SECTION 22 05 15
PIPING SPECIALTIES
P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for plumbing piping specialties for all piping systems. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

PART 3 - EXECUTION
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B650 Electrodeposited Engineering Chromium Coatings on Ferrous Substrates

QUALITY ASSURANCE
Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

SHOP DRAWINGS

Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA

All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

P A R T 2 - P R O D U C T S

THERMOMETERS

Ashcroft, Marsh, Taylor, H. O. Trerice, Ametek/U. S. Gauge, Weiss, Wika, Weksler.

Stem Type: Cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Hot Water
Scale Range, ^{o}F	30 - 180
Increment, ^{o}F	2

THERMOMETER SOCKETS

Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

TEST WELLS

Similar to thermometer sockets except with a brass cap that threads into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

TEST PLUGS

Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

PRESSURE GAUGES

Ametek/U. S. Gauge, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Wika, Weksler.

Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4" size.

Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

STRAINERS

Armstrong, Illinois, Keckley, Metraflex, Mueller Steam, Sarco, Watts.

Y type; cast bronze body, ASTM B62; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; sweat, threaded or flanged body rated at not less than 150 psi WOG.

Y type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG.

P A R T 3 - E X E C U T I O N

THERMOMETERS

Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

THERMOMETER SOCKETS

Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

TEST WELLS

Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

TEST PLUGS

Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for short-term measurement of pressure or temperature.

PRESSURE GAUGES

Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

Pressure Snubbers: Install in gauge piping for all gauges used on water services.

Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

STRAINERS

Install all strainers where indicated allowing sufficient space for the screens to be removed. Install a ball valve in the tapped screen retainer.

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

SCOPE

This section includes valve specifications for all Plumbing systems except where indicated under Related Work. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Lead Free Requirements
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Water System Valves
  - Ball Valves
  - Butterfly Valves
  - Swing Check Valves
  - Spring Loaded Check Valves
  - Balance Valves
  - Drain Valves
  - Buried Water Service Valves
  - Corporation Stop Valves
  - Curb Stop Valves
- Pure Water Valves
  - Diaphragm Valves
  - Check Valves
- Waste System Valves
  - Gate Valves
  - Ball Valves
  - Swing Check Valves
  - Spring Loaded Check Valves
- Natural Gas Systems
  - Shut-off Valves
  - Exterior Below Grade Shutoff Valves
  - Gas Pressure Regulators

PART 3 - EXECUTION
- General
- Shut-off Valves
- Balancing Valves
- Drain Valves
- Spring Loaded Check Valves
- Swing Check Valves
- Pressure Reducing Valves
- Safety Relief Valves
- Gas Pressure Regulators

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 22 05 00 Common Work Results for Plumbing
Section 22 05 14 - Plumbing Specialties
Section 22 30 00 - Plumbing Equipment

REFERENCE
Applicable provisions of Division 1 govern work under this section.

LEAD FREE REQUIREMENTS
All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Federal Safe Drinking Water Act as amended January 4th 2011 Section1417.

QUALITY ASSURANCE
Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

SUBMITTALS
Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

Valves to be line size unless specifically noted otherwise.

PART 2 - PRODUCTS

WATER SYSTEM VALVES
All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.

BALL VALVES:
3" and smaller: Two piece bronze body; sweat, threaded or ASTM F1960 joint connection ends, full port stainless steel ball and stem; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Nibco 585-70-66 LF or equal by Apollo, Milwaukee, Watts.

BUTTERFLY VALVES:
2-1/2" and larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using the valve for system shutoff. Nibco LD-2022 or GD-4765, or equal by Milwaukee, Victaulic or Watts.

Provide 10 position locking lever handle actuators for valves 6" and smaller. Provide worm gear operators with external position indication for valves 8" and larger.

SWING CHECK VALVES:
3" and smaller: Bronze body, sweat or threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Hammond UP904, Milwaukee UP509, Nibco S413-Y-LF, Watts LFCV, Apollo equal.

4" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Hammond IR 1124, Milwaukee F2974, Nibco F918B, Watts Series 411, Apollo equal.

SPRING LOADED CHECK VALVES:
2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Nibco S480-Y-LF, Watts LF600 or equal.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. Hammond IR9253 or IR9354, Milwaukee 1400 or 1800 series, Nibco W910-LF or F910-LF.

BALANCE VALVES:
2" and smaller: Brass body, 304 stainless steel ball, sweat or threaded ends, glass filled teflon seat, brass readout valves with EPT checks, with adjustable memory stop position indicator and extended handle stem, suitable for 300 psig water working pressure at 200 degrees F. B&G Xylem Circuit Setter Plus CB1SLF/CB-1LF, or equal by Nibco or Watts.

DRAIN VALVES:
3/4 inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Apollo 70LF-200-HC, Milwaukee BA-100H or BA-150H Hammond 8501H or 8511H or equal by Nibco, or Watts.

BURIED WATER SERVICE GATE VALVES:
Cast iron body, resilient elastomer coated cast iron disc, permanently lubricated stuffing box, bronze non-rising stem and stem nut, double O-ring stem seal, Delrin thrust bearings, electroplated nuts and bolts, cast iron operating nut, AWWA C509, rated for 200 psi. Coat valve inside and out with fusion bonded epoxy, AWWA C550. Clow F-6100, Kennedy 1571, Mueller A-2360, Waterous 500, Watts 406RW.

UNDERGROUND WATER SERVICE BUTTERFLY VALVES:
Rubber-seated butterfly valve meeting the requirements of AWWA C504, for Class 150B. Body and disc shall be constructed of cast iron. Disc shall be lens shaped.
Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Disc shall be provided with a stainless steel disc edge.

Valve stem shall be stainless steel. Packing shall be permanent duty “chevron V-type” or “O-ring” type. Bearings shall be permanent, non-metallic, and self-lubricating.

Valve seat shall be a single piece of elastomeric material that is not penetrated by the valve shaft.

Provide manual operator that is suitable for underground service and includes a standard 2” square operating nut.

Valve shall be provided with mechanical joint connections.

Mueller, Clow, Henry Pratt, or approved equal.

CORPORATION STOP VALVES:
2" and smaller: Bronze body ground key valve, bronze plug, AWWA taper thread inlet and copper flare outlet nut connections or compression type, AWWA C800.

CURB STOP VALVES:
2" and smaller: Bronze body plug valve, bronze plug, quarter turn check, O-ring seals, copper flare nut connections or compression type, AWWA C800.

VALVE BOXES
GATE/BUTTERFLY VALVE BOXES:

Valve boxes shall be 5 1/4", cast iron valve boxes. Boxes shall be threaded, three-piece design with stay-put "WATER" cover. Provide appropriately sized bonnet.

Provide valve box extensions as necessary to accommodate depth of cover shown on plans, or 6.5' minimum.

Valve boxes shall be Tyler, or approved equal.

