

SECTION 22 00 00 - PLUMBING GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. General Conditions: Refer to the General Conditions, the Supplementary General Conditions and the Special Conditions, all provisions of which apply to work under this section as if written in full herein.
- B. The scope of work described in these Specifications and/or indicated on the Drawings shall include (except where otherwise noted) the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all systems. All work shall be accomplished by workmen skilled in the various trades involved.
- C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the Engineer shall be notified of the discrepancy.
- D. All work performed under this specification shall be accomplished in accordance with the requirements and provisions of the following sections:
 - 1. Section 22 00 00 - Plumbing General
 - 2. Section 23 00 00 - HVAC General
 - 3. Section 26 00 00 - Electrical General

1.02 STANDARDS

- A. All Plumbing systems shall conform to all ordinances and regulations of the City, County, State and/or other authorities having jurisdiction in accordance with the requirements of the following codes, standards and design guides.
 - 1. The Florida Plumbing Code, 2020 Edition, with most current City of Tallahassee Amendments
 - 2. The Florida Building Code, 2020 Edition, with most current City of Tallahassee Amendments
 - 3. The Florida Fuel Gas Code, 2020 Edition, with most current City of Tallahassee Amendments
 - 4. The Florida Energy Conservation Code, 2020 Edition, with most current City of Tallahassee Amendments

5. Americans with Disabilities Act (ADA)
 6. ANSI/NSF 61, NSF 372, and NSF 61-G compliance is required for all components of the domestic potable water system.
 7. American Society of Plumbing Engineers (ASPE) Data Books
 8. National Fire Protection Association (NFPA) Standards:
 - a. NFPA 54 - National Fuel Gas Code
 9. Plumbing Drainage Institute (PDI)
 10. Underwriters Laboratories Inc. (UL)
 11. National Sanitation Foundation (NSF)
 12. Local and State Fire Marshal requirements
 13. Local Building and Inspection Department requirements
 14. Local Health Department requirements
 15. ASHRAE 90.1
- B. If code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03 PERMITS

- A. The Contractor shall obtain all permits and inspections required for the installation of this work and pay all charges incident thereto. He shall deliver to the Architect all certificates of said inspection.

1.04 MISCELLANEOUS DEFINITIONS

- A. Terms: The following definitions of terms supplement those of the Division 01- General Requirements and are applicable to Division 22 – Plumbing General:
1. Contractor: As used herein the term shall mean "the person or entity referred to throughout the Contract Documents as if singular in number. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative."
 2. Furnish: As used herein shall mean "supply and deliver to Project site, unload and inspect for damage."

3. Install: As used herein the term shall mean “to place in position for service, temporarily store, unpack, assemble, erect, apply, place, protect, clean, start up, and make ready for use.”
4. Owner: As used herein the term shall mean “the person or entity identified as such and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization. The term “Owner” means the Owner or the Owner’s authorized representative.”
5. Product: As used herein shall include materials, systems, and/or equipment, machinery, components, and fixtures forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
6. Provide: As used herein shall mean “furnish and install, complete and ready for the intended use.”
7. The Work: As used herein the term shall mean “the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor’s obligations. The Work may constitute the whole or a part of the Project.
8. Experienced: When used with an entity or individual, “experienced” means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.05 WORK INCLUDED

A. Systems

1. The Plumbing Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to, the following as noted below. The connection point for all systems from the site utilities shall be as 5'-0" from the exterior of the building unless specifically otherwise noted.
 - a. Domestic cold, hot and hot water recirculation systems
 - b. Sanitary, drainage, waste and vent systems
 - c. Natural gas system
 - d. Primary and emergency storm drainage systems
 - e. Grease waste and waste systems from food service areas

1.06 DRAWINGS

- A. The Drawings are diagrammatic and do not necessarily depict exact conditions. The indicated locations of equipment, ductwork, piping, etc. are approximate only. The Drawings are schematic in nature and are not to be scaled. Scales are shown for reference and approximation only. Refer to the architectural drawings for dimensional data of building components.
- B. The locations, arrangement and extent of equipment, devices, and other appurtenances related to the installation of work shown on the Drawings are approximate. The Contractor shall not scale drawings but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy for resolution.
- C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.07 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review, describing installation, operation and maintenance of all Plumbing equipment. Manuals shall include copies of control schematics, sequences of operations, indicate the function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists and instructions manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor.
- B. The Contractor shall give detailed instructions for a period of not less than two (2) days to the responsible personnel designated by the Owner in the operation and maintenance of all equipment furnished under this Contract. A letter containing the name of the person or persons to whom the instructions were given and the dates of instruction period shall be submitted to the Engineer in the as-built submittal.
- C. Prior to final acceptance by the Owner, the Contractor shall submit a complete as-built drawing submittal for the Engineer's review, three (3) sets of operating and maintenance manuals, spare parts lists, drawings, wiring diagrams, troubleshooting data, manufacturer's bulletins, and other pertinent data on all equipment furnished under this Contract. Each set shall be enclosed in a suitable hard cover binder.
- D. A complete set of reproducible as-built drawings shall be provided indicating the location of all piping dimensionally located from a minimum of two column lines or major building structures. Drawings shall be a minimum of 1/8" scale.
- E. Provide name, address and telephone numbers of the manufacturer's representative and service company for each piece of equipment installed in the as-built submittal package.

- F. Provide all loose keys for supply valves, wall hydrants and hose bibbs installed.
- G. Provide a full repair kit set (total relief valve kit, first check and second check kits) for each reduced pressure backflow preventer installed.

1.08 AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record set of drawings indicating all changes in the work from that shown in the Contract Documents. Prior to final acceptance by the Owner, the Contractor shall assemble the complete set of as-built drawings that accurately reflects all changes to indicate actual final construction. All concealed piping shall be dimensionally located from at least two (2) column lines or major building structure elements. Drawings shall be a minimum of 1/8" scale.
- B. The original set of "as-built" drawings shall be scanned and transmitted to the Architect in electronic (pdf) format.

1.09 EQUIPMENT, MATERIAL BID BASIS

- A. Manufacturers' names, model numbers, etc. as specified on the Drawings and herein are for the purpose of describing type, capacity, function and quality of equipment and materials required.
- B. Unless "approved equal" is specifically stated, bids shall be based on equipment named in Specifications or on Drawings as "base" products. Proposed alternate equipment and materials may be submitted along with the "base" products, provided deductive pricing is included with the alternate.
- C. Alternate "approved equal" items listed shall conform to specified base items and shall be substantially equal in quality, size, weight, construction, capacities and performance. The alternate equipment and materials shall be submitted as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. The Engineer shall consider the use of the alternate equipment based on the supportive documentation and other information available to him and shall approve or disapprove any alternates. The decision of the Engineer shall in all cases be final.
- D. The Contractor shall coordinate the installation of all plumbing equipment proposed for use in this project with all building trades (architectural, structural, mechanical and electrical). Coordination shall be accomplished prior to, and shall be reflected in, the submittal of shop drawings for approval. Any modifications or revisions required by other trades as a result of the use of equipment other than the basis of design shall be made at no additional cost. When substitution of equipment is made, the Contractor shall be responsible for the costs of any item and engineering and construction revisions necessary in his or any other contract or trade that may be required to satisfy plans and specifications.

1.10 START-UP-SERVICE

- A. The service of a factory-trained representative shall be provided on the jobsite for a minimum of one (1) day to provide the manufacturer's certification and start-up of all

major equipment and systems including water heaters, pumps, etc. A formal report is to be issued indicating any revisions required for certification of the assembly by the manufacturer. Instruction and training of the operator's personnel shall be provided following certification of the assembly.

1.11 SUBMITTALS

- A. The Contractor shall prepare, submit, and obtain Engineer's review of manufacturers' submittals on the following equipment and systems prior to ordering, purchasing, or installation of any equipment or materials. All required submittals shall be transmitted electronically (e.g. pdfs, etc.) with the associated specification section and the item submitted clearly identified. Partial submittals will be returned without review. Submittals, as a minimum, shall include:
1. Plumbing fixtures, faucets and trim
 2. Water heaters
 3. Insulation
 4. Floor drains and drainage accessories
 5. Hydrants and hose bibbs
 6. Mixing valves
 7. Submersible pumps
 8. Hot water return pumps
 9. Backflow preventers
 10. Grease/oil interceptors
 11. Pipe and fittings
 12. Grooved joint couplings
 13. Valves
 14. Pipe supports
 15. Piping accessories
 16. Pipe labels and valve tags
- B. All approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to equipment being submitted to the Engineer.
- C. Quality Assurance/Control Submittals: Submit the following:

1. Test Reports: Upon request, submit test reports from recognized testing laboratories.
2. Certificates: Submit the following:
 - a. Manufacturer's certificate that products comply with specified requirements.
 - b. Certificate indicating that the installer is authorized to install the manufacturer's products
- D. Review of submittals by the Engineer does not relieve the Contractor from the responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements of all approved equipment with other trades and disciplines such as roof openings, wall openings, electrical characteristics, etc.
- E. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.
- F. Submittals shall clearly indicate selection of model numbers, sizes, dimensions, electrical characteristics, etc. of the proposed equipment. Any proposed deviations from specified equipment shall be clearly indicated on the submittal.
- G. Included with submittals of plumbing equipment requiring electrical connections shall be a written statement confirming coordination of voltage requirements, bearing the names and signatures of the plumbing and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the electrical contractor.

Plumbing Contractor:

Project Manager Name:

Project Manager Signature/Date:

Electrical Contractor:

Project Manager Name:

Project Manager Signature/Date:

- H. Provide Material Safety Data Sheet (MSDS) or letter from manufacturer certifying the VOC content for each adhesive, sealant, paint and coating.

- I. VOC Content: Submit adhesive and sealants product information or MSDS showing VOC Content information for all applicable products specified under this section. All applicable products in this section must meet low VOC content as specified by LEED Specification Section 01 81 13 Sustainable Design Requirements.

1.12 COORDINATION OF TRADES

- A. The Contractor shall give full cooperation to other trades and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with least possible interference or delay.
- B. Piping and other plumbing equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated piping and other plumbing equipment installed should they interfere with the proper installation and mounting of electrical, HVAC equipment, ceilings and other architectural or structural finishes.
- C. The Contractor shall coordinate the elevations of all piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.
- D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.
- E. The Contractor shall confirm that work installed under this section does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.
- F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.
- G. All offsets, fittings, valves, devices and accessories which may be required are to be provided under this Contract. The Contractor shall examine the entire set of Contract Documents and carefully investigate the structural and finish conditions affecting all his work and shall arrange such work accordingly for the complete satisfactory operation of all systems, providing such fittings, traps, valves, devices and accessories as may be required to meet such conditions.

1.13 WARRANTY

- A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.
- B. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Contract Documents shall be suitable for the intended use and shall be subject to approval by the Engineer.
- B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.
- C. All equipment shall bear the inspection label of Underwriters Laboratories Inc.
- D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.
- E. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
- F. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.
- G. Cast iron soil pipe and fittings shall bear the collective trademark of the Cast Iron Soil Pipe Institute.

2.02 ELECTRICAL WORK

- A. Except as otherwise specified or noted, electrical equipment used for plumbing systems shall be as specified herein.
- B. Motor controls, system controls, starters, disconnects, pilot lights, push buttons, etc. shall be furnished by the Contractor compatible with the apparatus that it operates. Electrical equipment shall be wired for the voltage, as shown on the Electrical Drawings.
- C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.
- D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at + 10% of the design voltage without voiding the manufacturer's warranty.
- E. Motors controlled by a variable frequency drive (VFD) shall be inverter duty motors designed according to the requirements of NEMA MG 1, Part 31, "Definite Purpose, Inverter Fed Motors" and shall be compatible with the particular manufacturer's drive that is used.

1. Shaft Grounding Rings - All motors controlled by variable frequency drives shall be equipped with a maintenance free, conductive micro fiber, shaft grounding ring with a minimum of two rows of circumferential micro fibers to discharge damaging shaft voltages away from the bearings to ground.
 - a. Motors up to 100HP shall be provided with one shaft grounding ring installed either on the drive end or non-drive end. Motors over 100HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer's recommendations.
 - b. Shaft grounding rings shall be AEGIS bearing protection ring by Electro Static Technology-ITW.
2. High Frequency Grounding Straps - All motors controlled by variable frequency drives shall be bonded from the motor foot to the system ground with a high frequency ground strap fabricated of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection.
 - a. Proper grounding of motor frame for all inverter-driven induction motors shall be in accordance with ABB Technical Guide No.5 and Allen Bradley Publication 1770-4.1 Application Data Industrial Automation Wiring and Grounding Guidelines
 - b. High frequency bonding strap shall be AEGIS high frequency ground strap by Electro Static Technology-ITW.
- F. Starters for motors 1/3 HP and smaller shall be manual type, and for 1/2 HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.
- G. Magnetic motor starters shall be across-the-line, full voltage, non-reversing type unless otherwise indicated on the Drawings or specified herein.
- H. Motor controls shall be either "Hand-Off-Auto" switches or "On-Off" push buttons with one indicating light. "Hand-Off-Auto" switches shall be provided for automatically controlled apparatus.
- I. Motor starters that are not an integral part of equipment shall be installed in conformance with Division 26 - Electrical Requirements.
- J. All "loose" disconnects and starters shall be installed by Division 26.
- K. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with disconnect switches at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and the electrical drawings.

