SECTION 22 1100

PIPING

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 TRENCHING, BACKFILLING, AND COMPACTION

A. Provide trenching, backfilling, and compaction for the Work of this Section.

B. Trenching, backfilling, and compaction shall comply with requirements referenced in Section 20 1000, in addition to requirements specified in this Section.

1.03 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Piping Materials and Fittings		X						
Piping Specialties		X						
Pipe Supports		X						

1.04 DEFINITIONS

A. Indoors: Inside building insulation envelope.

B. Outdoors or Wet Areas: Outside building insulation envelope.

C. Accessible Locations: Installed where exposed or installed above accessible ceiling systems.

D. Inaccessible Locations: Installed in concealed spaces such as walls, shafts, chases, or above inaccessible ceilings.

PART 2 - PRODUCTS

2.01 PLUMBING PIPING

A. Domestic Water (CW, HW):
   1. Pipe: Type L copper, hard drawn, ASTM B-88.
   2. Fittings: Wrought copper, ANSI B-16.22.
   3. Compliant with ANSI/NSF 372, ANSI/NSF 61-G.
   4. Joints:
      a. 2-1/2 inch diameter & smaller: Lead-free 95-5 tin-antimony solder or silver/copper-alloy brazed.

B. Storm Drain (W, V), buried, 5 feet or more outside building wall unless otherwise shown on Drawings:
   1. Option #1:
      a. Pipe: PVC, type PSM, SDR 35, ASTM D-3034.
      b. Fittings: PVC, ASTM D-3034.
      c. Joints: Bell and spigot with rubber gaskets, conform to ASTM D-3212 and ASTM F-477.
   2. Option #2:
      a. Pipe: PVC DWV, ASTM D-2665.
      b. Fittings: PVC DWV, ASTM D-2665 and D-3311.
      c. Joints: Solvent-cemented, in accordance with ASTM D-2855, using ASTM D-2564 solvent cement and ASTM F-656 primer.
   3. Option #3:
      a. Pipe: ABS DWV, ASTM D-2661.
      b. Fittings: ABS DWV, ASTM D-2661 and D-3311.
      c. Joints: Solvent-cemented, using ASTM D-2235 solvent cement.

C. Sanitary Waste and Vent (W, V), buried, to minimum 5 feet outside building wall unless otherwise shown on Drawings:
   1. Pipe: Cast iron, no-hub, CISPI 301.
   2. Fittings: Cast iron, no-hub, CISPI 301.
   3. Joints: Neoprene gaskets and stainless steel clamp-shield assemblies, CISPI 310 or listed by IAPMO.

D. Sanitary Waste and Vent (W, V), above ground:
   1. Pipe: Cast iron, no-hub, CISPI 301.
   2. Fittings: Cast iron, no-hub, CISPI 301.
   3. Joints (All areas, unless noted otherwise): Neoprene gaskets and stainless steel clamp-shield assemblies, CISPI 310 or listed by IAPMO.

2.02 PIPING SPECIALTIES

A. Escutcheons:
   1. Construction:
      a. 2” diameter opening and smaller: Cast brass, nickel-plated with set screw.
      b. Over 2” diameter opening: Chrome plated stamped steel.
   2. Size: Sufficient to cover sleeves and openings.

B. Unions for copper pipe:
   1. Body: Bronze.
   2. Seat: Brass.
   3. Compliant with ANSI/NSF 372, ANSI/NSF 61-G.
   4. Rated Working Pressure:
      a. Domestic Water: 125 psi minimum.
      b. Hydronic: 250 psi minimum at 210 degrees F.
   5. Connection: Screwed, brazed, or flanged to match pipe.

C. Transition Couplings:
   1. Transition Couplings in Traffic-Rated Areas:
      a. Description: Compression style coupling, adaptable to dissimilar piping materials with different outside diameters.
      b. Material: Ductile iron per ASTM A536, Grade 65-45-12 with shopcoat finish.
      c. Gaskets: Virgin SBR per ASTM D 2000 MBA 710, compounded for water and sewer service.
      d. Fasteners: Track-head bolts, heavy hex nuts, UNC 5/8" rolled thread, high strength, low alloy, corrosion resistant per AWWA C111.
      e. Manufacturer: Romac, Smith-Blair or approved. Similar to Romac Style 501.
   2. Transition Couplings in Non-Traffic Areas:

a. Description: Rubber sleeve with full stainless steel jacket and clamping bands, adaptable to dissimilar piping materials with different outside diameters.
b. Material: Marine grade, 300 Series stainless steel jacket conforming to ASTM A240.
c. Sleeve: Rubber conforming to ASTM C425 and ASTM C1173.
d. Clamping Bands: Dual, worm drive, 300 series stainless steel.
e. Manufacturer: Mission or approved. Similar to Mission MR Series Flex-Seal.

2.03 PIPE SUPPORTS

A. Ring Hangers for Pipe Sizes 3 inch and smaller:
1. Type: Carbon steel band, adjustable, with knurled swivel nut.
2. Finish:
a. Indoors: Zinc plated.
b. Outdoors or Wet Areas: Hot dip galvanized.
3. Approvals: UL and FM.
4. For uninsulated copper piping: Equivalent to model specified, with addition of copper plating, neoprene coating, or PVC coating.
5. Manufacturer:
a. Anvil Fig. 70
b. B-Line Fig. B 3170
c. Super Strut C-727
d. PHD Model 151
e. Erico/Michigan Model 100

B. Hanger Rods:
1. Material: Carbon steel.
2. Finish:
a. Indoors: Zinc plated.
b. Outdoors or Wet Areas: Hot dip galvanized.