CURB STOP BOXES:
Curb stop boxes shall be 1 1/4" minimum diameter, cast iron, arch style, valve boxes. Boxes shall be telescopic, extendable to accommodate 7' bury. Lid shall be two piece threaded, with a plug having a pentagonal bolt for removal.

Ford, Mueller, or approved equal.

SWIMMING POOL AND FISH HATCHERY/AQUARIUM WATER VALVES
BALL VALVES:
6" and smaller, three piece body, full port design, for use with PVC or CPVC piping, PVC or CPVC thermoplastic construction with self-lubricating teflon seats and EDPM or FPM O-ring seals, rated 150 psi at 73 deg. F, with external adjustment for seat wear, dual (true) union, with flow direction arrow molded in operating handle, threaded or socket ends. Nibco Tru-Bloc/Tru Union or equal.

CHECK VALVES:
4" and smaller, three piece body, ball check type, for use with PVC or CPVC piping, PVC or CPVC thermoplastic construction, with EDPM or FPM O-rings, rated 150 psi at 73 deg F, with dual (true) union ends, threaded or socket ends. Nibco/Chemtrol True Union Ball Check or equal.

PURE WATER VALVES
DIAPHRAGM VALVES:
2" smaller, polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, butt fusion or spigot ends, rated 150 psi at 68 deg. F, PTFE/Teflon diaphragm seals with EDPM backing, wheel handle operated. George Fischer type 315 or equal.

2-1/2" thru 4", polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, flanged connections, rated at 150 psi at 68 deg. F, PTFE/Teflon diaphragm seals with EDPM backing, wheel handle operated. George Fischer type 317 or equal.

CHECK VALVES:

2" and smaller, three piece body, ball check type, polypropylene type 1 homopolymer construction ASTM D-4101 and D-2146, fusion socket, rated 150 psi at 68 deg. F. George Fischer type 360 or equal.

Polypropylene valves, unions, flanges, fittings to be constructed of same materials as pipe and fittings and compatible with the piping installed in the system.

WASTE SYSTEM VALVES
GATE VALVES:

2-1/2" and larger: Iron body, bronze trim, bolted bonnet, O.S. & Y., solid wedge, flanged, suitable for 200 psi WOG. Crane 465-1/2, Hammond IR1140, Lunkenheimer 1430, Milwaukee F2885, Nibco F617-O, Powell 1793, Stockham G623.

BALL VALVES:
3" and smaller: Two piece bronze body; sweat or threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG. Apollo 70-200, Milwaukee BA150, Nibco S585-70, Watts B-6001.

SWING CHECK VALVES:
1-1/2" and smaller: Bronze body, threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Hammond IB941, Nibco S413B, Watts CVYS.

2" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, outside lever and weight or spring, suitable for installation in a horizontal or vertical line with flow upward. Crane 383, Milwaukee F2974, Nibco F918B.

SPRING LOADED CHECK VALVES:
2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. APCO 300 or 600 series, Centerline CLC with full body option, Hammond IR9354, Milwaukee 1800 series, Mueller Steam 101AP or 105AP, Nibco W910 or F910, Val-Matic 1400 or 1800 or 8000 series.

NATURAL GAS SYSTEMS
SHUT-OFF VALVES:
4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L listed for use as natural gas shut-off. Apollo 80-100, DeZurik 425, Milwaukee, Nibco and Watts equals.

5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

EXTERIOR BELOW GRADE SHUT-OFF VALVES:
Plug or ball valve, body of same polyethylene type as piping system, pipe stub ends, high strength plastic stem and operating nut, position indicator, polyethylene plug or polypropylene ball, Buna-N seats and double stem seals, rated for 96 psi natural gas service (150 psi non-lethal service).

GAS PRESSURE REGULATORS:

2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20 degrees F to 150 degrees F.

COMPRESSED AIR SYSTEMS

SHUT-OFF VALVES:

3" and smaller: Two piece bronze body; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Apollo 70-100, Milwaukee BA100, Nibco T585-70 or T-590-Y, Watts B-6000.

SAFETY EXHAUST SHUT-OFF VALVES:

3" and smaller: Two or three piece bronze body; threaded ends, chrome plated bronze ball; downstream vent port; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 175 psig WOG. Apollo 70-100-41, Watts B-6000, Milwaukee or Nibco equals.

PRESSURE REDUCING VALVES:

Bronze or aluminum body and trim, diaphragm or balanced piston, 250 psig maximum, 0-125 psig adjustable output, internal relief, 1/4" outlet gauge tapping.

SPECIALTY VALVES AND VALVE ACCESSORIES

GAUGE VALVES:

Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

WATER PRESSURE REDUCING VALVES:

Bronze body, diaphragm operated, with an integral thermal expansion bypass valve, inlet union, stainless steel strainer, renewable monel or stainless steel seat and adjustable reduced pressure range, 300 psig at 160 degrees F. Pre-set for the scheduled pressure. A. W. Cash, Conbraco, Watts, Wilkins.

SAFETY RELIEF VALVES:

Bronze body, temperature and pressure actuated, stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Bell & Gossett, A. W. Cash, Conbraco, Watts, Wilkins. Temperature and pressure relief valve shall be sized per AGA rating for BTUH input, Re: SPS 382.40(5)(d).

SEWER AIR AND VACUUM VALVES:

Combination air release/air and vacuum valve consisting of cast iron elongated body; __" threaded inlet and __" outlet; stainless steel valve, trim and float; Hycar or Buna-N rubber seat; inlet, backflushing and blowoff valves; 5' backflushing hose with quick disconnect fittings; 150 psig. Apco Series 440 SCAV, Crispin S20A/S20 Series, Val-Matic 800 Series.

PART 3 - EXECUTION

GENERAL

Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Mount valves in locations which allow access for operation, servicing and replacement.

Provide valve handle extensions for all valves installed in insulated piping.

Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

Prior to flushing of piping systems, place all valves in the full-open position.

SHUT-OFF VALVES
Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

BALANCING VALVES
Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.
Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

DRAIN VALVES
Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

SPRING LOADED CHECK VALVES
Install a spring loaded check valve in each circulating pump discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

SWING CHECK VALVES
Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

PRESSURE REDUCING VALVES
Provide ball valve and strainer at inlet and ball valve at outlet. Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve.

SAFETY RELIEF VALVES
Install relief valves on all pressure vessels and elsewhere as indicated. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Pipe discharge to drain where indicated or to floor.

GAS PRESSURE REGULATORS
When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

COMPRESSED AIR VALVES
Install shut-off valves at each piece of equipment, base of drip legs and elsewhere as indicated. Install safety exhaust shut-off valves at terminal equipment designed for frequent removal. Install pressure reducing valves at filter stations and elsewhere as indicated. Mount in readily accessible location for gauge and maintenance access.

