luting or sealing compound are acceptable.
- F. Use prepared flux manufactured by Handy and Harman which consists of dry boric and water boric for hard solder joints. Alcohol mixture is prohibited. Resin or petroleum base of similar paste flux may contain compounds objectionable for oxygen service and shall not be employed.
- G. After installation of the piping, but before installation of the outlet valves, blow lines clear by means of oil-free, dry air or nitrogen.
- H. Buried piping shall be adequately protected against frost, corrosion, and physical damage. Ducts or casings shall be used on all buried piping.
- I. Identification tape shall be buried approximately 18 inches above the piping, and immediately on top of the conduit.
- J. Piping exposed to physical damage shall be adequately protected.

3.3 PRESSURE TESTING

- A. After installation of the piping and valves, but before installation of the service outlets, alarm actuating switches and gauges, the line shall be blown clear by means of oil-free, dry air or nitrogen.
- B. Next, each section of the piping system shall be subjected to a test pressure of one and one-half (1-1/2) times the maximum working pressure, but not less than 150 psig, with oil-free, dry nitrogen. This test pressure shall be maintained for at least 24 hours. Then each joint shall be examined for leakage by means of soapy water or other effective means of leak detection safe for use with oxygen.
- C. All leaks shall be repaired and the section retested.
- D. After completing the testing of each individual piping system, all of the medical gas systems shall be subjected to a pressure test at one and one-half (1-1/2) times the maximum working pressure, but not less than 150 psig. The test gas shall be oil-free, dry nitrogen. The main line shut-off valve shall be closed during the test.
- E. After completion of the above test procedure the finishing assemblies of station outlets, alarms, and all components (e.g. pressure switches, gauges, relief valves, etc.) shall be installed and all medical gas piping systems shall be subjected to a 24 hour standing pressure test at 20% above the normal operating line pressure with oil-free, dry nitrogen. The main line shut-off valve shall be closed during this test.
- F. Leaks, if any, shall be located, repaired, and the system retested.
- G. To determine that no cross connection to other pipeline systems exists, reduce all systems to atmospheric pressure. Disconnect all sources to test gas from all of the systems with the exception of the one system to be checked. Pressure this system with oil-free, dry air or nitrogen to a pressure of 50 psig. With appropriate adapters matching outlet labels, check each individual station outlet of all systems installed to determine that test gas is being dispensed from only the outlets of this system.

- H. When all medical gas piping systems have been tested, the source of test gas shall be disconnected and the proper gas source of supply connected to each respective system. Following this connection and pressurization, all outlets shall be opened in a progressive order, starting nearest the source and completing the process of purge flushing at the outlet farthest from the source. Gas shall be permitted to flow from each outlet until each system is purged of test gas used during previous tests. After completion of purge flushing of the pipeline system, the outflow from each designated and labeled oxygen outlet station, anesthesia machine, and other oxygen dispensing equipment shall be tested (using an oxygen analyzer) to confirm the presence of the desired purity of oxygen.

END OF SECTION

SECTION 22 60 06
CERTIFICATION PROCEDURE FOR MEDICAL GAS PIPELINES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section is to outline the responsibilities and procedures to be followed in final certification of the medical gas pipelines and included as a supplement to Section 22 60 05 Medical Gas Piping System.
- B. When new piping is "cut-in" to previously installed piping, it is possible that previously installed piping could be disturbed so as to cause crossed piping in previously installed systems. It is imperative that previously installed systems be inspected for crossed piping in conjunction with new system medical gas pipeline inspection and certification to the point of source.
- C. The certification procedure shall comply with all requirements of NFPA 99, latest published edition and as stated herein.
- D. Pipeline certification shall be performed by an independent third party Certification Agency. The Certification Agency qualifications data to be submitted and approved before any work to certify the systems has been performed.