C. Insulated Pipe Shields for Use at Pipe Supports:
1. Type: Preformed pipe insulation with an insulation shield.
2. Insulation (Pipe sizes 1-1/4 inch through 3 inch):
a. Type: Rigid, polyisocyanurate foam, preformed to fit pipe size.
b. Conductivity ("k"): Not to exceed 0.19 at 75 degrees F mean temperature.
c. Thickness: To match adjacent pipe insulation. See Section 22 1410.
d. Length: To match insulation shield.
e. Manufacturer: Dow “Trymer 2000".
3. Insulation Jacket:
a. Type: .016 inch thick aluminum, preformed to fit pipe.
b. Finish: Stucco embossed pattern.
c. Moisture Barrier: Kraft or polyethylene.
4. Insulation Shield:
a. Type: Galvanized steel, 2 overlapping pieces, full 360 degree.
b. Minimum Thickness:
1) Pipe Sizes 1-1/4 to 2 inch: 24 gauge
2) Pipe Sizes 2-1/2 to 3 inch: 20 gauge
c. Minimum Length: 12 inch.
5. Manufacturer: E.J. Bartells, ISSI Product Inc., Pipe Shields Inc., Erico/Michigan, or field fabricated with components specified herein.

D. Riser Clamps:
1. Type: 2 bolt.
2. Material: Carbon steel.
3. Finish:
a. Indoors: Zinc plated.
b. Outdoors or Wet Areas: Hot dip galvanized.
4. For uninsulated copper piping: Equivalent to model specified, with addition of copper plating, neoprene coating, or PVC coating.

5. Manufacturer:
    a. Anvil Fig. 261
    b. B-Line Fig. B 3373
    c. Super Strut C-720
    d. PHD 550
    e. Erico/Michigan Model 510

E. Wall Supports & Trapeze Assemblies:
1. Description: Field fabricate of manufactured channel components.
2. Pipe Supports: U-bolt, U-strap, or roller type components in accordance with those specified herein and compatible with manufactured channel system.
3. Trapeze Size: As published by manufacturer for span and total weight supported. Provide sizing criteria with product data submittal.
4. Manufacturer: Unistrut, Super-Strut, B-Line, Erico/Michigan, or approved.

2.04 SLEEVES AND SEALS

A. Sleeves:
1. Material: Galvanized steel.
2. Minimum Gauge: 20 gauge minimum.
3. Minimum Size: 1/2 Inch larger than diameter of pipe, including insulation.

2.05 EXCAVATION AND BACKFILL

A. Bedding and Backfill Material:
1. Unclassified or Native Material: Existing material.
2. Crushed Rock: 3/4 inch minus; conforming to the latest Oregon State Highway Specification for base rock.
3. Pea Gravel: Washed, naturally rounded aggregate with particle size not less than 1/8 inch nor more than 3/4 inch in diameter.
4. Sand: Washed concrete sand or washed fill sand if available.

PART 3 - EXECUTION

3.01 GENERAL

A. Install products in accordance with manufacturer's recommendations.

B. Install piping plumb and parallel true to building structural system.

C. Where possible, use full 20 foot lengths.

D. Install branch piping to allow for expansion with offsets and swing joints as necessary to prevent undue strain.

E. Do not use bushings and close nipples.

F. Do not penetrate structural members.

G. Screwed joints shall have less than two percent of threads showing.

H. Ream pipes to full inside diameter prior to making up joints.

I. Comply with applicable IAPMO Installation Standard for each particular piping material.

J. Make branches and elbows with fittings specified herein. "Pulled tees", saddle taps, and field fabricated fittings are not acceptable.

K. Brazed Pipe Joints:
1. Brazing procedures shall be in accordance with Copper Tube Handbook of the Copper Development Association.
2. Clean flux from joints.
3. Purge oxidized carbon from pipes prior to cleaning or disinfection.

L. Testing of Piping Systems:
1. Advise Architect or authorized representative when testing will be performed.
2. Test before concealing pipe joints and welds.
3. Before testing, isolate all equipment or components which are not rated for test pressures.

4. Record temperature at start and finish of test. Pressure readings at finish of test shall be adjusted to account for temperature change of medium during the test.
5. Test pressures shall be as specified herein for each type of piping system.
6. Comply with testing requirements of authorities having jurisdiction, in addition to requirements specified herein.
7. Piping systems shall hold test pressure for a minimum of one hour with no leakage.

3.02 PLUMBING PIPING

A. Domestic Water Piping:
1. Slope toward low points of system and provide ball valves with caps for drainage.
2. Test Pressure: Fill system with water and pressurize to 125 psig.
3. Joints nominally 1" diameter or smaller not permitted below grade.

B. Drain and Waste Piping:
1. Slope 1/4 inch per foot, minimum, unless otherwise noted on Drawings.
2. Test Pressure: Fill system with water to highest point.
3. At pipes crossing building seismic joints, install four 6-inch long sections of pipe with no-hub couplings.

C. Vent Piping:
1. Vents through roof shall be plumb, with weatherproof flashing.
2. Slope 1/2 inch per 10 feet, down toward fixture served.
3. Test Pressure: Fill system with water to highest point.
4. At pipes crossing building seismic joints, install four 6-inch long sections of pipe with no-hub couplings.

3.03 PIPING SPECIALTIES

A. Escutcheons:
1. Install on exposed pipe through walls, floors, or ceilings.
2. Secure escutcheon to pipe and wall with caulk.
3. Escutcheons not required in mechanical rooms.

B. Unions for copper pipe:
1. Provide unions as follows:
a. Where indicated on Drawings.
b. At each automatic control valve.
c. As required for removal of pumps, steam traps, and equipment with piping connections.