SEWER AIR AND VACUUM VALVES
Install sewer air and vacuum valves at high points of forcemains, at grade changes, every 1/2 mile on lines with little gradient and elsewhere as indicated. Locate in valve manhole with watertight cover, sealed to top of main and of sufficient depth to prevent freezing. Mount valves allowing access in manhole for backflushing and servicing.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors. Included are the following topics:

QUALITY ASSURANCE
Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

DESCRIPTION
Provide all supporting devices as required for the installation of mechanical equipment and materials. All support and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points; see Related Work above.

SHOP DRAWINGS
Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

All submittals are to comply with submission and content requirements specified with in section [17 00 00].

DESIGN CRITERIA
Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

P A R T 2 - P R O D U C T S

MANUFACTURERS
Anvil, B-Line, Pate, G-Strut, Piping Technology, Roof Products & Systems or approved equal.

STRUCTURAL SUPPORTS
Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

PIPE HANGERS AND SUPPORTS
HANGERS FOR PIPE SIZES 1/2" THROUGH 2":
Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

HANGERS FOR PIPE SIZES 2" AND LARGER:
Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

MULTIPLE OR TRAPEZE HANGERS:
Steel channels with welded spacers and hanger rods.

WALL SUPPORT:
Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

VERTICAL SUPPORT:
Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

FLOOR SUPPORT:
Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

COPPER PIPE SUPPORTS:
All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

PIPE HANGER RODS
STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

BEAM CLAMPS
MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

DRILLED FASTENERS:
Carbon steel drop-in type expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

ANCHORS
Use welding steel shapes, plates, and bars to secure piping to the structure.

EQUIPMENT STANDS
Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

SUPPORTS 30" OR MORE IN HEIGHT:
Use structural steel members supported by pipe supports and use pipe rollers fastened to the structural member. Pipe supports to be secured to the roof structure. Treat with corrosive atmosphere coatings.

CORROSIVE ATMOSPHERE COATINGS
Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanized threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

Corrosive atmospheres include the following locations:

- Exterior locations
- Food service/kitchen areas
- Walk-in coolers/freezers

P A R T 3 - E X E C U T I O N

INSTALLATION
Size, apply and install supports and anchors in compliance with manufacturers recommendations.

Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Trim steel hanger rods to within one inch of the final lock nut position. Hanger and support cutoff burrs shall be removed and sharp edges ground smooth.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

Perform welding in accordance with standards of the American Welding Society.

HANGER AND SUPPORT SPACING
Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Use hangers with 1-1/2 inch minimum vertical adjustment.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of these specifications.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Glass	Per Pipe Mfr.	8'-0"	12'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Steel	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
Plastic	Pure Water 1-1/2" or less	Continuous	5'-0"

RISER CLAMPS

Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

ANCHORS

Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

SECTION 22 05 14
PLUMBING SPECIALTIES

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Floor Drains
- Floor Sinks
- Hub Drains
- Roof Drains
- Trench Drains
- Cleanouts
- Backwater Valves
- Subsoil Drain Tile Receivers
- Water Hammer Arrestors
- Backflow Preventers
- Wall Hydrants
- Yard Hydrants
- Hose Bibbs
- Trap Primer Valves
- Fire Hydrants
- Valve Boxes
- Manholes and Catch Basins
- Safings
- Vent Flashings
- Washing Machine Wall Boxes
- Interior Grease Interceptors

PART 3 - EXECUTION
- Installation
- Construction Verification Items
- Agency Training

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS
ANSI A112.14.1 - Backwater Valves
ANSI A112.21.1 - Floor Drains.
ANSI A112.21.2 - Roof Drains.
ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
ASSE 1010 - Water Hammer Arrestors.
ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
ASSE 1018 - Trap Seal Primer Valves.

QUALITY ASSURANCE

SHOP DRAWINGS
Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

FLOOR DRAINS
To be furnished and installed by Plumbing Contractor -- See Ktichen Consultant Design

Trap Guards - provide submittals

SINKS – see Ktichen Design Consultant Plans – Kitchen Equipment Consultant to furnish/ plumbing connections by Plumbing contractor

CLEANOUTS
Manufacturer: Josam, Smith, Wade, Watts, Zurn.

INTERIOR CONCRETE FLOOR AREAS: Enameled cast iron body with round or square adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.

INTERIOR FINISHED WALL AREAS: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446- (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)

INTERIOR EXPOSED VERTICAL STACKS: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

INTERIOR HORIZONTAL LINES: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

EXTERIOR PAVED AREAS: Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top or surrounding pavement, crowned for drainage. Neenah R-1976 with non-ferrous securing screw.

EXTERIOR UNPAVED AREAS: Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron or PVC frost sleeve and cover set in 24” square by 4” min. thick reinforced concrete pad top. Neenah R-1976 with non-ferrous securing screw.

BACKWATER VALVES
Manufacturers:, Josam 67500, Smith 7012, Watts BV-200, Zurn Z1090.

Hub and spigot or No-Hub inlet and outlet cast iron body, cast iron gasketed bolted access cover, bronze valve. Flapper to hang in closed position during non-operation period.

WATER HAMMER ARRESTORS
Manufacturer: PPP Industries, Sioux Chief, Wade, Watts.

ANSI A112.26.1, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure, 1500 psig surge pressure. Watts series 15.

BACKFLOW PREVENTERS
Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, Wilkins.

HOSE CONNECTION VACUUM BREAKERS: ASSE 1011, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180ºF. Watts 8 (interior application).

LAB FAUCET VACUUM BREAKERS: ASSE 1035, brass or bronze construction, chrome plated, EPDM diaphragm and seat, stainless steel internals, rated for 125 psig and 160ºF. Watts NLF9.

PIPE APPLIED ATMOSPHERIC TYPE VACUUM BREAKERS: ASSE 1001, same size as pipe, brass or bronze construction, silicone disc, rated for 125 psig and 160ºF. Watts 288A.

ANTI-SIPHON PRESSURE TYPE VACUUM BREAKERS: ASSE 1020, same size as pipe, brass or bronze construction, silicone disc, plastic seat, stainless steel spring, inlet and outlet ball shutoff valves, test port ball valves, rated for 150 psig and 110ºF. Watts 800M4QT

HIGH HAZARD ANTI-SIPHON, ANTI-SPILL VACUUM BREAKERS: ASSE 1056, same size as pipe, brass or bronze construction, silicone rubber discs, stainless steel springs, inlet and outlet ball shutoff valves, with test cocks, anti-spill design, rated for 150 psig and 180 deg. F max.. Watts 008QT.

DUAL CHECK WITH ATMOSPHERIC VENT FOR CO_2 POST MIX VENDING MACHINES: 3/8", stainless steel body and parts, dual check with third ball check outlet, rated for 150 psig and 140ºF. Watts 9BD.

INTERMEDIATE ATMOSPHERIC VENTED BACKFLOW PREVENTERS: ASSE 1012, same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210ºF. Watts 9DM.