- L. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.
- M. All starters for 3-phase equipment shall have overload devices in each phase.
- N. All starters and variable frequency drives shall be labeled on the face of the device with a semi-rigid plastic laminate nameplate with 1" high white letters on a black background securely affixed to the equipment. The label shall indicate equipment served (equipment tag used on the Drawings). Labels shall be furnished and installed by the Contractor.
- O. Wiring diagrams shall be furnished by the Contractor.
- P. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.03 PIPING SYSTEMS

A. General

- 1. The various piping systems are classified as follows, and materials of construction shall be as specified unless otherwise noted on the Drawings.
- 2. Piping, valves and equipment used in similar applications shall be provided from the same manufacturer unless noted otherwise.

B. Domestic Cold-Water System, Underground, 3 Inches and Larger, Suitable for Working Pressure of 125 psig to 5'-0" Outside Building

1. Piping Systems

a. Basis of Design

- 1) Ductile iron thickness Class 51 for 3-inch and 4-inch size thickness, Class 50 for 6 inches and larger, ANSI A21.51, ASTM A746 with bituminous coating outside and cement mortar lining inside. Ductile iron mechanical or push-on joints and fittings ANSI/AWWA C110/A21.10.

b. Deductive Alternates

- 1) Mains where pressure is no greater than 100 psi: Polyvinyl Chloride (PVC), 160 psi water piping, ASTM D2241, SDR26 with mechanical or push-on joints with neoprene "O" rings, ASTM D3139.
- 2) Mains where pressure is greater than 100 psi: Polyvinyl chloride (PVC), 200 psi water piping, AWWA C900, 200 psi, with mechanical or push-on joints with neoprene "O" rings, ASTM D3139.

2. All valves, fittings, and changes in direction or elevation shall have joints restrained in accordance with NFPA-24.
 3. Trenching Conditions: Class B1 bedding with 4" minimum thickness of clean granular fill. Recesses shall be provided at all pipe barrels to ensure no loads are transmitted at the joint connections.
- C. Domestic Water System Branch Piping, Underground, 2 Inches and Smaller, Suitable for a Working Pressure of 125 psig
1. Piping Systems
 - a. Copper Type K, soft annealed, conforming to Federal Specification WWT-799. Joints and fittings are not permitted below floor slabs with copper Type K soft annealed pipe.
 - b. PEX Piping: Uponor Ecoflex Potable PEX Piping (PEX-a), listed to ASTM F876 and F877, tubing surrounded by multi-layer, closed cell, PEX-foam insulation and a water resistant, corrugated HDPE jacket. Protect all slab penetrations
 - c. For piping not exposed to ground water, pre-insulated PEX-a piping with engineered polymer (EP) or lead-free brass ASTM F1960 cold-expansion fittings. No joints or fittings shall be installed under slab. Protect all slab penetrations.
- D. Domestic Cold Water and Hot Water Systems Above Ground
1. Piping Systems
 - a. Basis of Design
 - 1) Type "L" hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Solder or brazed joint copper fittings per B16.18 or 16.22. Grooved copper fittings with full flow radius elbows; wrought copper to ASME B16.22 and ASTM B-75 or cast bronze to ASME B16.18 and ASTM B-584, Victaulic CTS system, or Engineer approved equal. Copper pressed fittings with radius elbows, crimped connections and EPDM O-rings, ASTM B-88, 200 psi rating, Ridgid Viega ProPress, Apollo Press, ProPress XL, Nibco Press System, Merit Copper Press system or Elkhart Xpress systems. Ductile iron mechanical couplings with bolted connection for grooved piping, ASTM A-536, housings with offsetting angle-pattern bolt pads, with EPDM-HP copper tube size gaskets, rated working pressure 300 psi, installation-ready for direct stab installation without field disassembly. Basis of Design: Victaulic Style 607H. Joints: Soldered or brazed joints with lead-free brazing filler materials and compatible alloys.

Temperature	Pipe Sizes	Type L Drawn Copper Tubing Permissible working pressures using NO LEAD SOLDERED FITTINGS (psi)	Type L Drawn Copper Tubing Permissible working pressures using PRESS FITTINGS (psi)	Type L Drawn Copper Tubing Permissible working pressures using ROLL GROVE FITTINGS (psi)
100	½"-1"	1090	200	300
	1¼"-2"	850	200	300
	2½"- 4"	705	200	300
	5"-8"	660	N/A	300
	10"-12"	500	N/A	
150	½"-1"	625	200	300
	1¼"-2"	485	200	300
	2½"- 4"	405	200	300
	5"-8"	375	N/A	300
	10"-12"	285	N/A	
200	½"-1"	505	200	300
	1¼"-2"	395	200	300
	2½"- 4"	325	200	300
	5"-8"	305	N/A	300
	10"-12"	230	N/A	

- 2) Schedule 10 T304L stainless steel pipe, ASTM A312 (300 psi at 140 degrees F), Schedule 40 T304L stainless steel pipe, ASTM A312 (600 psi at 140 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 10S/40S rolled groove 304 stainless steel fittings, Viega Megapress 316 Stainless fittings, and Merit Iso-TUBI 316 stainless press fittings. Joints: Ductile iron, Viega Megapress 316 Stainless, Merit Iso-TUBI 316 stainless press or 316 stainless steel rigid grooved couplings, EPDM gasket, 316 stainless steel nuts and bolts. Victaulic Style 89, Anvil Figure 7400 (300 psi for 10S), Victaulic Style 489, Anvil Figure 7401 (600 psi for 40S).
- a) Schedule 10S pipe shall be grooved using a Victaulic grooving tool equipped with RX roll sets, specifically designed for stainless steel pipe.
- 3) For pipe sizes 2" and smaller, the Viega Megapress Stainless or Vic-Press system for Schedule 10S pipe may be used in lieu of soldered copper. The system shall be rated to 500-psi CWP, with grade EPDM gaskets, UL classified in accordance with ANSI/NSF-61 for potable water service.

Temperature	Pipe Sizes	Stainless Steel Tubing Permissible working pressures using NO LEAD SOLDERED FITTINGS (psi)	Stainless Steel Tubing Permissible working pressures using PRESS FITTINGS (psi)	Stainless Steel Tubing Permissible working pressures using ROLL GROVE FITTINGS (psi)
100	½"-1"	3000	500	300
	1¼"-2"	1460	500	300
	2½"- 4"	725	500	300
	5"-8"	590	N/A	300
	10"-12"	360	N/A	

Temperature	Pipe Sizes	Stainless Steel Tubing Permissible working pressures using NO LEAD SOLDERED FITTINGS (psi)	Stainless Steel Tubing Permissible working pressures using PRESS FITTINGS (psi)	Stainless Steel Tubing Permissible working pressures using ROLL GROVE FITTINGS (psi)
200	½"-1"	2550	500	300
	1¼"-2"	1241	500	300
	2½"- 4"	616	500	300
	5"-8"	500	N/A	300
	10"-12"	300	N/A	

b. Deductive Alternates

- 1) Hot and Cold-Water Systems: Chlorinated Polyvinyl Chloride (CPVC) Schedule 40, ASTM F-441 and D-2846 (100 psi at 180 degrees F). Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings: Schedule 40 socket type CPVC, ASTM F-439 and F-441. Joints: Solvent cement and primer for CPVC piping, ASTM F-493. All metal thread connections to fixtures and fittings (tub spout, showerhead, etc.) shall be connected with a brass transition fitting. All cutting oils, thread sealants and other products must be compatible with the CPVC piping installed.

Temperature	Pipe Sizes	SDR 11 FlowGuard Gold CPVC	Schedule 80 Corzan (for Pipe Sizes greater 2")				
		Permissible working pressure (psi)	Permissible working pressure (psi)				
		½"-2" (max size)	2½"	3"	4"	6"	8"
73-80		400	420	370	320	280	250
100		325	344	303	262	229	205
120		260	273	240	208	182	162
140		200	210	185	160	140	125
160		160	168	148	128	112	100
180		100 (max. temp)	105	92	80	70	62
200			84 (max. temp)	74	64	56	50

- 1) For pipe sizes 3" and smaller: Hot and Cold-Water Systems: Cross-linked polyethylene (PEX) plastic tubing, PEX-a grade, ASTM F-876; ASTM F-877 (100 psi at 180 degrees F). Brass, copper or engineered plastic (EP) fittings, ASTM F-1960. Piping, fittings, and joints to comply with NSF 61-G, NSF 61, and NSF 372. Fittings/Joints: Cold expansion fitting with PEX reinforcing rings, ASTM F-1960.
 - a) All PEX tubing and fittings shall be from the same manufacturer. Fittings shall be third party certified to NSF-14, and ASTM-F1960 and shall comply to ASTM-F876 & ASTM-F877.

- b) All cold-water piping shall be blue in color. All hot water piping shall be red in color. All hot water return piping shall be white in color.
- c) Galvanized pipe and nipples are not acceptable for any portions of the domestic water system.
- d) Galvanized pipe and nipples are not acceptable for any portions of the domestic water system.
- e) Acceptable PEX manufacturers/systems:
 - (1) Uponor Wirsbro Aquapex tubing with ProPEX fittings
 - (2) Viega PEX tubing
 - (3) Rehau PEX tubing and fittings
- f) All PEX tubing and fittings shall be from the same manufacturer.

Temperature	Pipe Sizes	SDR 9 PEX piping Permissible working pressure (psi)
73-80	3/8"-4"	160
120	3/8"-4"	130
180	3/8"-4"	100
200 (max temp)	3/8"-4"	80

E. Sanitary, Waste and Vent and Storm Drain Systems, Below Ground to 5'-0" Outside Building

1. Piping Systems

a. Basis of Design

- 1) Service weight hub and spigot cast iron soil pipe per ASTM A-74, coated on outside. Fittings: Service weight hub and spigot cast iron soil pipe fittings per ASTM-A-74, coated on outside. Joints: Neoprene gasketed joints per ASTM C564 and ASTM C 1563.
- 2) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Cast iron mechanical couplings with neoprene gaskets and stainless-steel nuts and bolts. Heavy duty type 304 stainless steel shielded couplings, ASTM C1540. Acceptable manufacturers: Husky SD 4000 or Clamp-All 125.

b. Deductive Alternates

- 1) Schedule 40 solid wall DWV PVC pipe, ASTM D178. Install per ASTM D2321. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. (PVC piping is not acceptable for waste piping receiving discharge higher than 130 degrees F, cast iron piping is to be installed at the central plant, mechanical rooms and at all laundry and kitchen equipment discharges.)

c. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.

d. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

e. Foam core PVC piping is not acceptable for any drainage system.

f. All cast iron pipe and fittings shall carry an NSF International listing.

g. All piping and fittings shall be from the same manufacturer.

F. Sanitary, Waste and Vent Systems and Storm Drainage Systems Above Ground

1. Piping Systems

a. Basis of Design

- 1) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No-hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Joints for no-hub pipe and fittings shall be per CISPI 310, with stainless steel clamps and neoprene sleeve conforming to ASTM D 564. Where corrosion resistant cast iron piping is required, piping and fittings shall be Charlotte Edge HP Iron. Heavy duty couplings are required on no-hub systems at the base

of stack and vertical to horizontal offsets on all sanitary, waste and storm drainage systems. Heavy duty couplings shall conform to the requirements of ASTM Standard C-1540 and shall be type 304 stainless steel shielded couplings with bi-directional corrugations, with stainless steel worm gear clamps, 15 psi working pressure. Acceptable manufacturers: Husky SD 4000, Ideal or Mission.

- 2) Type DWV copper tube per ASTM B-306 and ANSI H-23.6. Fittings: DWV solder joint fittings per ANSI B16.29 or B16.23. Joints: All solder joints shall be made with a solder consisting of 95% tin and 5% antimony.
- 3) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- 4) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- 5) All cast iron pipe and fittings shall carry an NSF International listing.

b. Deductive Alternates

- 1) Solid Wall Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM D1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. PVC piping is not acceptable in plenum ceilings or for waste piping receiving waste discharge higher than 130 degrees F, such as from laundry and kitchen equipment.
- c. Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- d. Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- e. Foam core PVC piping is not acceptable for any drainage system.
- f. All cast iron pipe and fittings shall carry an NSF International listing.
- g. In all buildings, PVC sanitary stacks shall include an expansion coupling listed for building expansion and shrinkage of building materials. Coupling shall be solvent welded and capable of 3"-8" travel. Coupling shall be installed every 30'-0" max. of vertical stack. Acceptable

manufacturers include IPEX. Pipe clamps shall be included and installed at top plate and sill plate above fitting.

h. All piping and fittings shall be from same manufacturer.