C. Transition Couplings:
1. Provide transition couplings as follows:
a. Where indicated on Drawings.
b. For Sanitary Waste, at connection points between piping materials nominally 5 feet outside building wall or as otherwise shown on Drawings.

3.04 PIPE SUPPORTS

A. General:
1. Refer to Section 22 1410 to determine pipe insulation requirements.
2. Supports for the following shall bear directly on the pipe:
a. Uninsulated pipe.
b. 1 inch and smaller domestic hot water and heating water pipe.
3. Size hangers to fit outside of pipe insulation, except where hangers shall bear directly on the pipe.
4. Provide pipe support shoe welded to pipe at each roller hanger.
5. Comply with applicable IAPMO Installation Standard for particular piping material.

B. Insulated Pipe Shields:
1. Provide insulated pipe shield at each support, except as follows:
a. Pipe sizes 1 inch and smaller.
b. Where supports are permitted to bear directly on the pipe.

c. Where support shoes are required.

2. Secure insulation with 16 gauge stainless steel wire, stainless steel bands, or nylon tape as recommended by insulation manufacturer.
3. Cover pipe insulation with aluminum jacket and preformed fitting covers.
4. For cold pipe installations, seal seams and joints in jacket with vapor barrier mastic or tape, to provide a continuous positive vapor barrier.

C. Copper Pipe, Horizontal:
1. Support within 2 feet of each direction change.
2. Maximum spacing of supports:

Pipe Size	Rod Diameter	Maximum Spacing
1-1/2 inch and smaller	3/8 inch	6 feet 0 inches
2 inch and larger	3/8 inch	10 feet 0 inches

D. Cast Iron Pipe, Horizontal:
1. For joints less than 4 feet o.c.: Support at every other joint.
2. For joints 4 feet or greater o.c.: Support at every joint.
3. Support at every horizontal branch.
4. Maximum spacing of supports: 10 feet o.c.

E. Vertical Pipe Supports:
1. Provide riser clamp at each floor.
2. Provide wall supports, in addition to riser clamps, as follows:
a. For plastic pipe where spacing between riser clamps is greater than 6 feet.
b. For copper pipe where spacing between riser clamps is greater than 10 feet.
c. For cast iron and steel pipe where spacing between riser clamps is greater than 12 feet.
3. For PEX pipe, provide sleeves or grommets to protect pipe at metal studs or other penetrations where wear might occur.

F. Copper Pipes Through Floors in Finished Rooms:
1. Place slip-on cast bronze flange on pipe above floor penetration.
2. Braze flange to copper pipe.
3. Anchor flange to floor, using bolts and lead anchor inserts.

3.05 SLEEVES AND SEALS

A. Install sleeves and seals at pipe penetrations through walls and floors. Insulation shall be continuous through penetrations. Coordinate with pipe insulation requirements in Section 22 1410.

B. Caulk between pipe and sleeve at penetrations of walls and floors which are not fire-rated.

3.06 EXCAVATION AND BACKFILL

A. General:
1. Determine location of existing underground utilities and services, uncover by hand digging.
2. Completely de-water trenches and excavations before pipe is laid or concrete is placed.
3. When necessary to prevent caving, excavation in sand, gravel or other unstable materials provide shoring and bracing. Shoring shall remain in place until testing, inspection and backfill for 12 inches above pipe are complete.
4. Remove from site excavated materials not suitable for backfill.
5. Delay backfill of trenches until all tests are performed and until after inspection and approval by governing authority.
6. Record Drawings: During progress of underground work, maintain an accurate record of all installation depths and changes in direction for future accurate location. Record daily work progress prior to any backfill.
7. Repair any damage to existing streets, sidewalks, concrete, piping, etc., at Contractor's expense.

B. Excavation:
1. Unless otherwise shown, piping shall have the following minimum cover:

a. Water - 36 inches
b. Gas - 18 inches
c. Waste, Storm Drain - 24 inches

2. Width: To provide working space, but in no case less than 18 inches plus the inside diameter of the pipe to be placed therein.
3. Grade Bottom of Trenches: Carried to lines and grades as shown or as required and established with instruments with proper allowances for pipe thickness and gravel bedding. Any amount of trench excavated below grade shall be corrected with approved materials thoroughly compacted.

C. Bedding:
1. Buried pipes shall be laid on minimum 4 inches of compacted crushed rock bedding.
2. Bedding shall extend from bottom of pipe to undisturbed earth, be evenly graded to support pipe at proper slope, and compacted to 95% density of AASHTO T-180/ASTM D-1557.

D. Tracer Wire
1. For non-metallic piping, provide electrically conductive tracer wire, 18 - gauge. insulated copper or heavier, green in color placed full length of trench.

E. Backfilling:
1. Under concrete slabs (inside or outside building), paved areas, streets, or sidewalks, backfill shall be pea gravel or crushed rock. Fill material shall extend from bedding material to the bottom of surfacing material, filling voids around pipe. Fill in maximum 8 inch lifts and compact to 95% density of AASHTO T-180/ASTM D-1557.
2. For areas outside building, except as specified above, pipe shall be covered with minimum 12 inches of pea gravel or crushed rock and remainder of trench filled with thoroughly compacted native material.
3. Should any backfilled ditch show settlement at any time through one year warranty period, Contractor shall bring ditch back to grade with compacted fill and repair any damage to concrete or paved areas caused by settlement.