REDUCED PRESSURE ZONE BACKFLOW PREVENTERS: ASSE 1013 _" reduced pressure zone backflow assembly complete with inlet strainer, inlet and outlet ball or non-rising stem gate isolation valves. Size for maximum pressure drop of __ psig at __ GPM. Constructed of bronze or epoxy coated cast iron body with bronze and plastic internal parts, stainless steel springs, non-threaded vent outlet, 4 test cocks, rated for 175 psig and 210ºF, with air gap apparatus on drain. Watts series 919-S-QT-AG, Wilkins #975 or approved equal.

TRAP PRIMER VALVES
Manufacturers: Ancon, PPP Industries, Smith, Watts.

Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018. PPP model P-1/P-2.

Do not use trap primer valves unless absolutely necessary, use trap guard diaphragms if possible

VALVE BOXES
Manufacturer: C.P. Test Service, Mueller, Tyler.

Two-piece cast iron adjustable height casing with cast iron frame, cast iron cover and bottom bearing flange. Size for full burial depth of valve. 2" minimum internal diameter for valves sizes through 2", 4" minimum internal diameter for valve sizes 2-1/2" through 3" and 5-1/4" minimum diameter for 4" and larger valves. Cast name of service on cover top. On plastic pipelines, provide cast iron foot piece matched to valve box bottom or concrete bearing pad for support of valve.

MANHOLES AND CATCH BASINS
Precast reinforced concrete manhole sections, 48" diameter minimum manholes, 36" diameter minimum catch basins, ASTM C478. Construct base of 6" thick precast reinforced concrete or 8" thick cast in place concrete. Construct top of precast reinforced concrete eccentric cone and adjusting rings or 6" thick reinforced concrete slab with concentric opening.

Seal between sections with rubber ring gaskets, ASTM C443, or plastic preformed gasket material. Seal pipe penetrations with flexible watertight rubber gasketed seals.

Steps to be constructed of cast iron or polypropylene coated steel reinforcing rod.

Frame and cover or grate to be cast iron, ASTM A48, Class 35B, of style indicated, with minimum 24" diameter manhole opening, 20" diameter catch basin opening and pickhole. Provide gasketed self-sealing covers on sanitary manholes.

SAFINGS
Manufacturers: Noble, Oatey.

Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

VENT FLASHINGS
Manufacturers: Semco, Oatey.

Formed 3 lb./sq. ft. lead flashing with minimum base size of 15"x17".

Single Ply Membrane Roofs: Flashing boot of material compatible with roofing membrane with base flange for adhering to membrane and stainless steel drawband for securing to vent pipe.

P A R T 3 - E X E C U T I O N

INSTALLATION
Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have installations of combination trap evaporation/backflow preventer diaphragm installations.

Set backwater valves on undisturbed soil or compacted granular backfill, level and plumb with top adjusted to finished floor elevation. Test and adjust valve for proper operation. Allow minimum 18" clearance for servicing.

Install subsoil drain tile receivers where indicated. Adjust receiver height to drain tile inlet and outlet elevations and cleanout to finished floor elevation. Secure subsoil drain tile with mechanical or solvent weld connections. Backfill with granular material.

Install water hammer arrestors where indicated and at quick closing valve installations.

Install backflow preventers in accordance with applicable building code requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

Set valve boxes level and plumb centered over valve. Set bottom flange on undisturbed soil or compacted granular backfill. Where plastic piping is used, provide cast iron or concrete bearing pad below valve. Adjust top section to finished grade level.

Excavate for manholes and catch basins setting precast bases on granular backfill and pouring cast in place bases on undisturbed soil. Seal joints between base, sections, collars and castings with gasketing material for tightly packed waterproof seals. Adjust casting to match finished grade. Form interior shelves with concrete grout for smooth flowlines conforming to the shape and slope of the sewer. Place piping into manholes providing full support of piping on exterior bedding and insuring pipe seals are properly installed and waterproof. Valve manholes and other manholes intended to remain dry must be made waterproof and are subject to infiltration testing. Where an entering sewer is 2 feet or more above the springline of a leaving sewer, provide outside drop connection encased in concrete. Where existing pipe penetrations are being removed or capped, fill opening with non-shrink Portland cement grout plug. Backfill and compact soil around manhole or catch basin.

Install safing at floor drains above grade. Extend 12" beyond drains in all directions. Cover entire floor in showers and extend 6" up in walls above curbs and to a height of 6' (3" wide each direction) in corners. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test. Install safing at all built-up shower installations. (Note: spray-on and brush applied liquid safing is not acceptable).

Flash vent penetrations through roof. Turn down top of lead flashing into vent pipe. Tighten drawband of membrane boot to vent pipe. Adhere base flashing to deck or membrane. Provide waterproof patch around penetration on existing roofs.

Provide water hammer arrestors in supply piping. Mount box a min. of 36” above floor.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

SCOPE

This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Materials
- Insulation & Jackets
- Accessories

PART 3 - EXECUTION
- Installation
- Piping, Valve and Fitting Insulation
- Equipment Insulation
- Construction Verification Items

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C240	Cellular Glass Insulation Block
ASTM C302	Density of Preformed Pipe Insulation
ASTM C303	Density of Preformed Block Insulation
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
ASTM C591	Preformed Rigid Cellular Polyurethane Thermal Insulation
ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
ASTM C612	Mineral Fiber Block and Board Thermal Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM E84	Surface Burning Characteristics of Building Materials
MICA	National Commercial & Industrial Insulation Standards

NFPA 225 Surface Burning Characteristics of Building Materials
UL 723 Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE
Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

DESCRIPTION
Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- Pipe Insulation
- Equipment Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the DFD Project Representative.

DEFINITIONS
Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

SHOP DRAWINGS
Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

MATERIALS
Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

> Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

INSULATION AND JACKETS
Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

SEMI-RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

CALCIUM SILICATE INSULATION:
Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F. Material to be visually coded or marked to indicate it is asbestos free.

ELASTOMERIC INSULATION:
Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

POLYOLEFIN INSULATION:
Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.
This paragraph describes Imcoa insulation which is suitable for interior/exterior use or direct burial.

PHENOLIC INSULATION:
Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor transmission 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.

Kraft reinforced foil vapor barrier laminate all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.
This paragraph describes Childers Koolphen K insulation which has the highest insulating value per inch of specified insulations.

EXTRUDED POLYSTYRENE INSULATION:
Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.2 at 75 degrees F, minimum compressive strength of 35 psi, maximum water vapor transmission of 1.1 perm inch, maximum water absorption of .1% by volume, rated for service range of -290 degrees F to 165 degrees

URETHANE INSULATION:
Rigid closed cell polyisocyanurate, minimum nominal density of 1.8 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 19 psi parallel and 10 psi perpendicular, maximum water vapor transmission of 4 perm inch, maximum water absorption of .2% by volume, rated for service range of -290 degrees F to 300 degrees F.

CELLULAR GLASS INSULATION:
Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 100 psi, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

FIREPROOFING INSULATION:
Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 15, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F.

Jacket material shall be the same as jacket for adjacent insulation.

PVC FITTING COVERS AND JACKETS:
White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

METAL JACKETS:
.016 inch thick aluminum or .010 inch thick stainless steel with safety edge.