G. Grease Waste Below Ground to 5'-0" Outside Building

1. Piping Systems

a. Basis of Design

- 1) 316L stainless steel 20 gauge soil pipe with push fit socket connections with green EPDM (High Temperature) sealing rings
Acceptable manufacturers: Bluecher and Josam.
- 2) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- 3) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

b. Deductive Alternates

- 1) Service weight hub and spigot cast iron soil pipe per ASTM A-74, coated on outside. Fittings: Service weight hub and spigot cast iron soil pipe fittings per ASTM-A-74, coated on outside. Joints: Neoprene gasketed joints per ASTM C564 and ASTM C 1563.
- 2) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No-hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Joints for no-hub pipe and fittings shall be per CISPI 310, with stainless steel clamps and neoprene sleeve conforming to ASTM D 564. Where corrosion resistant cast iron piping is required, piping and fittings shall be Charlotte Edge HP Iron. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets on all sanitary, waste and storm drainage systems. Heavy duty couplings shall conform to the requirements of ASTM Standard C-1540 and shall be type 304 stainless steel shielded couplings with bi-directional corrugations, with stainless steel worm gear clamps, 15 psi working pressure. Acceptable manufacturers: Husky SD 4000, Ideal or Mission.
- 3) Type DWV copper tube per ASTM B-306 and ANSI H-23.6. Fittings: DWV solder joint fittings per ANSI B16.29 or B16.23. Joints: All solder joints shall be made with a solder consisting of 95% tin and 5% antimony.

- 4) All cast iron pipe and fittings shall carry an NSF International listing.
- 5) Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM D1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. PVC piping is not acceptable in plenum ceilings or for waste piping receiving waste discharge higher than 130 degrees F, such as from kitchen equipment.
- 6) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- 7) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- 8) Foam core PVC piping is not acceptable for any drainage system.
- 9) All cast iron pipe and fittings shall carry an NSF International listing.
- 10) All grease waste piping runs longer than 50' shall be heat traced.
- 11) All piping and fittings shall be from same manufacturer.

H. Grease Waste Systems Above Ground

1. Piping Systems

a. Basis of Design

- 1) 316L stainless steel 20 gauge soil pipe with push fit socket connections with green EPDM (High Temperature) sealing rings
Acceptable manufacturers: Bluecher and Josam.
- 2) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- 3) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.

b. Deductive Alternates

- 1) Service weight hub and spigot cast iron soil pipe per ASTM A-74, coated on outside. Fittings: Service weight hub and spigot cast

iron soil pipe fittings per ASTM-A-74, coated on outside. Joints: Neoprene gasketed joints per ASTM C564 and ASTM C 1563.

- 2) No-hub cast iron soil pipe per CISPI 301 and ASTM A888. Fittings: No-hub cast iron fittings per CISPI 301 and ASTM A888. Joints: Joints for no-hub pipe and fittings shall be per CISPI 310, with stainless steel clamps and neoprene sleeve conforming to ASTM D 564. Where corrosion resistant cast iron piping is required, piping and fittings shall be Charlotte Edge HP Iron. Heavy duty couplings are required on no-hub systems at the base of stack and vertical to horizontal offsets on all sanitary, waste and storm drainage systems. Heavy duty couplings shall conform to the requirements of ASTM Standard C-1540 and shall be type 304 stainless steel shielded couplings with bi-directional corrugations, with stainless steel worm gear clamps, 15 psi working pressure. Acceptable manufacturers: Husky SD 4000, Ideal or Mission.
- 3) Type DWV copper tube per ASTM B-306 and ANSI H-23.6. Fittings: DWV solder joint fittings per ANSI B16.29 or B16.23. Joints: All solder joints shall be made with a solder consisting of 95% tin and 5% antimony.
- 4) All cast iron pipe and fittings shall carry an NSF International listing.
- 5) Polyvinyl Chloride (PVC), schedule 40 DWV PVC pipe, ASTM D1785. Fittings: Schedule 40 DWV PVC, socket type fittings, ASTM D2665. Joints: Solvent joints for PVC, ASTM D2564. PVC piping is not acceptable in plenum ceilings or for waste piping receiving waste discharge higher than 130 degrees F, such as from kitchen equipment.
- 6) Single and double sanitary tee fittings are not allowed for the piping to any plumbing fixture; combination wye and eighth bend fittings shall be installed.
- 7) Double combination fittings shall not be used for connections to horizontal drainage piping; single wye and eighth bend fittings shall be used for all connections.
- 8) Foam core PVC piping is not acceptable for any drainage system.
- 9) All cast iron pipe and fittings shall carry an NSF International listing.
- 10) All grease waste piping runs longer than 50' shall be heat traced.
- 11) All piping and fittings shall be from same manufacturer.

I. ProSet Fittings

1. Cast in place fire penetration sleeves such as ProSet and Holdrite Hydro Flame may be installed in lieu of block-outs and/or steel sleeves only in areas where the design ceiling clearances are maintained.
2. Code Red stack assemblies manufactured by ProSet Systems are not an acceptable fire stopping method for any system.

J. Pumped Discharge Piping

1. Piping Systems
 - a. Type "L" hard drawn copper tubing per ASTM B-88 and Federal Specification WWT-799. Fittings: Grooved end, solder or brazed joint copper fittings per B16.18 or 16.22. Victaulic Installation-Ready Style 607H (300 psi).

K. Beverage Conduit

1. Piping Systems
 - a. Above grade - Galvanized electrical metallic tubing (EMT), UL Standard 797, ANSI C80.3. Fittings: Galvanized electrical metallic tubing (EMT) long radius sweeps, 18" minimum radius. Threaded or set screw type couplings.
 - b. Below grade - Schedule 40 PVC pipe, ASTM 1785. Fittings: Schedule 40 PVC long sweep socket type fittings, ASTM 2665.

2.04 VALVES, FLANGES AND UNIONS

A. General

1. All systems under this section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement and repair. They shall be installed where shown on the Drawings, or as herein specified. Valves to comply with NSF 61-G, NSF 61, and NSF 372. Valves shall be as manufactured by one of the following companies: American, Anvil International, Apollo, FNW, Jomar, Kennedy, Kitz, Milwaukee, Nibco, Powell, Stockham, Victaulic, Watts, or approved equal, and shall conform to description listed below.
2. Control valves shall be provided for the domestic hot and cold-water supply to all risers and specific areas such as restrooms, fixture groups, equipment, hose bibbs and wall hydrants, food service areas and building separations. Valves shall be located in back-of-house or service areas with access panels or above lay-in ceilings. No access panels will be permitted in public spaces with gypsum ceilings.

B. Valve Description

1. Gate Valves
 - a. 2-1/2" and larger, [Victaulic Series 771V](#) grooved ends (steel pipe), Stockham G-634, 175 lb. flanged OS&Y.
 - b. 2" and smaller, [Milwaukee UP149](#), low lead, 125 lb., sweat connection. 2-1/2" and larger, Victaulic MasterSeal (steel pipe) and Series 608 (copper tubing); Milwaukee Fig. F-2885, 125 lb., flanged or Apollo 141WD-SE-1 lead free Butterfly valve with 10 pos. lever handle.
 - c. 8" and larger, Apollo141WD-SE-2 lead free Butterfly valve with gear operator.
 - d. 2-1/2" and smaller, [Milwaukee BB-SC100](#), threaded.
2. Check Valves
 - a. 2" and smaller, [Milwaukee UP509](#), 200 lb., threaded, low lead.
 - b. 2" and larger, Victaulic Series 716, grooved ends.
 - c. 2-1/2" and larger, Milwaukee Fig. F-2974, 125 lb. flanged.
 - d. 2-1/2" and larger, Stockham G-939, 175 lb. flange.
3. Ball Valves
 - a. 2" and smaller, [Milwaukee UPBA 100](#).
4. Plug Valves (Natural Gas System)
 - a. 1/2" and larger, Rockwell Nordstrom Fig. 142 or 143 lubricated plug valve, threaded or flanged as required, wrench operated.
 - b. 1/2" through 2", two-piece full port brass ball valve, FM and AGA approved, [Watts series FBV-3](#) or equal.
5. Balancing Valves (Hot Water Recirculation)
 - a. Balancing valves shall be automatic, constant flow valves that are scale-resistant, made with low-noise polymer, built-in check valve, union end connections, and 232 psi maximum working pressure. Two shutoff ball valves shall be installed for servicing of the valve.
 - b. Balancing valves shall be Caleffi FlowCal+ with temperature gauge or engineer approved equal that is ANSI/NSF 61 and NSF/ANSI 372 compliant.

- c. Ball valves or manual balancing valves are not acceptable for balancing the hot water return system.
 - d. Circuit Solver thermal balancing valves with integral ball valves and strainer shall be allowed in all recirculation systems.
- 6. Backflow Preventers
 - a. Backflow preventers shall be installed at all locations required by code and local authorities, at all connections to mechanical equipment, and elsewhere as shown on the Drawings. Backflow preventers shall be reduced pressure principle type and shall be a complete assembly including tight-closing shutoff valves before and after the device. The design shall include test cocks and a pressure-differential relief seating check valves. The device shall meet the requirements of and be certified by ASSE Standard 1013, AWWA Standard C-506, NSF 61-G, NSF 61, NSF 372, and USC Foundation for Cross-Connection Control. A strainer shall be located upstream of the device. Route relief outlet from cone receptor to an air gap fitting for discharge to sanitary sewer.
 - b. Acceptable manufacturers are Ames Company, Apollo Valves, Hersey Products, Watts Regulator, and Zurn-Wilkins.
- 7. Class II turbine type water meters shall be installed downstream of the backflow preventer, on the domestic water supply to HVAC equipment make-up, irrigation supply, and pool/fountain supply to allow for a reduction in sewer rate charges.
- 8. Pressure Reducing Valves
 - a. A duplex pressure reducing valve station shall be provided on all domestic water systems greater than 80 psi.
 - b. Direct acting pressure reducing valves shall be used in residential, OEM, and commercial applications, where diameters smaller than 3" or less. Direct acting pressure reducing valves shall be Watts LF223S series or engineer approved equal.
 - c. Pilot activated automatic control valves (ACV) shall be used in applications and installations that require more consistent pressure control over wide flow ranges. Projects utilizing central plants shall use ACV's. ACV shall be Watts LFF115 series or engineer approved equal.
- 9. Flanges
 - a. All flanges shall be faced and drilled for not less than 125 pounds steam working pressure complete with necessary adapter and shall be of size and material of adjacent piping. All flanges shall be faced (raised or flat) to be compatible with connecting valves, equipment, etc. The connection of one raised face flange to a flat face flange shall not be permitted.

10. Unions and Joints

- a. Unions on drainage pipes on fixture side of traps may be slip or flanged joints with soft rubber washers or gaskets. Unions 2" and smaller on copper pipe shall be all brass with ground joint and shall be 250# copper to copper. Unions above 2" shall be flanged with gaskets. Provide union at water and gas connection to all equipment, except plumbing fixtures.
 - 1) Unions and flanges for servicing and disconnect are not required in installations using grooved joint couplings. (The couplings shall serve as disconnect points.)
- b. Bathtub waste and overflow joints shall be soldered if required by local authorities to eliminate the requirement for an access panel to bathtub drain connection.

11. Air Vents

- a. Air vents shall be installed at the high points of return loop of hydronic piping systems. Air vent shall also be installed just upstream of hot water recirculation pumps.
- b. Air vents shall be the serviceable type for inspection and replacement of internal components.
- c. Air vents shall be fitted with either an integral check valve, integral shut-off valve or external shut-off valve to allow servicing without draining the system.
- d. Construction for sizes 1/4" thru 1/2" shall be:
 - 1) Body: Brass
 - 2) Float: Polypropylene or polyethylene
 - 3) Mechanism stem: Brass
 - 4) Mechanism Seal: EPDM
 - 5) Seals: EPDM
 - 6) Maximum Working Temperature: 240°F (115°C)
 - 7) Maximum Working Pressure: 250psi (10 bar)
 - 8) Maximum Vent Pressure: 60psi (4 bar)
- e. Construction for size 3/4" shall be:

- 1) Body: Brass or Cast Iron
 - 2) Float: Stainless Steel
 - 3) Mechanism stem: Stainless Steel
 - 4) Mechanism Seal: EPDM or Viton
 - 5) Seals: EPDM
 - 6) Maximum Working Temperature: 250°F (115°C)
 - 7) Maximum Working Pressure: 230psi (10 bar)
 - 8) Maximum Vent Pressure: 90psi (6 bar)
- f. Air valve shall be Caleffi PLUMBVENT. Acceptable manufacturers (provided they meet or exceed these specifications): Watts, Bell & Gossett, Caleffi, and Hoffman.

2.05 CLEANOUTS

- A. Cleanouts shall be provided where indicated on Drawings and elsewhere as required by code.
1. Cleanouts in pipelines shall consist of cast iron ferrule and heavy-duty cleanout plug with square head as scheduled on the Drawings. Where piping is concealed in floors or walls cleanouts shall be installed in or near surface of floor or walls and have countersunk plugs with covers.
- B. Cleanouts shall be provided at the base of the stack on all sanitary, waste and drainage stacks. Base of stack cleanouts on piping located within walls or partitions shall be cast iron cleanout tee with countersunk plug and chromium-plated round access cover, [J.R. Smith figure 4530](#) or approved equal.
- C. Brass cleanouts shall be solid nut construction.
- D. Provide Owner with three (3) wrenches for removing flush cleanout plugs.