END OF SECTION

SECTION 22 1300

VALVES

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Ball Valves		X						

PART 2 - PRODUCTS

2.01 DOMESTIC POTABLE WATER SYSTEMS

A. Services Legend: CW, HW

B. Lead Free Requirements: Compliance with the "*2014 Reduction of Lead in Drinking Water Act*" defining "Lead Free" as not more than a weighted average of 0.25% lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

C. Ball Valves, 1/2 to 2 1/2 inch:
   1. Type: Full port, solid ball, 2-piece body with stainless steel trim.
   2. Body: Bronze.
   3. Rated Working Pressure: Minimum of 150 psig steam; 600 psig WOG.
   4. Handle:
      a. Uninsulated Pipe: Standard lever handle.
      b. Insulated Pipe: Extended lever handle.
   5. Ends: Threaded or soldered.
   6. Stem and Ball: 316 stainless steel.
   7. Seat and Seals: MTFE, RPTFE, PTFE, TFE, or Buna-N.
   8. Standards:
      a. Comply with ANSI/NSF 372, ANSI/NSF 61-9 Annex G.
      b. Comply with MSS SP-110.
   9. Manufacturer: Crane, Worcester, Apollo, Watts, Hammond, Grinnell, Milwaukee, WKM, Jomar, or approved. Similar to Apollo 77CLF-140 (threaded) or Apollo 77CLF-240 (soldered).

D. Ball Valves, 3 piece option:
   1. Type: Full port, 3-piece body, bolted, swings out for maintenance.

2. Body: Bronze.
3. Rated Working Pressure: Minimum of 150 psig steam; 400 psig WOG.
4. Handle:
    a. Uninsulated Pipe: Standard lever handle.
    b. Insulated Pipe: Extended lever handle.
5. Ends: Threaded or soldered.
6. Stem and Ball: Stainless steel, or chrome-plated bronze or brass.
7. Seat and Seals: Teflon, TFE, or Buna-N.
8. Standards
    a. Comply with ANSI/NSF 372, ANSI/NSF 61-9 Annex G.
    b. Comply with MSS SP-110.
9. Manufacturer: Crane, Watts, Apollo, Worcester, Hammond, Grinnell, Milwaukee, WKM, Jomar, or approved. Similar to Hammond UP8603 (threaded) or 8613 (soldered).

PART 3 - EXECUTION

3.01 GENERAL

A. Valves shall be full line size, except where noted otherwise.

B. Install valves in locations which are accessible without damage to finished walls and ceilings.

C. Where possible, position valve operator towards access opening.

END OF SECTION

SECTION 22 1410

PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 22 1100 - Piping: Pipe Supports, Insulated Pipe Shields

1.02 QUALITY ASSURANCE

A. Products shall have flame spread and smoke developed ratings based on test procedures in accordance with NFPA-255 and UL-723. Ratings shall be indicated on the product or on the shipping cartons.

B. Unless otherwise specified herein, products shall have flame spread ratings not to exceed 25 and smoke developed ratings not to exceed 50.

C. Products shall comply with the requirements of Oregon Revised Statute (ORS) 453.005 (7) (e), effective January 1, 2011. The referenced statute limits the use of three types of brominated fire retardant chemicals, which are defined as hazardous substances.

1.03 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information required for the products listed in the Product Table, indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.

1. Shop Drawings (submittal data)
2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
3. Manufacturer's Operation Manuals
4. Manufacturer’s Service and Lubrication Requirements
5. Service Contracts and Field Start-up Reports
6. Cleaning, Certification, and Test Reports
7. System Information
8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Pipe Insulation		X						
Jackets and Fitting Covers		X						
Accessories		X						

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR INSULATION MATERIALS

A. Comply with requirements in "INSULATION SCHEDULES" provided hereafter listing where various insulating materials shall be applied.

B. Products shall not contain formaldehyde, asbestos, lead, mercury or mercury compounds and shall be UL GREENGUARD Gold or Indoor Advantage Gold where available.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

2.02 PIPE INSULATION

A. Preformed Fiberglass Pipe Insulation (FG):
   1. General: Preformed to fit pipe size, with factory applied vapor barrier facing.
   2. Conductivity ("k"): Not to exceed 0.24 at 75 degrees F mean temperature.
   3. Vapor Barrier Facing:
      a. General: Factory applied, glass fiber reinforced kraft and aluminum foil laminate.
      b. Permeability: Not to exceed 0.02 perms.
      c. Closure System: Self-sealing pressure sensitive lap.
   4. Manufacturer and Model: John's Manville "Micro-Lok HP", Owens Corning "Evolution Paper-free ASJ", or approved.

B. Elastomeric Foam (EF):
   1. Type: Flexible, closed cell elastomeric foam, unslit tubing.
   2. Joining System: Field applied contact cement.
   3. Conductivity ("k"): Not to exceed 0.28 at 75 degrees F mean temperature.
   4. Temperature Rating: 220 degrees F for continuous use.
   5. Manufacturer: Armacell LLC "AP/Armaflex," with Armacell LLC "WB Armaflex Finish" weather resistant coating where required in Part 3.

C. Fiberglass Fitting Inserts:
   1. Type: Precut fiberglass blanket for use with fitting covers.
   2. Conductivity ("k"): Not to exceed 0.28 at 75 degrees F mean temp.
   3. Manufacturer: Same as fiberglass pipe insulation.

2.03 JACKETS AND FITTING COVERS

A. Polyvinyl Chloride Jackets and Fitting Covers (PVC):
   1. Type: White PVC, preformed to fit pipe and fittings, UV-resistant.
   2. Shapes: Elbows, tees, valves, reducers, flanges, and end caps; in various sizes including Zest-on Flanged Gate Valve Fitting Covers or similar style cover sized to provide complete coverage of balancing valves and flow control valves.
   3. Thickness:
      a. Indoors: Minimum 20 mils (.020 inches, 0.75 mm).
      b. Outdoors: Minimum 30 mils (.030 inches, 0.75 mm).
   4. Manufacturer:
      a. Johns Manville "Zeston 2000" or "Ceel-CO 550"
      b. Certain-Teed "Snap Form"
      c. Knauf "PVC Fitting Covers

2.04 ACCESSORIES

A. Insulating Cement: Comply with ANSI/ASTM C195.

B. Finishing Cement: Comply with ASTM C449.

C. Mastic, Coatings, Tapes, and Adhesives: Comply with Manufacturer's installation instructions for each type of insulation.