INSULATION INSERTS AND PIPE SHIELDS
Manufacturers: B-Line, Pipe Shields, Value Engineered Products

Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

Wood blocks will not be accepted.

ACCESSORIES
All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

Bedding compounds to be non-shrinking and permanently flexible.

Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

INSTALLATION
Install insulation, jackets and accessories in accordance with manufacturers instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

Provide a complete vapor barrier for insulation on the following systems:

- Cold water (potable and non-potable)
- Equipment piping with a surface temperature below 65 degrees F

PIPING, VALVE, AND FITTING INSULATION

GENERAL:

Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.

Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

INSULATION INSERTS AND PIPE SHIELDS:

Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES:

Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

ELASTOMERIC AND POLYOLEFIN:

Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

Protective jackets to be used for pipe insulation exposed in food handling/kitchen areas, wet areas, exterior installations or where insulation is subject to physical abuse. Jackets also need to be specified for insulations other than elastomeric and polyolefin where not factory installed. PVC fitting covers and PVC jacketing must be specified with mastic and glass fiber covering where painted finish is required.

PROTECTIVE JACKETS:

Provide a protective PVC jacket for insulated piping

Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.

PIPE INSULATION SCHEDULE:
Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation Types**	**Insulation Thickness by Pipe Size**				
		1" and smaller	**1-1/4" to 2"**	**2-1/2" to 4"**	**5" to 6"**	**8" and larger**
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"	1.5"	1.5"
Hot Water Circulating	Rigid Fiberglass	1”	1”	1.5”		
Cold Water	Rigid Fiberglass	0.5”	0.5”	1”	1”	1”
Tempered Water	Rigid Fiberglass	0.5"	0.5"	1"		
Non-Potable Cold Water	Rigid Fiberglass *	0.5”	0.5”	1"		
Non-Potable Hot Water	Rigid Fiberglass *	1”	1”	1.5"		

* = Elastomeric & Phenolic types are acceptable

The following piping and fittings are not to be insulated:

- Chrome plated exposed supplies and stops (except where specifically noted).
- Water hammer arrestors.
- Piping unions and flanges for systems not requiring a vapor barrier.

EQUIPMENT INSULATION
Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

SEMI-RIGID FIBERGLASS:
Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic. . Use vapor barrier mastic on systems requiring a vapor barrier.

ELASTOMERIC/POLYOLEFIN:
Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

EQUIPMENT INSULATION SCHEDULE:
Provide equipment insulation as follows:

Equipment	**Insulation Type**	**Thickness**	**Remarks**
Water Filters	Elastomeric	1/2”	Sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required
R.P.B.P.	Elastomeric	½”	Sheet type, pipe size type or combination of both. Fabricated for ease of removal and replacement when testing and servicing is required

END OF SECTION

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

P A R T 1 - G E N E R A L

SCOPE
This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Domestic Water
- Dielectric Unions and Flanges
- Unions and Flanges
- Mechanical Grooved Pipe Connections

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Copper Pipe Joints
- Welded Pipe Joints
- Threaded Pipe Joints
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Domestic Water
- Flushing and Disinfection of Potable Water Systems
- Underground Pipe Wrap
- Dielectric Unions and Flanges
- Unions and Flanges
- Piping System Leak Tests
- Construction Verification Items

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
ANSI A21.4
ANSI A21.11
ANSI A21.51
ANSI B16.3 Malleable Iron Threaded Fittings

ANSI B16.4	Cast Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM B32	Solder Metal
ASTM B88	Seamless Copper Water Tube
ASTM B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2513	Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
ASTM D4101	Propylene Plastic Injection and Extrusion Materials
ASTM F437	Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F441	Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
ASTM F493	Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
ASTM F656	Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM F876	Standard Specification for Crosslinked Polyethylene (PEX) Tubing
ASTM F877	Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F1960	Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings
AWWA C904	Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2-inch Through 3-inch, for Water Service
AWS A5.8	Brazing Filler Metal
AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water
AWWA C110	Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
AWWA C151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
AWWA C153	Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances
AWWA C651	Disinfecting Water Mains
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

SHOP DRAWINGS
Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to Owner.

DELIVERY, STORAGE, AND HANDLING
Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA
Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, and AWWA specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings unless approved for this use.

Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A Type E or S, or grade B Type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS
Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of

ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing.

P A R T 2 - P R O D U C T S

DOMESTIC WATER

ABOVE GROUND:

Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.

Stainless Steel pipe, all sizes: ASTM A312, Type 304, Schedule 10 or 40 pipe, dimensions conforming to ANSI/ASME B36.19M with threaded, welded or grooved joints. Systems used for potable water to include ANSI/NSF 61 lead free certification. Fittings: ASTM A276 and A312 outlets and austenitic stainless steel plain, threaded or grooved ends, Type 304 or 316. Grooved couplings may be standard painted ductile iron, with EPDM gaskets. 1 1/2” and larger: ASTM A312, Type 304/304L Schedule 10 stainless steel pipe, welded or roll grooved connections. Galvanic corrosion protection required when connecting to copper systems in accordance with manufacturer recommendation. Schedule 10 pipe threaded joints and cut grooved joints are not permitted. Schedule 5 pipe and mechanical press-fit joints are not permitted.

BELOW GROUND 2-1/2" AND SMALLER:

Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

BELOW GROUND 3" AND LARGER:

Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron. ***Where corrosive soil conditions exist, PVC should be specified exclusively. These include highly alkaline soils, high salt (deicing) concentrations, cinder fills, waste dumps, peat bogs and swamps.***

UNDERGROUND TO INTERIOR BUILDING ENTRANCE PIPING 3” AND LARGER:

Ductile iron as specified above with factory threaded and machined flanges.

DIELECTRIC UNIONS AND FLANGES
Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

UNIONS AND FLANGES
Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

2" AND SMALLER STEEL:
ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use galvanized malleable iron on galvanized steel piping. Use stainless steel unions for stainless steel piping.

2" AND SMALLER COPPER:
ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2-1/2" AND LARGER STEEL:
ASTM A181 or A105, threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.

2-1/2" AND LARGER COPPER:
ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

MECHANICAL GROOVED PIPE CONNECTIONS
Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruvlok or Grinnell may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.

Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.

Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

P A R T 3 - E X E C U T I O N

GENERAL
Install pipe and fittings in accordance with reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION
Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION
Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Where copper, steel, or plastic piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment This requirement is based on NFPA 70, 384-4 and 450-47.

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS
Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning

operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

WELDED PIPE JOINTS
Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

THREADED PIPE JOINTS
Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS
Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the **DFD** Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS
Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

MECHANICAL JOINT PIPE CONNECTIONS
Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

PUSH-ON GASKETED PIPE CONNECTIONS
Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into

gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

MECHANICAL GROOVED PIPE CONNECTIONS
Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

MECHANICALLY FORMED TEE FITTINGS
Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

DOMESTIC WATER
Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

Install exterior water piping below predicted frost level in accordance with COMM Table 82.30-6, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

FLUSHING AND DISINFECTION OF POTABLE WATER SYSTEMS
Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 10 parts per million of chlorine and allow to stand for 24 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

Piping that is pressure tested shall be drained completely dry. The piping system is not to be left full of

stagnant water. The piping system, water heaters and water softeners shall not be filled until within 10 days of occupancy to guard against microbial growth.