PART 2 - PRODUCTS

- 2.1** Refer to Section 22 60 05 Medical Gas Piping System.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The General Contractor shall furnish a verified list designating number and location of all medical gas outlets to the Certification Agent. The General Contractor shall review and check this list with the appropriate subcontractors and the medical gas system personnel performing the medical gas pipeline inspection.
- B. The Plumbing Contractor is to perform mechanical check of all medical gas outlets prior to the certification inspection. Any necessary repairs or rework to be done prior to system supplier's inspection. Check to include:
 - 1. Outlets properly supported.
 - 2. Installation complete.
 - 3. Appropriate adapters fit and securely lock in place.
- C. The Owner is responsible for ensuring that bulk tank and/or cylinder supplies are installed, connected, and filled (or partially filled) prior to system suppliers inspection.
- D. All medical gas outlets shall be tested by the Certification Agent, excluding none.
- E. Certification Agent shall provide factory trained, qualified representatives to perform pipeline inspection and to provide report and certification in accordance with NFPA 99, latest published edition.
 - 1. Any discrepancies discovered during the inspection shall be noted, corrected, and any and all portions of the system affected by corrective action shall be retested and findings recorded after retest.
- F. Plumbing Contractor to provide representative who shall serve as customer contact person and who shall witness the inspection and certify that all outlets on the list furnished by the General Contractor have been checked and is in accord with inspection procedure and findings as witnessed.
- G. Hospital Engineering Department shall provide a representative who shall witness the inspection and certify that all spaces and the outlets therein listed on the list furnished by the General Contractor have been checked in accordance with inspection procedure.

- H. Certification Agent shall perform a cross connection test on all medical gas outlets using oil-free nitrogen as described in NFPA 99, latest published edition. Each pipe system shall be reduced to atmospheric pressure. Certification Agent shall then pressurize and test each piping system, one system at a time.
- I. Contractor shall connect all designated gas systems and purge the systems, completely. Certification Agent shall then analyze each medical gas outlet for proper oxygen content.
- J. The Certification Agent to furnish copies of Medical Gas Pipeline Inspection Report and Medical Gas Pipeline Certification to General Contractor to be distributed as follows:
 - 1. Plumbing Contractor
 - 2. Owner's Construction Manager
 - 3. Consulting Engineer
 - 4. Hospital
- K. The following procedure should be followed in addition to the above on extensions to existing systems:
 - 1. Owner's Representative shall, with adequate advance notice, request that system supplier's inspector or inspection team be on-site when old piping is cut-in for installation of new lines.
 - 2. Owner's Representative and system supplier's representative shall arrange to have inspector or inspection team on-site when the existing piping is cut into for installation of new lines.
 - 3. Main line shut-off vales shall be installed in new piping as close as possible to point of cut-in to previously installed piping.
 - 4. NOTE: Following verification of proper labeling or proper gas distribution of previously installed piping after cut-in procedure, the aforementioned valves (Item 3) shall be considered the "source" of supply for the new piping.

GAS ANALYSIS		
Gas	Concentration (%)	Pressure (psig)
Oxygen	99-100	50 +/- 5
Vacuum	–	Negative
Air	19.5 - 23.5 O ₂ content	50 +/- 5

END OF SECTION

SECTION 22 66 53
ACID WASTE, PIPING AND EQUIPMENT

PART 1 - GENERAL AND PRODUCTS

1.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers as indicated in subsequent paragraphs.

1.2 EQUIPMENT

- A. Corrosive Waste and Vent Piping:

1. Material: Provide Schedule 40 polypropylene pipe and fittings that conform to dimensions and tolerances per ASTM F1412. Pipe and fittings to be manufactured with a chemically resistant polypropylene material conforming to ASTM D4101.
2. Pipe:
 - a. Below grade pipe shall be either flame retardant or non-flame retardant Schedule 40 polypropylene in accordance with ASTM D4101.
 - b. Above ground pipe shall be flame retardant Schedule 40 polypropylene in accordance with ASTM D4101.
3. Fittings: All fittings shall be manufactured to Schedule 40 polypropylene pipe dimensions of a chemically resistant and fire retardant polypropylene material conforming to ASTM D4101. Polypropylene Fittings to conform to applicable tolerances in ASTM F1412.
4. Acceptable Manufacturer: Orion or equal.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Corrosive Waste and Vent Piping:

1. Joints: All joints shall be fusion except those under casework.
2. Install at minimum slope of 1/8 inch per foot.
3. Follow manufacturers' recommendation for hanging and burial.
4. Each section or floor shall be tested with not less than 10 feet head of water for 24 hours with no leaks.
5. Polypropylene pipe shall be installed with appropriate expansion loops so as to eliminate creeping and/or bowing of the pipe due to temperature changes.
6. Where polypropylene pipe penetrates fire-rated floors or walls, approved UL listed fire stops must be installed.

END OF SECTION

SECTION 22 67 19
DEIONIZED WATER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. General:
1. Furnish all labor, materials, tools, equipment, and services for distilled and deionized water piping system, as indicated, in accordance with provisions of Contract Documents.
 2. Completely coordinate with work of all other trades.
 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
 4. See Section 23 01 00 for special mechanical requirements.
 5. See Division 01 for General Requirements.

1.2 QUALITY ASSURANCE

- A. Standard for Sterilization: AWWA C601.