PART 3 - EXECUTION

3.01 DEFINITIONS

A. Cold Pipe: Piping, fittings, equipment, or accessories handling rain water, potable cold water, and media at design temperature of 60 degrees F or below.

3.02 GENERAL

A. Install products in accordance with Manufacturer's instructions.

B. Install products in accordance with MICA (Midwest Insulation Contractors Association) - National Commercial & Industrial Insulation Standards.

C. Insulate new pipe, fittings, valves, and specialties for each piping system included under APPLICATION TO PIPING SYSTEMS.

D. Insulate pipe, fittings, valves, and specialties where existing insulation is removed to facilitate the remodel work.

E. Verify piping has been tested and approved before installing insulation.

F. Clean and dry piping before installing insulation.

G. On exposed piping, locate insulation seams in least visible location.

H. Insulation shall be continuous through walls, floors, ceilings, sleeves, and other penetrations. Where penetrations through non-structural framing members would require openings larger than allowed by the Oregon Structural Specialty Code or Oregon Mechanical Specialty Code (Section 302), fill maximum allowable size annulus with polyurethane expanding foam sealer. Trim foam sealer flush with framing member, butt insulation tight to foam, and seal vapor barrier to framing member.

I. Label insulation that covers unions. Refer to Section 20 6000 for labeling requirements.

J. Fill joints, cracks, seams, and depressions with canvas and finishing cement to form smooth surfaces.

3.03 TEMPERATURE-SPECIFIC REQUIREMENTS

A. Cold Pipe Installation Requirements:
   1. Seal seams and joints in vapor barrier facings, fitting covers, and insulation jackets with vapor barrier mastic or tape, to provide a continuous positive vapor barrier.
   2. At interruptions in insulation, seal ends of insulation to provide a continuous vapor barrier. For insulation with vapor barrier, seal with canvas or fiberglass cloth sealed with vapor barrier mastic. For insulation with PVC or aluminum jacket, seal ends with reducer endcaps, same material as jacket, tight to pipe surface and seal to pipe surface with vapor barrier mastic.
   3. For Cold Pipe do not insulate the following:
      a. Exposed supplies at plumbing fixtures
      b. Pressure reducing valves
      c. Reduced pressure backflow preventers located in mechanical rooms
      d. Water hammer arresters
      e. Trap primer valves
      f. Vacuum breakers
      g. Pressure relief valves
      h. Strainer access covers
      i. Control valve actuators
      j. Test plugs
      k. Air vents

3.04 INSULATION AT PIPE SUPPORTS

A. Refer to Section 22 1100 for insulated pipe shields at pipe supports. At insulated pipe shields, lap insulation vapor barrier over cover of pipe shield and seal with factory approved vapor barrier tape. Seal longitudinal seams of pipe shield cover with vapor barrier tape or mastic. For piping where PVC or aluminum jacket is required, jacket shall be continuous over insulated pipe shields.

B. Refer to Section 22 1100 for pipe support shoes at pipe supports. At pipe support shoes, fully insulate pipe around support shoe. Fill support shoe cavity with unfaced fiberglass insulation. For piping where PVC or aluminum jacket is required, jacket shall be continuous over support shoes.

3.05 FIBERGLASS PIPE INSULATION (FG)

A. General:
   1. Secure longitudinal laps in insulation vapor barrier with factory applied pressure sensitive tape system and outward clenching staples.

2. Secure butt joints in insulation vapor barrier with pressure sensitive tape to match vapor barrier.
3. Insulate fittings and valves (unless noted otherwise) with fiberglass fitting inserts and PVC Fitting Covers.

3.06 CLOSED CELL ELASTOMERIC FOAM PIPE INSULATION (EF)

A. Slip tubular insulation over pipe before making joints.

B. Do not slit insulation lengthwise.

C. Seal butt joints under light compression with contact adhesive approved by insulation manufacturer.

D. Insulate fittings with oversize pipe insulation or miter-cut pieces of pipe insulation joined with contact adhesive to provide a continuous positive vapor barrier.

E. On outdoor installations and installations where painting is required by Section 20 1000 provide two coats of insulation manufacturer's weather-resistant finish.

3.07 JACKETS AND FITTING COVERS

A. General:
   1. Provide Fitting covers as follows:
      a. On piping where type FG insulation is required provide fitting covers at pipe fittings, valves, and piping accessories.
      b. Insulated piping located outside building above ground.
      c. Valves where adjacent piping has jackets.
      d.
   2. Where jackets and fitting covers are required, use the following types:
      a. For Type FG insulation indoors: PVC (except where noted otherwise).
      b. Fitting covers shall be same material as jackets, except at Contractor's option Type EF insulation may be used as fitting covers on type FG insulation at flanged connections and grooved couplings.

B. Installation:
   1. General:
      a. Overlap seams 2 inches minimum and as indicated herein.
      b. Seal per manufacturer's recommendations.
   2. Polyvinyl Chloride Jackets and Fitting Covers (PVC):
      a. Fitting Covers:
         1) Lap PVC fitting covers over adjacent vapor barrier facing with end of overlap pointed downward.
         2) On indoor installations secure PVC fitting covers with fitting cover manufacturer's pressure sensitive tape and secure ends of tapes using outward-clenching staples.
         3) On outdoor installations seal fitting covers with cover manufacturer's solvent welding adhesive.
      b. Piping Jackets:
         1) Lap PVC jackets over fitting covers with longitudinal seams of jackets on lower third of piping, and end of overlap pointed downward.
         2) On indoor installations secure PVC fitting covers with fitting cover manufacturer's pressure sensitive tape and secure ends of tapes using outward-clenching staples.
         3) On outdoor installations seal fitting jacket seams and seal jackets to fitting covers using cover manufacturer's solvent welding adhesive.