UNDERGROUND PIPE WRAP
Use for steel piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

DIELECTRIC UNIONS AND FLANGES
Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

UNIONS AND FLANGES
Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS
Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

All pressure tests are to be documented by the contractor. Plumbing must pass pressure tests per City of Allen standards and be inspected by City for such.

	Test	Initial Test		Final Test	
System	Medium	Pressure	Duration	Pressure	Duration
*Below Ground Domestic Water	Water	N/A		200 psig	2 hr
Above Ground Domestic Water	Water	N/A		100 psig	8 hr

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **JKYog Project No:** _____

Contractor: _____

□ Plumbing □ Fire Sprinkler

Test Medium: □ Air □ Water □ Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ Initial Pressure: _____ PSIG

Stop Test Time: _____ Final Pressure: _____ PSIG

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

_____

_____

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

P A R T 1 - G E N E R A L

SCOPE
This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Sanitary Waste and Vent
- Acid Waste and Vent

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Copper Pipe Joints
- Threaded Pipe Joints
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Sanitary Waste and Vent
- Piping System Leak Tests
- Construction Verification Items

RELATED WORK
Section 01 91 01 or 01 91 02 – Commissioning Process
Section 22 08 00 – Commissioning of Plumbing
22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
22 05 14 - Plumbing Specialties

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
ANSI A21.4
ANSI A21.11
ANSI A21.51
ANSI B16.3 Malleable Iron Threaded Fittings
ANSI B16.4 Cast Iron Threaded Fittings
ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A861	High Silicon Iron Pipe and Fittings
ASTM A888	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B32	Solder Metal
ASTM B306	Copper Drainage Tube (DWV)
ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
ASTM C564	Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C1540	Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D2774	Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
ASTM F2618	CPVC Pipe and Fittings for Chemical Waste Drainage Systems
AWS A5.8	Brazing Filler Metal
CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE, AND HANDLING
Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA
Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Piping that is not in accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50 shall not be utilized in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS
Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

P A R T 2 - P R O D U C T S

SANITARY WASTE AND VENT
INTERIOR ABOVE GROUND:
Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the Engineer. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

PVC plastic pipe, Schedule 40, Class 12454 (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Above ground PVC should not be used where smoke generation, noise transmission or physical abuse/durability are an issue.

CPVC plastic pipe, Schedule 40, ASTM D1784, Class 23447 Type IV, with drainage pattern fittings per ASTM D3311, Solvent cement joints utilizing one step primerless cement as approved by the manufacturer. All fittings and pipe shall be tested and listed in accordance with CAN/ULC S102.2 and tested in general accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50. CPVC pipe and fittings shall be of Charlotte Chem Drain or Spears Lab Waste manufacturers, or equal.

CPVC material should be used for plenum areas, greasy waste systems, and areas where high temperature (up to 220 degrees F) discharge are possible.

PRESSURIZED INTERIOR ABOVE GROUND:
PVC Plastic pipe, Schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

INTERIOR BELOW GROUND:
Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301, and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454 (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

CPVC material should be copied and pasted from the above ground material section above for areas with high temperature discharge and greasy waste systems. Cast iron piping for underground systems should be avoided. Plastic material is preferred.

EXTERIOR BELOW GROUND 10" AND SMALLER:
Non-reinforced concrete sewer, storm drain and culvert pipe, Class III, ASTM C14; rubber gasket joints, ASTM C443; bell and spigot ends with opposing shoulder or confined O-ring seal configuration, ASTM C302.

EXTERIOR BELOW GROUND 15" AND SMALLER:
Cast iron soil pipe and fittings, CISPI 301, ASTM A74 or ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PVC plastic pipe, Schedule 40, Class 12454 (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Type PSM PVC sewer pipe and socket fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

Corrugated PVC pipe and fittings with smooth interior, ASTM F949; gasketed joint, ASTM D3212; elastomeric gasket, ASTM F477.

PRESSURIZED BELOW GROUND 3" AND SMALLER:
PVC Plastic pipe, schedule 40, Class 12454, where temperature will not exceed 130 degrees F, ASTM D1784, ASTM D1785, with solvent cement joint fittings, pressure rated, ASTM D2466, medium or long sweep radius fittings; primer, ASTM F656; solvent cement, ASTM D2564.

Type K copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813.

PRESSURIZED BELOW GROUND 3" AND LARGER:

PVC pressure pipe, DR 18, Class 150, AWWA C900; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

ACID WASTE AND VENT
Mechanical joints are not allowed in acid waste piping, except at sink and fixture outlets at the trap connections; to facilitate maintenance and replacement of traps

CPVC plastic pipe, Schedule 40, ASTM D1784, Class 23447 Type IV, with drainage pattern fittings per ASTM D3311, Solvent cement joints utilizing one step primerless cement as approved by the manufacturer. All fittings and pipe shall be tested and listed in accordance with CAN/ULC S102.2 and tested in general accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50. CPVC pipe and fittings shall be of Charlotte Chem Drain or Spears Lab Waste manufacturers, or equal.

P A R T 3 - E X E C U T I O N

GENERAL
Install pipe and fittings in accordance with reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION
Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION
Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment per NFPA 70, 384-4 and 450-47.

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

COPPER PIPE JOINTS
Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

WELDED PIPE JOINTS
Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

THREADED PIPE JOINTS
Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS
Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and

fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the **DFD** Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS
Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

MECHANICAL JOINT PIPE CONNECTIONS
Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

PUSH-ON GASKETED PIPE CONNECTIONS
Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

MECHANICAL GROOVED PIPE CONNECTIONS
Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

SANITARY WASTE AND VENT
Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.

Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection in accordance with SPS 382.30(11)(c).

Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the owner's representative. All pressure tests are to be documented on forms to be provided to the contractor and all sanitary plumbing must be tested for leaks and such testing inspected by the City of Allen and be executed according to city standards.

	Test	Initial Test		Final Test	
System	Medium	Pressure	Duration	Pressure	Duration
Sanitary Waste and Vent	Water	N/A		10' water	2 hr
Pressurized Sanitary Waste & Vent	Water	N/A		100 psig	2 hr
Acid Waste and Vent	Water	N/A		10' water	2 hr

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 22 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for water heaters, water softeners, pumps and other equipment used for plumbing applications. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Water Heaters
- Water Softeners
- Sumps
- Pumps

PART 3 - EXECUTION
- Installation
- Functional Performance Testing
- Owner Training

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

SHOP DRAWINGS
Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

Water heaters must meet Federal Energy Management Program (FEMP) and ASHRAE 90.1 efficiencies in addition to the Energy Code. Coordinate drawing and schedule efficiencies with specification efficiency requirements below

RESIDENTIAL GAS FIRED WATER HEATER
Manufacturers: American, A.O. Smith, Bock, Bradford White, Lochinvar, Rheem, Ruud, State.