2.06 FLOOR DRAINS

- A. Setting Grades
1. The plumbing contractor shall obtain exact elevation of finished grade at the top of the drains prior to setting any drains. Drains installed in excess of 1/4" below the adjacent finished floor shall be removed and reset to the correct elevation.
- B. Drain Types

1. All floor drain outlets shall be of size noted on the Drawings. All drains shall be equal to the assembly specified. Acceptable manufacturers are as follows: Josam Co., Zurn Co., J.R. Smith Co., Wade, Watts, MIFAB, or approved equal. Drains shall be acid-resisting where indicated.
2. Floor drains noted as FD "CT" for use at cooling towers shall be [Jay R. Smith Figure 3960](#) cast iron drain with domed strainer, 10-½" diameter.
3. Floor drains noted as FD "DD" for use in deck drainage applications shall be [Jay R. Smith Figure 1412-HP](#), C.I. drain with 13" square heel proof grate, D.I. undergrate with nickel bronze strainer.
4. Floor drains noted as FD "G" for use in public spaces such as Restrooms, Locker Rooms, Showers, etc., shall be general purpose type. Drains shall be cast iron with 6" square nickel bronze strainer and trap primer connection. Drains shall be [Jay R. Smith Figure 2005B-L-B6-P050](#) or approved equal.
5. Floor drains noted as FD "K" for use in food service areas shall be general duty type, cast iron, with flashing collar, sediment bucket, nickel bronze, and 6" square nickel bronze strainer. Drains shall be [Jay R. Smith 2010-B6-B](#) or approved equal.
6. Floor drains noted as FD "M" for use in mechanical rooms shall be heavy duty type. Drains shall be cast iron shallow type, 12" diameter with ductile iron tractor grate, sediment bucket, and trap primer connection. Secured funnels shall be provided on all drains receiving condensate discharge to eliminate overflow or spillage. Drains shall be [Jay R. Smith Figure 2142 series](#) or approved equal. Drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
7. Floor sinks noted as "FS" for use in food service areas shall be cast iron with acid resistant coating, 12" square x 8" deep, aluminum or cast-iron dome bottom strainer (plastic strainers are not acceptable), nickel bronze half or three-quarter grate as required by the equipment served. The solid portion of the grate shall be located to the front of the equipment; the open section of the grate shall be located at the rear of the equipment for receipt of the indirect waste. Floor sinks shall be [Jay R. Smith figure 3150 series](#).
8. Floor drains noted as FD "PD" for use in parking deck drainage areas shall be [Jay R. Smith Figure 2142-M](#), C.I. drain with 11-½" ductile iron grate sediment bucket.
9. Floor drains noted as FD "TD" for use at trench drains in parking deck areas shall be Zurn flow-thru system, [Z-812 Series](#), 12" wide, 4" outlets, Z-812-HPD ductile iron heel proof grate.
10. Floor or hub drains located within rooms considered to be a plenum are to be provided with a deep seal trap and trap primer.
11. Unless otherwise noted, acceptable manufacturers shall be Josam, Jay R. Smith, Mifab, Watts, and Zurn.

C. Trap Primers

1. Drains not receiving a continuous discharge are to be provided with an automatic trap primer.
2. Trap primers shall be in-line type actuated by flow independent of pressure, pressure activated primers are not acceptable. PPP PRO1-500 and Josam 88250.
3. Proset Trap Guards or equal can be used in lieu of trap primers where approved by local authorities having jurisdiction.

D. Roof Drains

1. Roof drains labeled "RD" installed in poured concrete slab shall have a cast iron body with combined flashing and gravel stop, cast-iron dome. [Jay R. Smith 1010](#) or approved equal.
2. Roof drains labeled "RD" installed in steel construction or built-up roof shall have a cast iron body with combined flashing and gravel stop, underdeck clamp and sump receiver, adjustable extension and cast-iron dome. [Jay R. Smith 1015-R-C](#) or approved equal.
3. Emergency roof drains labeled "ERD" shall have a cast iron body, combined flashing and gravel stop, cast-iron dome, 3" minimum PVC standpipe under dome, under deck clamp, sump receiver and extension as required. [Jay R. Smith 1070-C-R](#) or approved equal.
4. Unless otherwise noted, acceptable manufacturers shall be Josam, Sioux Chief, J.R. Smith, Mifab, Watts, and Zurn.

2.07 ACCESS PANELS

- A. Group valves together above suspended ceilings, walls, furred spaces to minimize the number of access panels, but with all valves freely accessible for maintenance. Locate all valves within 1'-0" of access point.
- B. Furnish access panels of proper size to service concealed valves and cleanouts. Panels shall be of the proper type for material in which they occur and are to be furnished by the Contractor but installed by the particular trade for the material within which the access panel is installed.
- C. Panels shall have flush doors with No.14 USCG steel door and trim No. 16 USCG steel frame, metal wings for keying into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with one coat of zinc chromate primer. Valves above removable ceilings shall have tile clips by the Contractor for identification.
- D. Access panels are not allowed in gypsum ceilings in public spaces.

2.08 INSULATION

- A. The following shall be insulated:
1. All domestic cold-water (copper) piping and piping subject to freezing.
 2. All hot water and hot water return piping.
 3. All horizontal storm drain piping and roof drain bodies.
 4. All hot and cold-water piping exposed to areas subject to freezing, refer to "Heat Cable for Freeze Protection of Piping" under Part 2 of Section 22 00 00 for additional requirements.
- B. Domestic hot, cold, hot water recirculation, primary storm drainage, and waste drainage piping shall be insulated with 4 lb. density sectional fiberglass insulation with a thermal conductivity not to exceed 0.24 with white all service jacket and vapor barrier. All joints and seams shall be sealed vapor tight. All seams and staples shall then be covered with "All Service Jacket" three-inch wide tape.
- C. All interior horizontal storm drainage piping systems and roof drain bodies are to be insulated with blanket type glass fiber bonded with thermosetting resin with white vinyl vapor retarding facing, 2" wide stapling/taping tab.
- D. Piping insulation exposed to weather shall be protected from damage, including that caused by sunlight, moisture, equipment maintenance and wind. The protection shall provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall be prohibited.
- E. Materials as specified in this section shall be manufactured by CertainTeed, Johns Manville, Knauf, Owens Corning or equal. Insulation thicknesses shall be as shown in the following table:

Minimum Pipe Insulation			Insulation Thickness for Pipe Sizes				
Piping System Types	Fluid Temperature Range		Less than 1 in.	1 in. to <1-1/2 in.	1-1/2 to <4 in.	4 to <8 in.	8 in. and Larger
	°C	°F	In.	In.	In.	In.	In.
PLUMBING							
Domestic Water	Ambient	Ambient	0.5	1.0	1.0	1.0	—
Domestic Hot Water and Hot Water Recirculation	43-71	105-140	1.0	1.0	1.5	1.5	1.5

Minimum Pipe Insulation			Insulation Thickness for Pipe Sizes				
Piping System Types	Fluid Temperature Range		Less than 1 in.	1 in. to <1-1/2 in.	1-1/2 to <4 in.	4 to <8 in.	8 in. and Larger
Above Grade Drains and Piping Receiving Condensate or Ice Machine Discharge	4.5-15.5	40-60	0.5	1.0	1.0	1.5	–
Horizontal Storm Drainage	Ambient	Ambient	–	–	1.0	1.0	1.0

2.09 HEAT TRACE CABLE FOR PROTECTION OF PIPING (FREEZING AND FOG)

- A. Provide electric heat tracing on all domestic water piping and sanitary traps exposed to areas subject to freezing.
- B. Provide heat tracing on all grease waste piping above and below ground.
- C. Provide a complete UL Listed, CSA Certified, or FM Approved system of heating cables, components, and controls to prevent pipes from freezing.
- D. Electric heat cable shall be installed linearly along the bottom of the pipe and allowance shall be made for all fittings, valves, pipe supports, etc. Cable shall be installed prior to insulation of the piping system.
- E. Electric cable shall be capable of maintaining a minimum water temperature of 40 degrees F at an ambient air temperature of 0 degrees F for freeze protection.
- F. Electric cable shall be capable of maintain a minimum water temperature of 110 degrees F for grease waste piping to keep grease from solidifying.
- G. The electric cable shall be the self-regulating type that responds to varying localized temperature conditions by varying the heat output along its length. This shall be accomplished by a self-regulating core, which varies its resistance continuously with changes in temperature. A constant wattage heater is unacceptable.
- H. Provide a thermostat control, which de-energizes the heating cable when the ambient air temperature is above 40 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized in freeze protection applications.

- I. Provide a thermostat control, which de-energizes the heating cable when the grease waste pipe temperature is above 120 degrees F (adjustable). The heat cable shall be entirely self-regulating while energized
- J. Provide all power connection hardware, splices, end seals, etc., to accomplish installation. All hardware shall be by the same manufacturer as the cable.
- K. Electric heating cable and accessories shall be UL Listed. Electric heating cable shall conform to all requirements of Division 26 - Electrical Requirements.
- L. Electric heating cable shall be [Raychem XL-Trace](#) or approved equal, 8 watts per foot.
- M. All piping shall be insulated with 1" thick fiberglass insulation.
- N. Heating-cable circuit shall be protected by a ground-fault device for equipment protection. This requirement is in accordance with section 427-22 of the NEC-2002.
- O. All heating cable components shall be UL Listed, CSA Certified, or FM Approved for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable.

2.10 PIPE SUPPORTS AND HANGERS

- A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor structure using supplementary steel and/or lagbolts. Water supply pipe connecting to pumps, equipment, fixtures or fixture supplies shall be made rigid at the connection point.
 - 1. Piping shall be supported from new concrete construction with Anvil International Fig. 282 inserts or drilled expansion anchors.
 - 2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.
 - 3. Piping and brackets shall be supported from hollow block construction using drilled masonry holes and cadmium plated toggle bolts.
 - 4. Piping shall be supported from wood truss construction with plated lag screws or bolts, B-3227 and B-3228.
 - 5. Pipe supports shall not be attached to floor or roof deck.
 - 6. Acceptable manufacturers are: Anvil, B-Line and FNW.
- B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers are B-Line Systems):

1. Cast iron/steel pipe - B3100 or B3109.
 2. Insulated water pipe - B3100 or B3109 with B3151 placed over insulation protection saddle.
 3. Uninsulated bare copper pipe - B3170 CTC plastic coated.
 4. All supports and mounting hardware are to be galvanized, cadmium plated, or factory enamel painted.
 5. All supports on insulated piping systems shall be sized to fit outside the insulation and shall be provided with insulation inserts and shields at each hanger or support point.
- C. Branch piping to fixtures in chases shall be supported with plastic or copper clamp type supports:
1. B-Line Ruffin series.
 2. Holdrite Systems.
- D. Maximum spacing between pipe hangers shall be:
1. Steel pipe
 - a. 1-1/4" and smaller: 6'-0"
 - b. 1-1/2" – 2": 8'-0"
 - c. 2-1/2" and larger: 10'-0"
 2. Cast iron soil pipe: 2" and larger: 10'-0"
 3. Copper tubing:
 - a. 1/2" – 1-1/4": 5'-0"
 - b. 1-1/2" – 2": 8'-0"
 - c. 2-1/2" and larger: 10'-0"
 4. PVC/CPVC and all plastic pipe:
 - a. 1-1/4" and smaller: 3'-0"
 - b. 1-1/2" and larger: 4'-0"
 5. Pex Piping

- a. Crosslinked Polyethylene PEX Pipe: Install hangers for PEX tubing in strict accordance with manufactures instructions.
- b. Horizontal PEX-a Piping Hangers: Install CTS hangers suitable for PEX-a piping in compliance with the Uponor Commercial Piping Pocket Guide (2017) and local codes, with the following maximum spacing:
 - c. For IPC Jurisdictions: 3 inch (75mm) and below: Maximum span, 32 inches (0.81 m).
 - d. For UPC Jurisdictions: 1 inch (25 mm) and below: Maximum span, 32 inches (0.81 m).
 - e. For UPC Jurisdictions: 1-1/4 inch (31 mm) and above: Maximum span, 48 inches (1.2 m).
 - f. Note: The above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
6. Horizontal PEX-a Piping with PEX-a Pipe Channel: Install hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
 - a. 1/2 inch (12.7 mm) and above: Maximum span, 8 feet (2.4 m).
7. Vertical PEX-a Piping: Support PEX-a piping with maximum spacing of 5 feet (1.5 m).
8. PEX-a Riser Supports: Install CTS riser clamps at the base of each floor and at the top of every other floor for domestic hot-water systems. Install mid-story guides between each floor. Install CTS riser clamps at the base of each floor and at the top of every fourth floor for domestic cold-water systems. Install mid-story guides.
- E. At least one hanger shall occur within 2'-0" from where change in direction takes place. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support vertical risers. Vertical piping drops shall be rigidly anchored to structure at the top and bottom offsets and at eight-foot increments along the vertical drop.
- F. Special approved hangers that require less installation space are to be used where required due to ceiling space limitations.
- G. All connections to pumps and other vibrating machinery shall be provided with stainless steel braided flexible hose connections. Connections to potable water systems shall meet ANSI/NSF 61 design standards.
- H. Expansive/Thrusting Soils. For areas with expansive soils or soil bedding that can fall away, all underground piping at a minimum shall be hung from the bottom of the slab and have backfill of sand or pea gravel. For thrusting soils in particular, pipe isolation of underground piping shall incorporate the Plumbing Void Form System. System shall

incorporate 1/2" polypropylene wall panels, 3/8" #3 rebar joining system. Piping will be supported by stainless steel clevis or roller type hanger using stainless steel all thread rod washers and nuts. See drawings for detail. Note: Cellular core is specifically not permitted for this application.