3.08 APPLICATION TO PIPING SYSTEMS

A. General Application To Piping Systems:
   1. Piping above ground located inside building, on roof, on grade or outside building.
   2. Piping not imbedded in concrete or in CMU walls.

3. Insulation of valves and miscellaneous piping accessories: See Part 3 Execution hereinbefore.
4. Minimum Insulation Thickness Compliance: 2014 Oregon Energy Efficiency Specialty Code (OEESC) Table 503.2.8 as a minimum unless shown to comply with ASHRAE 189.1-2009 Standard For The Design Of High Performance Green Buildings.
5. For piping smaller than 1-1/2 inch and located within conditioned spaces, reduction of these thicknesses by 1 inch shall be permitted (before thickness adjustments allowed by OEESC Table 503.2.8) but not to a thickness less than 1 inch.

B. Domestic Cold Water (CW):
1. Fluid Operating Temperature Range: 40 to 60 deg F
2. Inside Building:
   a. Type: FG or EF.
      1) Pipe sizes less than 1-1/2 inches: 1/2 inch
      2) Pipe sizes 1-1/2 inches and larger: 1 inch

C. Domestic Hot Water (HW):
1. Fluid Operating Temperature Range: 105 to140 deg F.
2. Inside Building:
   a. Type: FG or EF.
      1) Pipe sizes less than 1-1/2 inches: 1 inch
      2) Pipe sizes 1-1/2" inches and larger: 1-1/2 inches

END OF SECTION

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Domestic Water Heaters	X	X	X	X	X			X

PART 2 - PRODUCTS

2.01 DOMESTIC WATER HEATERS

A. Electric Water Heater (WH-1, WH-2):
   1. Type: Electric instantaneous tankless heater.
   2. Controls: Flow activated switch.
   3. Heating Coils: Nickel-chrome.
   4. Voltage: 120 volts, single phase
   5. Capacity: 3.5 kW.
   6. Temperature Rise: 48 Deg F at 0.5 gpm.
   7. Temperature Control: ASSE 1070-2004 integral mixing valve.
   8. Accessories: In-line flow control.
   9. Compliant with ANSI/NSF 372, ANSI/NSF 61-G.
   10. Manufacturer: Chronomite, Eemax or approved. Similar to Eemax MT004120T.

PART 3 - EXECUTION

3.01 GENERAL

A. Install products in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 22 4000

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data)
   3. Manufacturer's Operation Manuals
   4. Manufacturer's Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Water Closets		X	X	X				X
Lavatories		X						
Hydrants and Hose Bibbs		X						
Closet Seats (include with applicable fixture)		X						
Faucets (include with applicable fixture)		X		X				X

PART 2 - PRODUCTS

2.01 WATER CLOSETS

A. WC-1:
   1. Usage: Handicap height, floor-mounted, tank type water closet.
   2. Accessibility: ADA Compliant.
   3. Fixture:
      a. Description: Floor-mounted, floor outlet, elongated bowl, 1.6 gallon pressure-assisted siphon jet flush, metal chrome trip lever, slow close solid white reinforced plastic seat and cover, Provide bolt caps with water closet.
      b. Overall Dimensions: 30 inches x 15 inches x 16-1/2 inch rim to floor dimension.
      c. Material: Vitreous china.
      d. Color: White.
      e. Manufacturer: American Standard, Briggs, Eljer, Kohler or approved. Similar to American Standard Cadet Right Height EL Pressure-Assisted, Model 2467.016.
   4. Seat:
      a. Material: Solid white reinforced plastic.
      b. Bumper: Non-metallic.
      c. Concealed check.
      d. Hinge with insert molded integrally in seat.

e. Manufacturer: Church, Bemis, American Standard, Olsonite, Beneke or approved. Similar to Church 9500C seat.

2.02 LAVATORIES

A. L-1:
   1. Usage: Integral counter lavatory.
   2. Accessibility: ADA Compliant.
   3. Fixture:
      a. Description: Lavatory bowl integral to counter, refer to Architectural.
   4. Fittings:
      a. Faucet: Sensor operated, 4-1/2 inch spout, 6 inch baseplate, 0.5 gpm vandal-resistant aerator, back checks, 24 VAC transformer, chrome finish, compliant with ANSI/NSF 372, ANSI/NSF 61-G. Sloan, Chicago, Zurn, Delta, Symmons, Moen or approved. Similar to Sloan Model ETF 600-8-LT-BDM.
      b. Drain: Heavy cast brass grid strainer, 1-1/4 inch, 17 gauge tubular brass tailpiece. McGuire, American Standard, Kohler or approved. Similar to McGuire Model 155A.
      c. Mixing Valve: Provide MV-1 per Section 22 41 00.

2.03 HYDRANTS AND HOSE BIBBS

A. HB-1:
   1. Usage: Exterior public area wall hydrant.
   2. Accessibility: Not handicap accessible.
   3. Fixture:
      a. Description: Freeze-proof wall hydrant with locking box and ASSE 1052 compliant backflow preventer. Removable "T" handle. 12 inch minimum length. Self-draining feature must function with hose attached.
      b. Manufacturer: Woodford, Jay R. Smith, Wade, Zurn, Clayton Mark, or approved. Similar to Woodford Model B67.