1.3 SUBMITTALS

- A. Submit product for owner approval for water purification equipment. Submittal data not required for piping, fittings, support, etc.
- B. Submit test reports to Owner at completion of job.
1. Pressure tests.
 2. Sterilization tests.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by the following:
1. Ferguson Enterprises
Contact: Bettina Dawson
office (615) 316-1920
email: HCA@Ferguson.com

2.2 VALVES

- A. All valves: Rated for 125 PSIG working pressure, non-shock.
1. Acceptable manufacturer: Orion.
 2. Use valves of same material as piping system in which they are installed.
- B. Shut-off valves: Ball type, socket or threaded ends, and teflon seating.
- C. Check valves: Ball type for either vertical or horizontal mounting, with threaded or socket ends.
- D. Provide reduced pressure backflow preventer in piping serving equipment producing distilled or deionized water.

2.3 PIPE AND FITTINGS

- A. Deionized water piping: Polypropylene pipe and fittings, with electrically welded or threaded joints.
- B. Fire-Rated Pipe Enclosures: Provide noncombustible, inorganic fireproofing jacketed wrap for fire-rated pipe enclosures equivalent to Thermal Ceramics Fire Firemaster, CertainTeed Flamecheck, Johns Manville Firetemp, or Nelso FlameShield. The system shall be designed for 2300 degrees F. continuous service and meet the following testing standards: ASTM E-

84 and E-119; U.L. 263, 1479, and 1709; and U.L. Classification for fire-rated plastic pipe enclosures. A total 2-hour fire-rated assembly shall be created.

- C. Install fireproof pipe enclosure in accordance with U.L. classification and manufacturer's published U.L. installation instructions.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Install piping and fittings as indicated in 22 11 16 DOMESTIC WATER PIPING AND VALVES.
- B. Install piping to provide every fixture and item of equipment requiring deionized water with suitable supply connection.
- C. Consult manufacturers' data and large scale details of rooms containing plumbing fixtures on architectural drawings before roughing in piping. Plug or cap piping immediately after installation.
- D. Connect equipment furnished by others in accordance with 22 01 00 PLUMBING GENERAL PROVISIONS.
 - 1. For each water supply piping connection to equipment by others, furnish and install a union and a gate or angle valve. Provide a wheel handle stop valve at each sink water supply. Minimum line size 1/2 IN.
 - 2. Cap and protect until such time as installation is performed.

3.2 STERILIZATION OF SYSTEMS

- A. Sterilize system as indicated, or in accordance with AWWA C601.
- B. Thoroughly flush system.
- C. After flushing, introduce chlorine or chlorine compound into system with dosage sufficient to give an initial residual chlorine content of 50 ppm.
- D. Collect samples from various taps and fixtures throughout buildings during introduction of chlorine to assure uniform distribution. Open and close valves several times.
- E. After 24-hour contact period, flush all traces of heavily chlorinated water from systems.
- F. After flushing is complete, provide evidence of effectiveness of disinfection by filing with Designer, laboratory reports of bacteriological tests on samples taken from system.
 - 1. Number and locations of taking samples as specified by Designer.
- G. If satisfactory results are not obtained, repeat above disinfection process until satisfactory results are obtained.
- H. Do not put system into service until satisfactory tests are reviewed by Designer.

3.3 TESTING

- A. Do not insulate, conceal or furr in pipe until it has been tested to satisfaction of Designer.
- B. Upon completion of a section of system, test hydrostatically to pressure not less than 50 percent in excess of maximum pressure to which pipe will ordinarily be subjected, but in no case less than 100 PSI.
- C. If test shows defects, replace such defective work or material and repeat tests.
 - 1. Make repair to piping with new material.
 - 2. No caulking of screwed joints or holes will be acceptable.

END OF SECTION

SECTION 22 70 10
NATURAL GAS CONNECTION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section includes requirements for:
 - 1. Natural gas connection.

PART 2 - PRODUCTS

2.1 NATURAL GAS CONNECTION

- A. Provide connection to local gas company's line on building side of gas meter.
- B. Provide shut-off valve, wall sleeve, and building gas pressure regulator.

PART 3 - EXECUTION

3.1 INSTALLATION AND TESTING

- A. Natural Gas Connection:
 - 1. Arrange and coordinate with local gas company for service line, meter, regulator, fees, permits, and pressure desired on house side of meter.
 - 2. Maintain clear access and protection from mechanical damage to meter.
 - 3. Maintain minimum 10 foot separation of meter from fresh air intakes to building.

END OF SECTION