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1. All installations shall be in accordance with ASTM F2536.
2. Pipe hangers shall be at 4'-0" centers maximum.
3. Pipe hangers shall be clamp on type hanger and shall match pipe size.
4. Hangers shall be made of hot dipped galvanized steel or stainless steel.

2.11 EXPANSION FITTINGS AND LOOPS

- A. All vertical DWV piping stacks in buildings shall have expansion fittings to allow for building shrinkage compensation. The fitting shall be equal to IPEX piston style expansion joint HxH 21381-AWBC series. Expansion fitting shall be documented specifically for shrinkage of building materials and thermal expansion/contraction.
 1. Wood framed buildings shall have a fitting in the first-floor ceiling space and every other floor thereafter.
 2. Concrete buildings shall have a fitting in the first-floor ceiling space and every 8 floors thereafter.
 3. All buildings stacks shall utilize riser pipe clamps at each floor.
- B. All water piping shall have expansion loops installed in the system for thermal expansion and contraction. Expansion/contraction shall be compensated for using Z-bends, U-bends, expansion joints, and/or flexible connectors. Installation size and location shall be dependent on piping system material used. Refer to manufacturer installation instructions and expansion detail on drawings.

2.12 WATER HEATERS – ELECTRIC

- A. Provide electric storage type water heaters as specified on the Drawings.
- B. Water heater shall carry a UL certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.
- C. Provide a metal drain pan and 3" high concrete housekeeping pad at each water heater. Water heaters greater than 10 gallons shall be floor mounted.
- D. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, [Watts series LFBVR](#) or approved equal.

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- E. Water heaters that are not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment. A check valve and expansion tank can be utilized in lieu of the supply side heat trap.
- F. The water heater shall carry a five-year minimum limited warranty for tank leakage.
- G. Electric water heaters shall be as manufactured by:
 - 1. A.O. Smith
 - 2. Rheem
 - 3. Bradford White
 - 4. HTP

2.13 WATER HEATERS – GAS STORAGE TYPE

- A. Provide gas storage type water heaters as specified on the Drawings.
- B. Water heater shall carry an A.G.A. certification for 150 psi working pressure, an ASME temperature and pressure relief valve (T and P) sized for the heater, vacuum relief valve, immersion thermostat, glass lined tank, temperature gauge on outlet, and manual reset high limit control.
- C. Provide a 3" high concrete housekeeping pad at water heaters, pad is to be 3" larger than the footprint of the heater. Water heaters greater than 10 gallons shall be floor mounted.
- D. Provide a combination ball/relief valve on the domestic water supply sized as indicated on the Drawings, [Watts series LFBRV](#) or approved equal.
- E. Water heaters that are not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment. A check valve and expansion tank can be utilized in lieu of the supply side heat trap.
- F. Water heaters
- G. Gas-fired water heaters shall be as manufactured by:
 - 1. A.O. Smith
 - 2. PVI
 - 3. Lochinvar
 - 4. State

2.14 WATER HEATERS – GAS FIRED – INSTANTANEOUS

- A. Provide instantaneous gas water heaters and separate storage tanks as specified on the Drawings.
- B. Water heater shall have an ASME temperature and pressure relief valve (T and P), sized for the heater, vacuum relief valve, factory mounted circulating pump, temperature gauges on inlet and outlet, high limit control and low water cut-off.
- C. Water heaters are to be 96% minimum efficiency.
- D. Provide a 3" high concrete housekeeping pad at each water heater and storage tank assembly. Pad is to be 3" larger than the footprint of the equipment.
- E. Provide a check valve and expansion tank on the domestic water supply to each water heater system.
- F. For condensing heaters, a condensate neutralization kit shall be included and installed.
- G. The exact pipe sizing and arrangement between the water heaters and tanks shall be installed in compliance with the approved manufacturer's installation requirements. The contractor is to submit the proposed layout to the water heater manufacturer for confirmation of the water heater pump size and the minimum pipe sizing between the heater(s) and tank(s) and provide as required.
- H. Gas fired water heaters shall be as manufactured by:
 - 1. A.O. Smith Circulating W.H. series
 - 2. Intellihot
 - 3. Lochinvar Armor series
 - 4. Rinnai

2.15 GAS WATER HEATER VENTING

- A. The vent shall be of the single wall, factory-built type, designed for use in conjunction with Category II, or IV condensing gas fired appliances, condensing oil fired appliances or as specified by the heating equipment manufacturer.
- B. Maximum continuous flue gas temperature shall not exceed 230 degrees F (110 degrees C).
- C. Vent shall be listed for a maximum positive pressure rating of 20" w.c.
- D. The vent system shall be continuous from the appliance's flue outlet to the vent termination outside the building. All systems components shall be UL/cUL listed and supplied by the same manufacturer.
- E. The vent shall be constructed from Flame Resistant Polypropylene, with a min. wall thickness of 0.0669 inches.

- F. All systems components such as vent supports, roof or wall penetrations, terminations, appliance connectors and drain fittings required to install the vent system shall be UL/cUL listed and provided by the vent manufacturer.
- G. All systems components shall include a factory- installed gasket in their female-end to render the vent air and water tight when the male/female ends are pushed together as per manufacturer's instructions. Vent systems requiring field installed sealants or compounds shall not be acceptable.
- H. Vent layout shall be designed and installed in compliance with manufacturer's installation instructions and all applicable local codes.
- I. Vent shall comply with and be listed to UL-1738.
- J. Gas Vent Piping shall be manufactured by:
 - 1. InnoFlue® manufactured by Centrotherm.

2.16 FLASHING

- A. Vent pipes passing through roof shall be flashed watertight.
- B. The roof connections shall meet the approval of the manufacturer of the roofing materials and shall comply with the roof bond requirements.
- C. All vent piping shall be offset above ceilings or in attic space and as shown on the Drawings to penetrate roofs on the least visible sides of building.

2.17 FLOOR, WALL AND CEILING PLATES

- A. Furnish and install heavy gauge chromium plated steel wall and ceiling plates on all exposed pipes in finished areas where they pass through walls, ceilings, etc. Plates shall be of type that will remain permanently in position and where pipes are insulated they shall be of size necessary to cover insulated pipe.

2.18 GALVANIC PROTECTION

- A. Connections between dissimilar metal water pipe shall be made with dielectric unions or flange waterways so there will be no contact between the metals or with insulating bushings. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.
- B. Insulate joints between dissimilar metals with suitable isolation gasket and bolts with fiber ferrules and washers and/or suitable armored insulation fittings by Clearflow, Crane, Capital, Mifab, or Epco,

2.19 WATER LEAK PROTECTION

- A. The contractor shall install an electronically actuated resettable shutoff valve on the cold water supply of the water heater. The electronically actuated valve shall be a full flow valve that closes upon detection of water at the water detector pad supplied with the valve. Lead Free* valves shall be constructed using Lead Free* materials. Lead Free* Water Detector Shutoff valves shall comply with state codes and standards, where applicable, requiring reduced lead content. A water detector pad shall be installed on the floor beneath the water heater or in a drain pan supplied by the contractor. The water detector pad shall be supplied with an integral cable with connector to connect to the valve control unit. The water detector pad shall be an electronic sensing device. The electronically actuated valve shall act to shut off both the water supply and the power to the water heater simultaneously upon detection of water. A visual and audible indication of actuation shall be initiated and normally open contacts suitable for connection to remote monitored alarm actuation shall close.
- B. Shutoff detector and valve shall be Watts LFWDS series system or engineer approved equal.

2.20 PIPING SYSTEMS IDENTIFICATION

- A. A marker showing the service and an arrow indicating the direction of flow shall be applied on all of the following piping systems applicable to the project installed under this section of the Specifications:
 - 1. Domestic hot, cold and hot water recirculation water piping
 - 2. Gas piping
 - 3. Primary and emergency storm drainage piping
 - 4. Sanitary, waste and vent piping
- B. Piping identification shall be applied on all piping systems in areas of exposed construction and in areas with accessible or lay-in ceilings. The piping shall be labeled at each wall and floor penetration (both sides), and at connections to equipment. In addition, straight runs of piping shall be labeled at intervals not greater than 25 feet.
- C. The letter size and background color shall conform to the Identification of Pipe System ANSI A-13-1. The vinyl plastic markers shall be as manufactured by Seton Name-Plate Company, W. H. Brady Company, or Westline products.
- D. Each valve in the Plumbing and Fire Protection systems is to be provided with an individually numbered valve tag.
- E. Valve tags are to be brass or plastic laminate, 1-1/2" minimum diameter with brass chain and hook for securing to the valve.

- F. Valve tags will include a "P" or "FP" lettering designation to indicate the appropriate system. Numbering shall be consecutive for each service of either the Plumbing or Fire Protection systems.
- G. A printed list or schematic drawing shall be compiled for each system indicating the location and detailed description of the system or equipment served.
- H. One copy of each list shall be framed and mounted at the location designated by the Building Engineer. An additional copy of each list is to be included in the Operations and Maintenance Manual.

2.21 EQUIPMENT LABELING

- A. All equipment shall be labeled. This shall include all pumps, water heaters, storage tanks, and other similar equipment.
- B. Equipment labeling shall be one of the following, unless noted or specified otherwise.
 - 1. Permanently attached plastic laminate signs with 1" high lettering.
 - 2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.
- B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such times and in such a manner as to avoid damage and as required by the job progress. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.
- C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.
- D. Mounting heights, unless otherwise noted, are to the finished bottom of the device.
- E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02 EXCAVATION, TRENCHING AND BACKFILLING

- A. The Contractor shall perform all excavation to install the work herein specified and as indicated on the Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. No tunneling or boring shall be done except under pavement.
- B. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, and tamped in 12" layers. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
- C. The trenches shall be backfilled with the excavated materials approved for backfilling, non-cohesive consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and tamped until the crown of the pipe is covered by a minimum of 6" of tamped earth. The backfill under and beside the pipe shall be compacted for pipe support. Backfill shall be brought up evenly on both sides of the pipe so that the pipe remains aligned. In instances where the manufacturer's installation instructions for materials are more restrictive than those prescribed by the code, the material shall be installed in accordance with the more restrictive requirement. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off. A metallic lined underground warning tape shall be provided 12" below finished grade. The tape shall be identified as to the type of line per ANSI standard nomenclature and color.
- D. Provide a layer of sand at least 6" deep under all plastic pipe installed in soil. Bell holes shall be excavated to ensure that the sewer pipe rests for its entire length upon a solid trench bottom.
- E. Perform excavation and backfilling work in accordance with applicable portions of the earthwork section.

3.03 STORAGE AND PROTECTION OF MATERIALS

- A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until final connection to system is made.
- C. All equipment and piping shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

- D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in manner to prevent damage to materials during storage and handling. Replace damaged materials.
- E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged or which are subjected to these elements are unacceptable and shall be removed from the premises and replaced.

3.04 CUTTING AND PATCHING

- A. Work shall include all cutting, patching, masonry and carpentry required as part of the equipment installation when not provided by other sections of these specifications.
- B. All work shall be performed as specified under architectural specification section for cutting and patching.

3.05 CONCRETE WORK

- A. Construct curbs, pads, vaults and similar supports for equipment where required.
- B. Provide 3" thick housekeeping pads at floor mounted equipment a minimum of 3" larger than the entire area occupied by equipment. Dowel pads to structural slab.
- C. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

3.06 CLEANING

- A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.
- B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, etc. shall be thoroughly cleaned both inside and out.
- C. After testing and balancing of systems as specified and just prior to Owner review and acceptance, all systems shall be finally cleaned and shall be left ready for use.

3.07 PAINTING

- A. Painting, except as otherwise specified, will be done under another section of the specifications, but the Contractor shall leave all surfaces of work free of rust, dirt and grease.
- B. The Contractor shall touch-up to match original finish any equipment scratched in shipment or installation. Touch-up painting of plumbing equipment shall be part of the plumbing work.

- C. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces which are not galvanized (this includes piping systems). Rust preventative painting shall be part of the plumbing work.
- D. All painting and coating shall match the original and shall conform to the requirements detailed in other sections of these specifications. Do not paint over nameplates on equipment, nonferrous hardware, accessories or trim.

3.08 EQUIPMENT SUPPORT

- A. Major equipment supports (framed structural openings, etc.) shall be furnished and installed by others as shown on the Drawings. The plumbing work shall include, the furnishings and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all equipment.
- B. Unless otherwise shown on the Drawings, all equipment, piping, and accessories shall be installed level, square, and plumb.
- C. All equipment, piping, etc. supported by structural joists shall be supported by the top chord only of such joists. Hangers shall not be attached to the bottom chord of any joists.