Type: High efficiency natural gas fired atmospheric storage water heater. Design to be AGA certified with 5 year tank warranty and 1 year parts warranty.

Efficiency:
$\leq$50 gallons and $\leq$75,000 Btu/h Minimum Energy Factor = 0.67-(.0005 x rated volume)

Tank: Steel glass lined tank rated for 150 psig complete with removable magnesium anode rod, plastic diffuser type dip tube, inlet and outlet heat trap fittings, polyurethane foam insulation, painted steel jacket, draft hood, drain valve and temperature and pressure relief valve.

Burner: Construct burner of cast iron, aluminized steel (natural gas only) or stainless steel.

Controls: Self-generating controls consisting of operating thermostat with adjustable temperature control, energy cutoff, gas valve and integral pressure regulator.

COMMERCIAL POWERED GAS FIRED WATER HEATER
Manufacturers: A.O. Smith, Bock, Bradford White, PVI, Lochinvar, Rheem, Ruud, State.

Type: Commercial natural gas fired power burner storage water heater. Design to be National Board stamped and UL listed with 3 year tank and parts warranty. Water heater to include start-up and training by manufacturer's representative.

Efficiency:

>50 gallons or >75,000 Btu/h	Minimum Thermal Efficiency = 80% Maximum Standby Loss = $(Q/800+110\sqrt{V})$ Q=Input Btu/h, V=Volume Gallons

Tank: Steel glass or nickel lined water leg type tank, ASME construction and stamp, rated for 160 psig complete with 6 removable magnesium anode rods, 2-4" tank access hand holes, foam or fiberglass insulation, painted steel jacket, drain valve and temperature and pressure relief valve per CSA rating..

Burner: Flame retention gas burner with pilot and main gas valves and regulators; 3500 RPM capacitor start fan; solenoid gas valve; air switch; pilot light; on-off switch; flame inspection port; intermittent ignition; flame safety control with pre-purge, flame rod and ultra-violet detector.

Controls: 120 volt, 1 phase, 60 Hz controls consisting of junction box, 24 volt transformer, dual bulb operating thermostat with adjustable temperature control and high limit control with manual reset.

HIGH EFFICIENCY STAINLESS STEEL COMMERCIAL GAS FIRED WATER HEATER
Manufacturers: Heat Transfer Products, Hamilton Engineering, PVI Conquest.

Type: Modulating gas fired sealed combustion condensing commercial water heater. Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.

Efficiency: Minimum Thermal Efficiency = 94%
or
Minimum Thermal Efficiency = 93% and
Maximum Standby Loss (btu/hr) = .84 x $(Q/800+110\sqrt{V})$
Q=Input Btu/h, V=Volume Gallons

Tank: 316L stainless steel or phase-balanced austenitic and ferritic duplex steel with minimum 21% chromium mill certified per ASTM A 923 Method A rated for 150 psig complete with stainless steel pipe fittings, submerged combustion chamber, 90/10 cupronickel or 316L stainless steel heat exchanger, insulation, plastic jacket, brass drain valve and temperature and pressure relief valve.

Burner: Side mounted stainless steel power burner.

Controls: 120 volt, 1 phase, 60 Hz self-diagnostic electronic microprocessor controls, intermittent spark or hot surface ignition, operating thermostat with 70°-180°F adjustable temperature control,
Energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

Vent: Schedule 40 solid wall CPVC with DWV fittings for flue gas outlet and schedule 40 solid wall PVC with DWV fittings for combustion air intake with solvent weld fittings and vent termination fitting.

Condensate Drain: PVC with solvent weld fittings. Drain neutralizer package.

WATER SOFTENERS

Select smaller water softening systems sized to handle no more than the service flow rate rather than larger tanks with less frequent regeneration or tanks on standby for extended periods of time. Select multiple tanks for systems with wide flow variations. Supply fixture unit tables based on Hunter's curves are not corrected for water conserving fixtures and their use commonly results in oversizing. SPS 382.40(7) accepts and DFD recommends sizing based on a detailed engineering analysis to avoid oversizing of equipment. Reference Water Quality Association studies (Aquacraft 2001 single family residence, IAPMO/WQA/ASPE 2016 residential study by Univ. of Cincinnati). Idle conditions contribute to microbiologically induced corrosion and associated water quality concerns.
Manufacturers: Capital, Culligan, Hellenbrand, Kinetico, Water Right.

SUMPS

Fiberglass sump basin constructed of 25-30% fiberglass and 70-75% polyester resin with no fillers; minimum design safety factor of four; complete with tapped top flange; side hub fittings; bolted galvanized steel or aluminum ***(fiberglass)*** gasketed cover with inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required. Minimum sump wall thickness as follows:

	Wall Thickness (Inches)						
Diameter	24	30	36	42	48	60	72
Max. 10' Depth	3/16	1/4	1/4	1/4	5/16	5/16	3/8
Max. 15' Depth	1/4	5/16	5/16	5/16	3/8	3/8	7/16
Max. 20' Depth	5/16	5/16	3/8	3/8	7/16	1/2	1/2

Specify anti-flotation flange and concrete ballast in high groundwater conditions.

Precast reinforced concrete manhole sections, ASTM C478. Construct base of 6" thick precast reinforced concrete or 8" thick cast in place concrete. Construct top of precast reinforced concrete or 6" thick reinforced concrete slab. Seal between sections with rubber ring gaskets, ASTM C443, or plastic preformed gasket material. Seal pipe penetrations with flexible watertight rubber gasketed seals. Provide bolted galvanized steel or aluminum gasketed cover with inspection access plate, access plate with discharge pipe flange for each pump and control and vent flange where required.

SUMP PUMPS

Manufacturer: Aurora/Hydromatic, Gould, Little Giant, Myers, Paco, Stancor, Sta-Rite, Weil, Zoeller.

Type: Submersible pumps constructed of epoxy coated cast iron shell, cast iron volute, two vane enclosed ***(semi-open, or recessed vortex)*** non-clog cast iron, bronze or thermoplastic impeller, stainless steel shaft, stainless steel fasteners, upper and lower ball bearings, oil lubricated or factory sealed grease lubricated, and ceramic mechanical seal.

Motor: Hermetically sealed, capacitor start, with built-in thermal overload protection sized for non-overloading over the entire pump curve.

CONTROLS:

- Single On/Off float switch, UL listed.