PART 3 - EXECUTION

3.01 GENERAL

A. Install in accordance with manufacturer's instructions.

B. Install fixture traps easily removable for servicing and cleaning.

C. Seal fixtures to wall and floor surfaces with sealant. Color to match fixture.

D. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise or overflow.

3.02 ADA COMPLIANCE

A. Americans with Disabilities Act (ADA):
   1. All plumbing fixtures noted to be ADA compliant must be installed in accordance with current ADA requirements. Height, clearances, and controls shall comply with ADA requirements and applicable codes in addition to specific requirements listed here.

B. Water Closets:
   1. Locate flush lever on wide side of water closet area. Verify configuration prior to ordering tank type water closets.

C. Lavatories:
   1. Insulate waste and hot water pipes under fixture.
   2. Mount counter lavatories in minimum 22 inch deep counter installed 2 inches minimum from front edge of counter. Mount lavatory with rim to finish floor dimension of 34 inches maximum. Note that sink rim and counter top are not flush for drop-in style lavatories.

3.03 INSTALLATION

A. Water Closets:
   1. Closet Bowl Gaskets: Sponge rubber (wax gaskets not allowed).

B. Lavatories:

1. See detail on Drawings for installation of instantaneous water heater with integral thermostatic mixing valve.
2. Coordinate with Division 26 for installation of 120V sensor activated faucets.

END OF SECTION

SECTION 22 4100

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

C. Section 22 4000 - Plumbing Fixtures

1.02 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required for the products listed in the Product Table, in accordance with Section 20 1000. Operation & Maintenance Information required as indicated in the Product Table in accordance with Section 20 2000.

B. Operation & Maintenance Information requirements indicated by number designation as follows. Refer to Section 20 2000 for a description of each type of information.
   1. Shop Drawings (submittal data)
   2. Product Data (submittal data), including documentation of ORS 453.005 (7) (e) compliance.
   3. Manufacturer's Operation Manuals
   4. Manufacturer’s Service and Lubrication Requirements
   5. Service Contracts and Field Start-up Reports
   6. Cleaning, Certification, and Test Reports
   7. System Information
   8. Warranties

	Operation & Maintenance Information							
PRODUCT TABLE	1	2	3	4	5	6	7	8
Fixture Traps		X						
Stops and Supplies		X						
Trap and Supply Insulation		X						
Cleanouts		X						
Septic Tanks	X	X	X	X	X	X	X	X

C. Shop drawing and Product Data shall include:
   1. Factory piping diagrams, and set-up/adjustment data for Hi/Lo and extended flow range thermostatic master supply fixtures.

PART 2 - PRODUCTS

2.01 FIXTURE TRAPS

A. P-Traps, Exposed Locations:
   1. Materials: Chrome plated brass, 17 gauge minimum.
   2. Joints: Metal to metal ground.
   3. Flange: Chrome-plated steel.
   4. Manufacturer: American Standard, Kohler, Dearborn Brass, McGuire, Zurn, EBC, or approved.

B. P-Traps, Concealed within chases, walls, or underfloor:
   1. Materials: One piece cast iron.
   2. Joints: No-hub.

2.02 STOPS AND SUPPLIES

A. Stops and Supplies:

1. Valve: Chrome-plated brass, angle pattern, loose key.
2. Keys: Provide 2 keys for first valve and 1 additional key for each additional 10 valves.
3. Inlet: 1/2 inch copper, compression fitting, with chrome-plated cover sleeve and stainless steel escutcheon.
4. Outlet: 3/8 inch copper, compression fitting.
5. Supply Riser: 3/8 inch flexible copper, non-corrugated, chrome-plated, with nosepiece and length to suit fixture served.
6. Compliant with ANSI/NSF 372, ANSI/NSF 61.
7. Manufacturer: Brasscraft, T&S, McGuire, Robert Manufacturing, Chicago, Eastman, EBC, Zurn, or approved. Similar to McGuire "Standard" LF2165CCLK.

2.03 TRAP AND SUPPLY INSULATION

A. Trap and Supply Insulation Kits
1. Complies with ADA requirements for insulating pipes and fittings under handicapped accessible fixtures.
2. Material: Molded closed cell vinyl.
3. Components: Pre-molded to fit trap, tail piece, wall bend, supplies, and stops.
4. Burning Characteristics: Self-extinguishing when tested in accordance with ASTM D635.
5. Color: White.
6. Manufacturer: McGuire, Truebro, EBC, or approved. Similar to McGuire "ProWrap".
7. Products shall comply with the requirements of Oregon Revised Statute (ORS) 453.005 (7) (e), effective January 1, 2011. The referenced statute limits the use of three types of brominated fire retardant chemicals, which are defined as hazardous substances.

2.04 CLEANOUTS AND CLEANOUT COVERS

A. Wall Cleanouts, Interior Finished Areas:
1. Plug: Cast iron spigot ferrule with bronze, taper thread.
2. Cover: Round nickel bronze frame with cover, perimeter vandal proof screws, anchoring lugs.
3. Manufacturer: Jay R. Smith, Josam, Jonespec, Mifab, Wade, Watts, Zurn, or approved. Similar to Jay R. Smith 4436-U-NB.

B. Wall Cleanouts, Interior Unfinished Areas and Concealed:
1. Plug: Bronze, taper thread.
2. Cover: Shallow stainless steel or deep chrome plated bronze, secured to plug with countersunk, vandal proof screw.
3. Manufacturer: Jay R. Smith, Josam, Jonespec, Mifab, Wade, Watts, Zurn, or approved. Similar to Jay R. Smith 4472-U (shallow) or 4715-U (deep).