3.09 PIPE PENETRATIONS

- A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe penetrations. Sleeves for pipe shall be Schedule 40 black steel. Sleeves shall be sized to provide a minimum of 1/4" clearance between the sleeve and pipe.
- B. The 1/4" minimum clearance shall be provided between the sleeve and the insulation on insulated piping systems. A gap of the insulation shall be omitted at each side of a rated wall penetration to allow for the required fire stopping.
- C. As far as possible, all pipe penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.
- D. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.
- E. Pipe penetrations through exterior walls shall be sealed watertight with expandable link type seals by Thunderline, Linkseal or Engineer approved equal.
- F. All pipe and duct penetrations of fire, smoke, or fire and smoke-rated assemblies shall be fire-stopped as required to retain the integrity of the UL rated assembly. Fire barrier products shall be as manufactured by Tremco, Hilti, 3M, Metacaulk, Nelson, or approved equal.

3.10 FLASHING

- A. All piping penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in other sections of these specifications.
- B. Flashing for piping shall be sheet lead of not less than 6 pounds per square foot, shall have a base not less than 2 square feet, and shall extend up over and into the open end of the pipe. All flashing shall be properly caulked and sealed.

3.11 PIPING SYSTEMS

A. Water Piping - General

- 1. Pipe used in piping assembly must be clean of dirt and obstructions and shall have ends square and reamed before putting into the fittings.
- 2. All piping must be true and plumb with proper pitch for draining of the soldering.
- 3. All domestic water lines serving flush valve fixtures and washing machines shall be protected from water hammer by shock absorbers. Where shock absorbers are required they shall be as manufactured by Josam Mfg. Company, J. R. Smith, Sioux Chief Ind., Precision Plumbing or Zurn Mfg. Co. and shall conform to the Plumbing and Drainage Institute published requirements.
- 4. All connections to water heaters, tanks and equipment shall be made with unions or flanges. Insulated piping systems shall be installed to provide space for insulation.
- 5. Grooved joint shall be installed in accordance with the manufacturer's written recommendations. Grooved ends shall be clean and free from indentations, projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor's representative is not considered qualified to conduct the training.)
- 6. When installing CPVC for all Potable and Non-Potable systems Contractor shall have received installation training from either the pipe/fitting manufacturer or designated representative before the project starts and shall furnish a copy of the "training documentation" within the project submittal for each installing individual showing current installation training.
- 7. When installing Pex piping for all Potable and Non-Potable systems Contractor shall have received installation training from either the pipe/fitting manufacturer or designated representative before the project starts and shall furnish a copy of the "training documentation" within the project submittal for each installing individual showing current installation training.

8. When installing heavy duty couplings, install per manufacturer's installation instructions. All couplings shall be installed with a torque wrench and to the manufacturer's torque requirements.

B. Sanitary Waste, Vent, Indirect Waste and Storm Drain Piping - General

1. Pipes shall be plumb and parallel to building walls, beams and columns unless otherwise indicated. All horizontal lines are to be evenly pitched and properly secured with iron or steel hangers, unless noted otherwise. A pitch of 1/4 inch per lineal foot shall be maintained on all soil, and waste lines, wherever possible. Where long runs of piping require less pitch due to space restrictions, a less pitch shall be allowed on main lines four (4) inches and over in size, but in no event should any pipeline have a slope less than 1/8 inch per foot.
2. All soil and waste pipes shall be extended out full size through the roof or connected to a common vent as shown on the Drawings.
3. Main vent stacks shall run parallel to the soil pipe stacks and shall connect to the vent continuation of the soil stack at least three (3) feet above the rim of the highest plumbing fixtures on the stack. Vent stacks shall also be connected at the base or horizontal offset of the soil stack through a Y and 1/8 bend or an upright Y fittings. Offsets in vent pipe shall be made with 45-degree fittings wherever possible. Horizontal vent lines shall pitch toward the waste line.
4. Threaded joints shall have American National taper screw thread with graphite and oil compound applied to the male threads.
5. Sanitary and vent stacks are to be run straight and plumb and all offsets shall be made at an angle of not less than 45 degrees.

- C. Mounting heights, unless otherwise noted, are to the centerline of the equipment and/or device.

3.12 TESTING OF PIPING SYSTEMS

A. General

1. All piping systems shall be subjected, before being insulated or concealed, to testing with water or air as noted and shall hold tight at the pressure head stated for the time interval required without adding air or water. While any system is being tested required head or pressure shall be maintained until all joints are inspected.
2. All tests shall be witnessed by the inspector having jurisdiction and the Owner's Representative, with a minimum 48-hour notice given these authorities.
3. All equipment, material, labor and testing mediums required for testing any of the various systems or any part thereof shall be furnished by the Contractor.
4. All connected equipment, accessories, etc. shall be isolated from piping systems prior to testing.

B. Sanitary Piping Systems

1. Water test shall be applied to these drainage systems either in their entirety or in sections as required, after rough piping has been installed. If the system is tested in sections, each opening shall be tightly closed except the highest opening in the section under test. All sections shall be tested with a minimum of 10 feet of head. In testing successive sections, at least the upper 10 feet of the next section shall be tested so that no joint of piping in the building shall be submitted to a test of less than 10 feet of head. The water shall be kept in the system for at least 30 minutes before inspection starts; the system shall then be made tight at all points.
2. Any points of the drainage systems to be tested with air instead of water shall be made by attaching an air compressor testing apparatus to any suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a minimum gauge pressure of 5 psi. This pressure shall be held without the introduction of additional air for a period of at least 30 minutes.
3. Exterior connections shall be tested as part of the interior systems.

C. Interior Water Piping Systems

1. Upon completion of the entire water supply system or a section of it as required, it shall be tested prior to connection of fixtures and proved tight under a water/air pressure of 150 psi. Pressure shall hold for a period of one hour without introducing additional water/air. Water used for testing shall be from a potable source of supply. Defective joints or piping shall be replaced as required and all piping shall be retested.

D. Exterior Water Piping System

1. All exterior domestic water piping shall be tested to 150 psi for a period of two hours.

E. Defective Work

1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. Caulking of screwed joints or holes is not acceptable.

F. Additional Tests

1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
2. Provide for any repeated test as directed by the Owner's Representative, to make all systems tight as required.
3. Visual inspections of joints, valves, etc. shall be made as directed by the Engineer.

3.13 DISINFECTION OF WATER SYSTEM – INTERIOR AND EXTERIOR

- A. Prior to project completion, all potable water piping systems shall be disinfected per local code requirements.
- B. Whenever the authority having jurisdiction does not specify disinfection procedures, the new water piping system shall be thoroughly disinfected with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hydrochloride solution and shall be introduced into the system and drawn to all points in the system. The disinfection solution shall be allowed to remain in the system for a period of eight hours, during which period all valves and faucets shall be opened and closed several times. After disinfection, the solution shall be flushed from the system with clear water until the residual chlorine content is not greater than 0.2 parts per million.
- C. This work is to be supervised or performed by an approved chemical testing laboratory and results sent to Engineer or his representative for verification.

3.14 DOMESTIC HOT WATER SYSTEM BALANCING

- A. The TAB agency shall be a subcontractor of the General Contractor and shall not report to or be paid by the HVAC or plumbing Contractor. The plumbing subcontractor shall be responsible to cooperate with and provide for the balancing subcontractor any and all materials, services, labor, etc. to facilitate completion of the balancing work.
- B. The TAB agency and its specialists shall be certified members of Associated Air Balance Council (AABC) or certified by the National Environmental Balance Bureau (NEBB) to perform TAB service for HVAC/Plumbing [, and vibration and sound testing of equipment]. The certification shall be maintained for the entire duration of duties specified herein. The TAB agency shall have been in business for at least the past five years and must be free of disciplinary action by either the AABC or the NEBB during that time.
- C. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity of this project and must be certified so by the TAB agency in writing.
- D. The basic instrumentation shall be calibrated to accuracy requirements by its manufacturer, AABC or NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. Submit calibration history of the instruments to be used for test and balance purpose during the preliminary and final submittal phase.
- E. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by the ASHRAE Handbooks and requirements stated herein shall be the basis for planning, procedures, tolerances and reports. Final report shall cite the exact names of publications used as a basis or reference for the TAB work or reports.
- F. TAB PROCEDURES
 - 1. TAB shall be performed in accordance with the requirements of the Standard under which the TAB agency is certified, either AABC or NEBB.

2. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project.
3. Test and balance required in dwelling units must be completed and the TAB report submitted prior to occupancy. Coordinate with the general contractor, owner's representative, and mechanical subcontractor to schedule TAB well in advance of occupancy.
4. Record dates and time of day of all tests, and ambient conditions (dry bulb and wet bulb).
5. Water circulating systems shall be adjusted and balanced so that water quantities circulated through the apparatus will be as specified.
6. After completion of the testing, adjusting and balancing of the water systems, provide electronic files (e.g. PDFs, etc.) of the complete test report showing the minimum following information which shall be submitted to the Engineer for review:
 - a. Systems inspection narrative on equipment and installation for conformance with design
7. Systems Readiness Report
 - a. TAB report covering flow balance and adjustments, performance tests, Required information:
 - 1) Identification of each piece of apparatus, manufacturer, size, model, etc.
 - 2) Flow as indicated on the Drawings for each piece of apparatus and corresponding pressure drop
 - 3) Temperatures, pressures and corresponding water flow at each coil/valve after each complete system has been balanced and adjusted
 - 4) Head, gpm, bhp, volts, amps for each pump specified
 - 5) Suction and discharge pressures at each pump and corresponding water flow after each complete system has been balanced and adjusted.
 - 6) Verify recirculation pump operation and rotation.
 - 7) outlet temperature of the system at water heaters and/or storage tanks.

- 8) Confirm/adjust setpoint of each individual riser balancing valve to flow a minimum of 0.5gpm or as otherwise noted on the documents.

8. Narrative of uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

- G. Copies of the final approved balancing report are to be included in the O and M manuals as noted in "Permits" under Part 1 of Section 22 00 00.

3.15 FIXTURE CONNECTIONS AND SUPPORTS

- A. Wall fixtures shall be hung by means of carrier type fixture supports as manufactured by J.R. Smith, Josam, Mifab, Wade or Zurn.

3.16 SLEEVES

- A. Furnish and install pipe sleeves around all piping passing through masonry walls, floors, beams, etc. Sleeves shall be of such diameter as to allow pipe to pass through easily and permit expansion and contraction of pipe. Where pipes are insulated, the sleeves shall be of such diameter as to allow the insulated pipe to pass through easily. The sleeves shall be placed before the pouring of concrete and before construction of walls. Sleeves for vertical risers shall extend a minimum of 1" above the floor slab. Sleeves to outside walls below grade shall be caulked or provided with expansion type mechanical seals as required to make them waterproof.

3.17 INSTALLATION OF UNIONS

- A. Unions shall be located as shown on plans and as required by equipment so piping and equipment can be easily dismantled. Unions shall not be installed in any location where they are not readily accessible.

3.18 TRAPS

- A. All fixtures, drains, etc. shall be provided with traps, unless specifically shown or specified otherwise. Traps shall be set in an upright position, level and true, and shall be vented as shown and required. All exposed traps shall be provided with cleanout plugs.

3.19 CLEANOUT INSTALLATION

- A. Furnish and install cleanouts in soil and waste lines as required by Code and/or job conditions, as shown on the Drawings and as follows: At or near the end of each branch and main drainage line, horizontal lines at intervals as required by code. All cleanouts shall be readily accessible, with plugs easily removable for cleanout lines. Cleanouts at the base of vertical piping shall be held within 2'-0" from finished floor unless otherwise indicated.

3.20 FLASHING INSTALLATION

- A. All pipes passing through roofs shall be flashed in an approved manner. Flashing shall be watertight.
- B. Roof connections shall meet the approval of the manufacturer of roofing material and shall comply with roof bond requirements.

3.21 EQUIPMENT AND MATERIAL PROTECTION

- A. During construction all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers.
- B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, test plugs until connection to system is made.

3.22 SPACE REQUIREMENTS

- A. Piping, apparatus and equipment shall fit into the space provided in the building or within the property and shall be installed at such time and in such manner as to avoid damage to the building structure or property as required by the job progress. Equipment, apparatus and accessories requiring normal servicing or maintenance shall be made easily accessible.

END OF SECTION 22 0000

SECTION 22 16 00 - NATURAL GAS PIPING SYSTEM

PART 1 - GENERAL

1.01 SYSTEM

- A. Provide a complete system of natural gas piping from gas meter to all natural gas burning equipment and appliances.
- B. All gas equipment specified herein shall be suitable for use with natural gas system.

1.02 DESIGN STANDARDS

- A. The natural gas system shall be designed and installed in accordance with the requirements of the following codes and standards:
 - 1. The Florida Fuel Gas Code, 2020 Edition, with most current City of Tallahassee Amendments
 - 2. NFPA 54 - National Fuel Gas Code

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Underground Piping
 - 1. Schedule 40 black steel pipe, ASTM A53 with polyethylene jacket, welded joints and standard weight black steel butt weld or socket weld fittings, ASTM A243 or press-connect fittings ANSI LC-4/CSA 6.32 (Viega MegaPressG).
 - 2. Polyethylene pipe, ASTM 2513, with heat fusion joints and fittings, ASTM D2513.
 - a. **Tracer.** A yellow insulated copper tracer wire or other approved conductor shall be installed adjacent to underground nonmetallic piping. Access shall be provided to the tracer wire or the tracer wire shall terminate above ground at each end of the nonmetallic piping. The tracer wire size shall not be less than 18 AWG and the insulation type shall be suitable for direct burial.
- B. Aboveground Piping
 - 1. Schedule 40 black steel pipe, ASTM A53 with welded joints and standard weight black steel butt weld fittings, ASTM A234 or socket weld fittings, ASTM A105.
 - 2. Schedule 40 black steel pipe, ASTM A53, with 150 pound steel slip-on welding flanges, ASTM A181, for connection to flanged valves and equipment.