- Double (one On, one Off) float switch, UL listed.
- Triple (1st pump On, 2nd pump on, both pumps Off) float switch, UL listed.
- Four (1st pump On, 2nd pump on, both pumps Off, high level alarm) float switches, UL listed.
- NEMA 1 indoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
- NEMA 4X outdoor alarm panel with warning light, horn, silence switch, test switch and high level alarm switch, UL listed.
- Combination magnetic starter with fused disconnect switch, HOA switch, run light, resettable overload heaters, NEMA 1 ***(NEMA 4)***, UL listed.
- Mechanical pump alternator with mechanical switch and float mechanism for control of 1st pump On, 2nd pump On, both pumps Off and alarm, with alarm panel, warning light, horn, silence switch, test switch, NEMA 1. ***(NEMA 4)***
- Electrical pump alternator and alarm panel with combination magnetic starter for each pump, fused disconnect switch, external HOA switch for each pump, run light for each pump, resettable overload heaters, warning light, horn, silence switch, test switch, labeled terminal switch and devices, auxiliary dry contact for remote alarm, UL listed components, NEMA 1 ***(NEMA 4)***.

ACCESSORIES:

- 10’ power cord.
- 20’ power cord.
- NEMA 4 junction box.
- Discharge check valve, fullport ball valve and union for each pump.
- Dual mechanical seals, seal leak detector probe and warning light in control panel.
- Dual stainless steel lift out guide rails with stainless steel wall, pump and sump brackets, bronze and neoprene quick disconnect fitting and corrosion proof pull chain or cable.

- Electrical pump alternator and alarm panel with combination magnetic starter for each pump, fused disconnect switch, external HOA switch for each pump, run light for each pump, resettable overload heaters, warning light, horn, silence switch, test switch, labeled terminal switch and devices, auxiliary dry contact for remote alarm, UL listed components, NEMA 1 ***(NEMA 4)***.
- Class 1, Group D, Division 1 explosion proof rated controls and switches.
- Elapsed time meters.

PART 3 - EXECUTION

INSTALLATION

Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

Set commercial water heaters, commercial water softeners, storage tanks and booster pumps on concrete housekeeping pads. Adjust and level equipment.

Set sumps on compacted granular backfill adjusting for plumb and level. Backfill in even layers around sump with granular backfill.

Connect equipment to water and drain piping using unions or flanges and isolation valves. Water softener drain pipe and fittings to be solvent welded PVC/CPVC SDR 13.5. Water softener brine piping to be polyethylene as supplied by softener manufacturer or same as drain piping.

Connect pneumatic controls to compressed air source.

Size temperature and relief valves per CSA ratings. Pipe temperature and pressure relief valves to floor drain or floor as indicated.

Startup and test equipment adjusting operating and safety controls for proper operation.

Water Softener Startup: Do not fill water softeners with water or startup until building occupancy and active use to avoid stagnant conditions and resulting microbiological contamination. Maintain water softeners in dry bypass mode until active use. Program and cycle water softeners for specified minimum efficiency rating, regeneration cycle intervals and times, consumption, backflow rate, brine flow rate, variable reserve and proportional brining, etc. Program standby ion exchange media tanks into service every 12 hours for minimum of 1 tank full of water to pass through. Provide initial salt fill of brine tank. Test and report on untreated and treated water hardness, pH, iron and chlorine. For water softeners demonstrating efficiency through field sampling, meter analysis and adjustment; report field data confirming efficiency.

Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

Adjust compression tank precharge to scheduled minimum operating pressure prior to connecting to system.

FUNCTIONAL PERFORMANCE TESTING
Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 22 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

OWNER TRAINING
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

P A R T 1 - G E N E R A L

SCOPE

This section includes specifications for plumbing fixtures, faucets and trim.

PART 1 - GENERAL
- Scope
- Related Work
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria
- Energy Efficiency Requirements

PART 2 - PRODUCTS
- Plumbing Fixtures

PART 3 - EXECUTION
- Installation
- Construction Verification Items

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

SHOP DRAWINGS
Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
ANSI A112.6.1M-88 - Supports for Off-the Floor Plumbing Fixtures for Public Use.
ANSI A112.18.1-94 - Finished and Rough Brass Plumbing Fixture Fittings.

P A R T 2 - P R O D U C T S

PLUMBING FIXTURES
This project will use specs provided by Kitchen Designer in kitchen design plans, and follow kitchen equipment schedule.

Unless noted otherwise on the plans, manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted.

- Faucets - Chicago Faucet, Kohler, Speakman, Symmons, Zurn.
- Drains - Chicago Faucet, Engineered Brass Co., Kohler, McGuire.
- Stops and Supplies - Chicago Faucet Co., McGuire. (Heavy Duty Type Only)
- Flush Valves - Coyne & Delany, Sloan Royal, Zurn AV.

- Traps - Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge Min.)
- Carriers and Supports - Josam, Smith, Wade, Watts Drainage, Zurn.
- Sinks - American Standard, Elkay, Just, Kohler.
- Service Sinks - American Standard, Crane, Kohler.

SINKS

S-1 - Counter mounted 18 ga type 302 stainless steel single compartment sink with 3 faucet openings 4" on center.

- Fixture: Elkay LR-2219.
- Faucet: Chicago Faucet No. 201ACP.
- Drain: Elkay LK-335
- Trap: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend, With C.O. plug.
- Supplies & Stops: Chicago Faucet No. 1013-CP w/ 3/8" riser, length as necessary.

S-2 - Counter mounted 18 ga. type 302 stainless steel double compartment sink with 3 faucet openings 4" on center.

- Fixture: Elkay LR-3322.
- Faucet: Chicago Faucet No. 201ACP.
- Drains: Elkay LK-335
- Waste McGuire No. 113C16G17, Center outlet, 17 ga.
- Traps: 1-1/2"x1-1/2" 17 ga. cast brass trap and tubular wall bend.
- Supplies & Stops: Chicago Faucet No. 1013-CP w/ 3/8" riser, length as necessary.

SERVICE SINKS

SS-1 - Wall mounted enameled cast iron service sink with stainless steel rim guard and wall hanger supports.

- Fixture: Kohler Bannon K-6719.
- Faucet: Chicago Faucet No.897RCF with Watts 8BC vacuum breaker.
- Drain: Kohler K-6673 3" trap with strainer, cleanout and floorplate.
- Stops: (Integral with faucet)

PART 3 - EXECUTION

INSTALLATION

Install plumbing fixtures in accordance with manufacturers' instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

Install barrier free fixtures in compliance with IBC 1108 and 3408, COMM 52, 69 and Federal ADA Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27" above floor to avoid contact by wheelchair users.

Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, same items in concealed locations may be of rough brass finish.

Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow.

Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

Foodservice Equipment: Provide rough-in piping, traps, tailpieces, indirect waste lines and Make final and necessary connections for foodservice equipment. Install faucets, spray units, drains, lever drains, vacuum breakers, solenoid valves, check valves, flow control valves, water inlet fittings, filters, strainers, pressure reducing valves and gas valves furnished by foodservice equipment contractor. Provide condensate drain piping from cooler and freezer evaporators. Make all final and necessary plumbing connections.

Existing Fixtures: Where existing fixtures and fittings are indicated to be reused or relocated, this contractor is responsible for documenting condition prior to construction and for damages incurred during construction.

END OF SECTION