3. Schedule 40 black steel pipe, ASTM A53, with screwed joints and 150 pound threaded malleable iron fittings, ASME B.16.3.
4. Schedule 40 black steel pipe, ASTM A53, with press-connect joints (Viega MegaPressG) ANSI LC-4/CSA 6.32.
5. Where allowed by Authority Having Jurisdiction, corrugated stainless steel tubing (CSST) with energy dissipating polyethylene jacket conforming to ASTM-A240; brass flare type fittings, ASTM B16, 5 psi maximum system pressure. Polyethylene jacket shall not exceed 25/50 flame/smoke spread rating. [Tracpipe Counterstrike CSST](#) system only.

2.02 JOINTS

- A. Threaded joints shall be made with a pipe compound specifically listed as resistant to reaction with liquefied petroleum gas and shall be applied to male threads only. After cutting and prior to threading, pipe shall be reamed and shall have burrs removed.
- B. Welded joints shall be fusion welded in accordance with the American Standards Code for pressure pipe, ASME B31.1, Section 6.
- C. Flanged joints shall be faced true, provided with ring type gasket, and made square and tight. Flanges shall have raised or flat faces to mate with adjacent flanges of valves.
- D. Press-connect joints (Viega MegaPressG) shall be listed to ANSI LC-4/CSA 6.32 and shall have HNBR sealing elements.

2.03 UNIONS

- A. Unions in steel piping shall be 150 pound socket welded carbon steel conforming to ASME B.16.11 or class 150 malleable iron threaded fittings conforming to ASME B.16.3.

2.04 VALVES

- A. Valves 3" in size and larger shall be semi-steel plug valves with cast iron body, lubricated cast iron plug, flanged ends, and wrench operated for 175 pound WOG. Valve shall be [Rockwell Nordstrom Fig. 143](#) or equal.
- B. Valves 2-1/2" in size and smaller shall have bronze body and plug, socket welded ends, and square head for 125 WOG. Valve shall be Crane or Fig. 250 or equal.
- C. Full port ball valves 2" in size and smaller shall have brass body with chrome plated brass ball with threaded or socket welded ends, 600 psi WOG, FM approval, AGA approval. Valve shall be [Watts series FBV-3C](#) or equal.
- D. Lubricated plug valves shall be lubricated at the factory and sealant shall be suitable for natural gas. Provide two valve wrenches for each type of valve specified.
- E. Acceptable valve manufacturers are Rockwell Nordstrom, Crane, FNW, Stockham, Powell, Walworth, or Milwaukee.

2.05 PRESSURE REGULATING VALVES

- A. Pressure regulator shall be cast iron, ductile iron or stainless steel, corrosion-resistant spring-loaded type with internal pressure relief, 175 psi working pressure. Provide threaded ends for piping 2" and smaller, flanged ends for piping 2-1/2" and larger. All regulator vents shall be extended to the exterior unless otherwise specified. Regulators equipped with and labeled for use with an approved vent-limiting device shall not require a vent to the exterior. Acceptable manufacturers are Fischer Regulators, Jordan Valve, Maxitrol, Rockwell and Sensus.
- B. Low pressure regulators supplied from medium and high pressure gas systems shall be lock-up type high gas pressure regulators and shall be installed a minimum of ten feet upstream of the equipment inlet connection.

2.06 PROTECTIVE COATING

- A. Underground steel service entry piping shall be furnished with factory applied plastic coating and field coating at joints conforming to AWWA Standard C-203. All valves, fittings, and joints in underground piping shall be field coated using a heat-applied coal tar enamel tape, using two coats of heavy mastic, using "Scotchwrap," "CT Tapecoat" or "X-Tru-Tape." Field coating shall extend over mill wrapping a minimum of 4 inches. Damaged coating shall be repaired as specified for valves, fittings, and joints.

2.07 CATHODIC PROTECTION

- A. All underground gas piping shall be cathodically protected. Provide a minimum of two 17-pound magnesium anodes containing 6% aluminum and 3% zinc alloy. Anodes shall be distributed equally along the pipe run, but spacing shall not exceed 100 feet between anodes. Each anode shall be attached to the pipe by the Caldwell or brazing process. The connecting wire shall be buried in backfill composed of 75% gypsum, 20% bentonite and 5% sodium sulphate. Wherever the underground gas piping rises above grade, provide an insulating dielectric fitting.

2.08 FIRE PLACE LOG LIGHTER

- A. Cast iron burner bar, 10" long with 1/2" IPS threaded inlet, chrome plated three way loose key gas valve. [Prier model number C-69 / C-64.](#)

2.09 PIPE SUPPORTS & HANGERS

- A. All piping shall be supported by means of hanger rods and pipe hangers from roof or floor construction using supplementary steel and/or lagbolts.
 - 1. Piping shall be supported from new concrete construction with [\[Anvil International Fig. 282 inserts\]](#) [\[drilled expansion anchors\]](#).
 - 2. Piping shall be supported from new steel construction with Anvil International Fig. 131 beam clamp, Fig. 61 beam clamp, Fig. 66 welded beam attachment or Fig. 60 washer plate with all-thread rod.

3. Piping and brackets shall be supported from hollow block construction using masonry drilled holes and toggle bolts.
 4. Piping shall be supported from wood truss construction with plated lag screws or bolts, [B-3227](#) and B-3228.
- B. Unless otherwise noted, hangers and clamps shall be as listed below (all model numbers noted are B-Line Systems):
1. Gas pipe – [B3100](#) or B3109.
 2. All supports and mounting hardware are to be galvanized or cadmium plated.
- C. Maximum spacing between pipe hangers shall be:
1. 1/2": 6'-0"
 2. 3/4"-1": 8'-0"
 3. 1-1/4" and larger: 10'-0"
- D. At least one hanger shall occur within two feet (2'-0") from where a change in direction takes place in the line. Where pipes extend down or up to other floors, pipe clamps shall be provided on each floor to support pipe. Equal manufacturers for hangers and clamps are B-Line Systems, Anvil International, Fee and Mason, PHD Manufacturing, or approved equal.
- E. Piping on roofs shall be supported every six feet on piping 1/2" size, eight feet on piping 3/4" – 1" size, and ten feet on piping 1-1/4" and larger, and at each change in direction, with manufactured adjustable height stainless steel pipe stands with integral pipe roller guides or clevis hanger for securing horizontal piping. Pipe stands shall be secured to the roof per the roofing manufacturer's installation requirements. Pipe stands shall be [Miro Industries Model 4-RAH Series](#), [Dura-Blok Rooftop Supports](#) or [ERICO CADDY Series](#).
- F. Pipe supports for rooftop gas piping may be painted fabricated steel pipe stands with integral pipe guides if approved by the roofing manufacturer.

2.10 EMERGENCY SOLENOID VALVE

- A. The main gas supply to kitchen equipment shall be provided with an automatic solenoid valve with manual reset lever. The valve shall be interconnected with the hood fire suppression system to shut down gas supply to all kitchen equipment.
- B. Where required by local codes or jurisdictions, main gas supplies to fireplaces, fire pits, BBQ grills, etc. shall be provided with an automatic solenoid valve with manual reset lever. The valve shall be energized to open, closed when de-energized with manual reset. The required voltage shall be coordinated with the electrical contractor. The valve shall carry a UL Listing.

- C. The valve shall be energized to open, closed when de-energized with manual reset. The required voltage shall be coordinated with the electrical contractor. The valve shall carry a UL Listing.
- D. The emergency shutoff valve is to be provided with manual shutoff valves and unions on each side and located in a surface mount steel cabinet with flush solid metal door. The cabinet is to be located as shown on the drawings with the top of cabinet flush with finished ceiling. The cabinet shall be [Potter Roemer 1810 series](#) or approved equal.
- E. Valves 3/4"-2-1/2" in size shall be [ASCO 8044 series](#).
- F. Furnish and install gas timer valve Fire Magic Model 3090 or approved equal on all fireplaces, fire pits, gas grilles, and other recreational gas fired appliances in addition to main shut off valve.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All interior gas systems shall be bonded to the building's grounding system per the requirements of NEC Section 250. A written statement bearing the names and signatures of the plumbing and electrical contractors indicating compliance with the NEC grounding requirements is to be submitted prior to project close-out.
- B. A valved union shall be provided at each connection to a piece of equipment. Equipment provided with a flanged inlet shall have a flanged connection.
- C. All valves installed in horizontal lines shall be installed with the stems horizontal or above.
- D. All gas piping shall be graded at the maximum slope available to prevent traps. All horizontal lines shall slope to risers and from the risers to the meter or appliance.
- E. Drip legs, 6" long, shall be provided in gas piping at ends of horizontal runs, at the base of risers, and at connections to equipment.
- F. Provide pressure regulators at all required connections to equipment; regulators shall be provided at the pressure required by the equipment served. Extend all pressure regulator vents individually to the exterior per local code authority requirements.
- G. Branch piping shall be taken off the top or sides of horizontal lines, but not from the bottom.
- H. Changes in pipe size shall be made with reducing fittings. No bushings will be allowed.
- I. No gas piping shall be placed underground inside the building.
- J. All gas supply connections to food service equipment are to be provided with an AGA rated flexible connector with quick disconnect coupling. The flexible connector shall be 5'-0" minimum length or longer as required to allow for removal of the food service equipment item.
- K. Underground Piping

1. General:

- a. Lay, align, anchor and test pipe and make-up joints. Perform excavating, cleaning, laying, jointing and backfilling as concurrently as possible to maintain uniform installation. Replace or repair damaged materials to condition equal to new material.

2. Excavation and Backfilling:

- a. Care shall be taken not to excavate below depth necessary.
- b. Do not leave unjointed piping in trench overnight. Backfill trenches by filling and tamping in not more than 6" layers after pipes, tanks, or other structures have been installed, tested and approved.

3. Pipe Crossing:

- a. Lay lower pipe, backfill with crushed stone, gravel or concrete as directed and thoroughly compact to level of upper pipe.

3.02 PAINTING

- A. All interior and exterior ferrous metal gas piping, fittings and supports shall be primed and painted with two (2) coats of exterior grade enamel paint unless galvanized, stainless steel, or coated CSST piping is used. The paint color shall be submitted to the Architect for approval.

3.03 TESTING

- A. All piping is to be inspected and purged per the requirements of NFPA 54 and the local authorities' requirements.
- B. The entire gas piping system shall be tested with compressed air to 100 psi for a period of two (2) hours.
- C. Defective joints or piping shall be replaced as required and the system shall then be re-tested.

END OF SECTION 22 1600

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 22 00 00 - Plumbing General.

1.02 WORK INCLUDED

- A. Receipt, unloading, handling, proper storage and protection from damage of all materials.
- B. Layout and coordination of work with other trades.
- C. The work under this section shall include all labor, materials, accessories, services, and equipment necessary to furnish and install the plumbing fixtures, trim and supports, complete as indicated on the Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All fixtures shall be white, unless otherwise indicated.
- B. All water closets shall have fully glazed trapways.
- C. All exposed trim to be heavy polished chrome plated brass, unless otherwise indicated. Chrome plated escutcheons are to be provided on all exposed fixture and food service equipment supplies and waste lines.
- D. Electric water coolers shall be ARI Certified and shall carry a UL Listing. Units shall use refrigerant which is approved for use without ozone depleting properties. All waterway components are to be certified as lead free.
- E. All sinks and lavatories for use by the disabled shall have manufactured insulation shields on all supplies and P-traps per ADA requirements unless the vanities are provided with ADA compliant shrouds.
- F. All exposed plumbing fixture items such as faucets and flush valves shall be provided with vandalproof trim.

2.02 CLEANOUTS

- A. Cleanouts on exposed piping in unfinished areas shall be heavy duty cast iron with countersunk plug. Cleanouts shall be Jay R. Smith Figure 4220 or approved equal.
- B. Cleanouts installed behind walls in finished areas shall be cast iron ferrule type for no-hub or service weight pipe with nickel bronze round frame and cover with securing screws. Cleanouts shall be Jay R. Smith Figure 4472T or approved equal.

- C. Cleanouts installed in concrete floors shall be cast iron type with gasket seal ABS plug round adjustable ductile iron cover with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4231L-M or approved equal.
- D. Cleanouts installed in tile floors shall be cast iron type with gasket seal ABS plug for easy removal, adjustable round nickel bronze top recessed for tile with securing screw and Speedi-Set outlet connection. Cleanouts shall be Jay R. Smith Figure 4151L or approved equal.
- E. Cleanouts installed in carpeted areas shall be cast iron type with gasket seal ABS plug, nickel bronze round frame and cover with carpet marker. Cleanouts shall be Jay R. Smith 4031-Y or approved equal.

2.03 PLUMBING FIXTURES

- A. The following is a list of acceptable manufacturers for the project:
1. Fixtures: American Standard, Kohler, Toto
 2. Faucets: American Standard, Chicago Faucets, Kohler, Moen, Speakman, Symmons and Zurn
 3. Stainless Steel Sinks: Elkay, Just, Kohler
 4. Trim: American Standard, Brasscraft, Kohler, McGuire and Zurn
 5. Drains, Carriers and Hydrants: Josam, Mifab, Prier, Jay R. Smith, Wade and Zurn
- B. Plumbing fixtures shall be as scheduled below:

PLUMBING FIXTURE SCHEDULE

Fixture	Description	Acceptable Manufacturers	
WC-1	WATER CLOSET – PUBLIC: Wall hung, 1.28-gallon flush valve, vitreous china, elongated, siphon jet, 1-1/2" back spud, bolt caps, cotton finish. ADA fixture to be installed with top of seat 18" above finished floor.		TOTO CT728CUV
	CARRIER: Adjustable, horizontal and vertical series.	Smith 210 Series	Zurn 1203/1204 Series
	FLUSH VALVE - CONCEALED: 1.28-gallon self-powered hydroelectric flush, sensor operated, concealed flush valve with 1" angle stop and 1-1/2" vacuum breaker, back spud coupling, manual flush override, 14" x 12" heavy duty stainless steel cover with satin finish.		TOTO TET2LB31#SS

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	SEAT: Commercial grade solid plastic, elongated, open front, stainless steel check hinge, cotton finish.		TOTO SC534
WC-2	WATER CLOSET – PUBLIC: Wall hung, 1.28-gallon flush valve, vitreous china, elongated, siphon jet, 1- 1/2" top spud, bolt caps, cotton finish. ADA fixture to be installed with top of seat 18" above finished floor.		TOTO CT728CU(G)
	CARRIER: Adjustable, horizontal and vertical series.	Smith 210 Series	Zurn 1203/1204 Series
	FLUSH VALVE: 1.28-gallon self-powered hydroelectric flush, sensor operated exposed flush valve with 1" angle stop and 1-1/2" vacuum breaker, top spud coupling, mechanical flush override, chrome plated finish.		TOTO TET1LB32#CP
	SEAT: Commercial grade solid plastic, elongated, open front, stainless steel check hinge, white.		TOTO SC534
WC-3	WATER CLOSET – TANK-TYPE : One-piece, floor mounted tank type, 1.28 gallon flush, 2-1/8" trapway, vitreous china, elongated bowl with soft close seat, siphon jet, chrome plated trip lever (located on wide side of stall), bolt caps, 12" rough-in, ADA compliant, cotton finish.		TOTO MS614124CEFG/ MS614124CEFRG (Right or left-hand trip lever) TOTO SS124
	SUPPLY: 1/2" O.D. x 3/8" O.D. angle stop, wheel handle, wall flange, chrome plated.	Brasscraft OCR 1912	Kohler K-7663
L-1	LAVATORY – UNDERCOUNTER: 16-1/2" x 12-3/4" x 6" undercounter porcelain lavatory with overflow, white finish.		Lacava #5485
	FAUCET: Two level handle widespread faucet, 8" centers, 5-15/16" spout, 0.5 gpm, matte black with modern brass finish.		Kohler K-27416-4N-BMB

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	SUPPLY: 1/2" O.D. x 3/8" O.D. angle supply, loose key stop, wall flange, chrome plated.	Brasscraft SR1712A	Kohler K-7676
	DRAIN: 1-1/4", 17 ga. open grid strainer and tailpiece, provide 1-1/4", 17 ga. offset drain with open grid strainer at ADA locations, chrome plated.	Kohler K-7715 Kohler K-13885	McGuire 155 McGuire 155-WC
	TRAP: 1-1/4" x 1-1/2", 17 ga., adjustable trap with cleanout and wall flange, chrome finish.	McGuire 8902	Kohler K-8999
L-2	LAVATORY - WALL-HUNG W/ PEDESTAL: 19-1/2" x 17-1/2" x 7-1/2" wall-hung porcelain lavatory with overflow and freestanding porcelain pedestal, three faucet holes, 8" spread, white finish.		Lacava #4272 #4231
	FAUCET: Two level handle widespread faucet, 8" centers, 5-15/16" spout, 0.5 gpm, matte black finish.		Kohler K-27416-4N-BL
	SUPPLY: 1/2" O.D. x 3/8" O.D. angle supply, loose key stop, wall flange, chrome plated.	Brasscraft SR1712A	Kohler K-7676
	DRAIN: 1-1/4", 17 ga. Offset open grid strainer and tailpiece, provide 1-1/4", 17 ga., chrome plated.	Kohler K-13885	McGuire 155-WC
	TRAP: 1-1/4" x 1-1/2", 17 ga., adjustable trap with cleanout and wall flange, chrome finish.	McGuire 8902	Kohler K-8999
L-3	LAVATORY – UNDERCOUNTER: 16-1/2" x 12-3/4" x 6" undercounter porcelain lavatory with overflow, white finish.		Lacava 5485
	FAUCET: Two level handle faucet, 6" spout, 0.5 gpm flow rate, 8" centers, vibrant brushed moderne brass finish.		Kohler K-27009-N K-27010-4
	SUPPLY: 1/2" O.D. x 3/8" O.D. angle supply, loose key stop, wall flange, chrome plated.	Brasscraft SR1712A	Kohler K-7676

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	DRAIN: 1-1/4", 17 ga. open grid strainer and tailpiece, provide 1-1/4", 17 ga. offset drain with open grid strainer at ADA locations, chrome plated.	Kohler K-7715	McGuire 155
	TRAP: 1-1/4" x 1-1/2", 17 ga., adjustable trap with cleanout and wall flange, chrome finish.	Kohler K-13885	McGuire 155-WC
		McGuire 8902	Kohler K-8999
L-4	LAVATORY – WALL-HUNG: 21" x 18", wall hung lavatory, 8" centers, concealed arms, rear overflow, white.		American Standard 9024.008EC
	FAUCET: Two level handle widespread faucet, 8" centers, 5-15/16" spout, 0.5 gpm, matte black with modern brass finish.		Kohler K-27416-4N-BMB
	SUPPLY: 1/2" O.D. x 3/8" O.D. angle supply, loose key stop, wall flange, chrome plated.	Brasscraft SR1712A	Kohler K-7676
	DRAIN: 1-1/4", 17 ga. Offset open grid strainer and tailpiece, provide 1-1/4", chrome plated.	Kohler K-13885	McGuire 155-WC
	TRAP: 1-1/4" x 1-1/2", 17 ga., adjustable trap with cleanout and wall flange, chrome finish.	McGuire 8902	Kohler K-8999
	INSULATION KIT: Self-fastening, vinyl insulation covers for drain, traps and supply piping with accessible angle valve insulation cover, white. Provide at all ADA locations	McGuire PW2125WC	Handi Lav-Guard Model 102 and 105
	CARRIER: Adjustable floor support with concealed arms.		Smith 700 series
L-5	LAVATORY - WALL-HUNG W/ PEDESTAL: 19-1/2" x 17-1/2" x 7-1/2" wall-hung porcelain lavatory with overflow and freestanding porcelain pedestal, three faucet holes, 8" spread, white finish.		Lacava #4272 #4231
	FAUCET: Two level handle faucet, 6" spout, 0.5 gpm flow rate, 8" centers, vibrant brushed moderne brass finish.		Kohler K-27009-N K-27010-4

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	SUPPLY: 1/2" O.D. x 3/8" O.D. angle supply, loose key stop, wall flange, chrome plated.	Brasscraft SR1712A	Kohler K-7676
	DRAIN: 1-1/4", 17 ga. Offset open grid strainer and tailpiece, provide 1-1/4", 17 ga., chrome plated.	Kohler K-13885	McGuire 155-WC
	TRAP: 1-1/4" x 1-1/2", 17 ga., adjustable trap with cleanout and wall flange, chrome finish.	McGuire 8902	Kohler K-8999
UR-1	URINAL: Floor mounted, washout urinal, 0.5 gallon per flush, vitreous china, 3/4" rear spud, white.		Kohler K-4920-R
	FLUSH VALVE - CONCEALED: 0.5-gallon self-powered hydroelectric flush, sensor operated, concealed flush valve with 3/4" angle stop and 3/4" vacuum breaker, back spud coupling, manual flush override, 14" x 12" heavy duty stainless steel cover and finish.		TOTO TEU2LA11#SS
MS-1	MOP SINK: 24" x 24" x 12" high terrazzo or molded stone basin with recessed front lip, stainless steel tiling flange/caps on all curbs, 3" stainless steel combination dome strainer and lint basket, 36" long hose with stainless steel wall hook, stainless steel mop hanger.	Fiat TSB-3000 832-AA 889-CC	Stern Williams HL-1810 T-35 T-40
	FAUCET: Wall mounted service faucet, vacuum breaker, integral stops, adjustable wall brace, pail hook, chrome plated.	American Standard 7692.049/ 8344.112	Kohler K-8907
SH-1	SHOWER – PUBLIC – HANDICAPPED:		
	SHOWER ENCLOSURE: Refer to Architectural.		
	SHOWER VALVE: Pressure balanced with integral check stops, adjustable, temperature limit stops, face plate with lever handle, ADA compliant, vibrant brushed moderne brass finish.		Kohler K-2971-KS K-TS27043-4

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	SHOWER HEAD/HAND SHOWER ASSEMBLY: Arch shower column with shower head and hand shower head, 1.75 gpm max. flow at 80 psi, 60" metal flexible hose, 18" long adjustable slide bar, vacuum breaker, elbow-supply, vibrant brushed modern brass finish.		Kohler K-27118-G
	SHOWER DRAIN: 48" x 2-1/2" linear drain with perforated grate, 2-1/2" drain channel, vibrant brushed modern brass finish.		Kohler K-80660 K-80646
S-1	BREAKROOM SINK – SINGLE BOWL: 30-1/4" x 17-1/4" x 5-1/4", single bowl undermount sink, enameled cast iron, five-hole punch, ADA compliant.		Kohler K-8689-5U
	FAUCET: Touchless pull-down kitchen sink faucet with three function sprayhead, AC powered, single lever handle, 1.5 gpm flow rate, 3-hole installation, matte black finish.		Kohler K-22974-BL
	DRAIN: Stainless steel strainer drain with removable crumb cup, 3-1/2" O.D., 1-1/2" tailpiece.		Kohler K-8801
EWC-1	ELECTRICAL WATER COOLER W/ BOTTLE FILLING STATION – BI-LEVEL BOWLS: Heavy gauge stainless steel, wall mounted, barrier free fountain, bottle filling station with electronic sensor, bi-level oval bowls, front button activation, recessed refrigeration unit with matching wall louver, unit to provide 8 GPH of 50°F water with 90°F ambient and 80°F supply water temperature, polished stainless steel finish.		Elkay EZWS-ERPBM28K
	SUPPLY: 1/2" O.D. x 3/8" O.D., wheel handle stop.		McGuire ST07
	TRAP: 1-1/4" x 1-1/2", 17 ga. adjustable trap with cleanout, chrome finish.	Kohler K-8995	McGuire 8902

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All wall hung fixtures shall be supported on concealed chair carriers furnished complete with all necessary bolts, nuts, washers and gaskets unless noted otherwise. The adjustable nipple between the cast iron fitting and the closet bowl shall be threaded cast iron. Secure all floor pieces to floor slab.
- B. All exposed piping in connection with fixtures shall be chromium plated. Where supply and waste lines pass through walls, provide chromium plated escutcheons and firmly secure in place.
- C. Provide straight or angle supply valves on inlet supplies to all fixtures.
- D. Fixtures, trim and methods of piping and installation shall conform to local plumbing code. All fixture types shall be the product of one manufacturer. All fixtures shall be white unless otherwise noted.
- E. Bathtub waste and overflow fittings shall be provided with soldered metal connections or PVC solvent welded connections if required by code authorities to eliminate the requirement for access to the fitting.
- F. Fixtures shall be cleaned, adjusted and left in proper working order before the project is turned over to the Owner. Flush and clean all faucet aerators prior to turn over. Adjust all faucet lever handles to be parallel to adjacent rear wall in the off position.
- G. The Contractor shall furnish and install protective guards as required to protect fixtures against damage by normal operations of other trades. Bathtubs shall be provided with tub liners at all times during construction.
- H. Caulk all floor and counter top mounted fixtures and behind all wall-hung plumbing fixtures with white, non-shrinking, silicone caulking eliminating all voids and cracks.
- I. Coordinate the mounting height of all fixtures with the Architect prior to installation.
- J. The Contractor shall obtain exact information relative to finish grade of the top of the floor drains. All floor drains shall be set flush with finished floors.
- K. Cleanouts shall be provided where indicated on drawings and elsewhere as required by code.
- L. Where test tees are installed at the base of the stack or on the stack, they may be used as a cleanout.
- M. Provide the Owner with three (3) wrenches for removing flush cleanout plugs.

END OF SECTION 22 40 00