C. Floor Cleanouts, Finished Areas:
1. Body: Coated cast iron two piece, adjustable.
2. Plug: Bronze, taper thread.
3. Cover: Nickel bronze, secured to body with vandal proof screws.
4. Adjustable Carpet Clamp Frame: Required when cleanout is located in carpeted area.
5. Manufacturer: Jay R. Smith, Josam, Jonespec, Mifab, Wade, Watts, Zurn, or approved. Similar to Jay R. Smith 4023 (4023-x in carpeted areas).

D. Floor Cleanouts, Unfinished Areas:
1. Body: Coated cast iron, two piece, adjustable.
2. Plug: Bronze, taper thread.
3. Cover: Cast iron, heavy duty, with vandal proof, center-securing screw.
4. Manufacturer: Jay R. Smith, Josam, Jonespec, Mifab, Wade, Watts, Zurn, or approved. Similar to Jay R. Smith 4243.

E. Outside Cleanouts:
1. Body: Cast iron, free of housing.
2. Housing: Coated cast iron, double flanged.
3. Cover: Heavy-duty cast iron, secured to housing with vandal proof screws.
4. Plug: Bronze, taper thread.

5. Manufacturer: Jay R. Smith, Josam, Jonespec, Mifab, Wade, Watts, Zurn, or approved. Similar to Jay R. Smith 4253.

2.05 THERMOSTATIC MIXING VALVES

A. Mixing Valve (MV-1):
   1. Features: Adjustable temperature control, straight checkstops, 1/2 inch IPS connections, compensates for fluctuations in supply temperature and pressure.
   2. Certification: ASSE 1070.
   3. Capacity: 0.5 gpm to 3.0 gpm flow range, maximum 20 psi pressure differential at 2.2 gpm flow.
   4. Compliant with ANSI/NSF 372, ANSI/NSF 61-G.
   5. Manufacturer: Powers, Leonard, Symmons, Lawler or approved. Similar to Powers Hydroguard Series LFe480.

2.01 SEPTIC TANKS:

A. Septic Tanks:
   1. Provide all tank components and accessories for a complete and operational installation.
   2. Concrete Tanks: Reinforced precast concrete tank conforming to ACI-318-89 Building Code, ASTM A-615 Grade 60, ASTM C-150 Type II, ASTM C857 (latest revision) and H-20 vehicle loading. Concrete shall have a compressive strength of 4,000 psi at 28 days. Tank shall be sealed water tight. Install fiberglass riser sections with PVC cover. Tank and all tank accessories shall conform to DEQ requirements
   3. Capacity: 1000 gallons.
   4. Manufacturer: Willamette Graystone Inc. or approved.

PART 3 - EXECUTION

3.01 CLEANOUTS

A. Provide cleanouts where indicated on Drawings and additional cleanouts as required to meet code requirements.

B. Install in accordance with cleanout details on drawings.

C. Location: Cleanouts may be located within a 5 foot radius of where shown on drawings at Architect's discretion.

D. Wall Cleanouts: Provide deep cover where pipe hub extends beyond face of finished wall.

E. Floor Cleanouts: Provide floor and outside cleanouts for all locations shown on Drawings. Floor and outside cleanouts are not to be deleted or replaced by other types without Engineer's approval.

3.02 SEPTIC TANK

A. Installation:
   1. Per manufacturers standards and state of Oregon on-site rules 340-71 and 73.
   2. Tanks shall be tested and certified watertight per Oregon On-site Rules 340-71 and 73.

END OF SECTION

SECTION 22 5400

PIPING SYSTEMS CLEANING, DISINFECTION AND TREATMENT

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Section 20 1000 - General Mechanical Provisions

B. Section 20 2000 - Mechanical Operation and Maintenance Manuals

1.02 SECTION INCLUDES

A. Disinfection and bacteriological testing of Domestic Water Systems.

1.03 QUALIFICATIONS

A. Work of this section shall be performed by an approved firm specializing in cleaning, disinfection, and treatment of piping systems. Work shall be performed by qualified personnel with chemical and laboratory experience. Water samples to be tested by a bacteriological laboratory or testing facility certified by the State of Oregon.

B. Approved Firms:
   1. Mount Hood Chemical Corporation - Portland, Oregon
   2. Chemcoa - Tualatin, Oregon
   3. Hydro-Chlor - Pleasant Hill, Oregon

1.04 SHOP DRAWINGS, PRODUCT DATA, OPERATION & MAINTENANCE DATA

A. Submittals required in accordance with Section 20 1000. Operation & Maintenance Information required in accordance with Section 20 2000.

B. Provide cover sheet with each report containing:
   1. Project name and location
   2. Architect
   3. Engineer
   4. Mechanical Contractor
   5. Cleaning, Disinfection, Treatment Firm

C. Bind report in 3 ring binder, properly indexed.

D. Submit three copies.

E. 30 days after Contract is awarded, submit 3 copies of preliminary field test reports to be used for recording procedure/readings during cleaning/disinfection/chemical treatment work to Engineer for review. Reports to include (as a minimum) all data required elsewhere in this Section.

F. Provide Final Report prior to Contractor's application for substantial completion.

G. Submittals required for the following:
   1. Domestic Water System:
      a. Disinfection Procedure Report, containing:
         1) Name and location of the job site and date when disinfection was performed.
         2) Material used for disinfection.
         3) Retention period of disinfectant in piping system.
         4) Concentration (PPM) of disinfectant during retention (initial and residual).
         5) Concentration (PPM) of disinfectant after flushing system.
         6) Statement that disinfection was performed as specified.
         7) Signature and address of company/person performing disinfection.
      b. Bacteriological Test Report, containing:
         1) Name and location of the job site and date when samples were obtained.
         2) Name and address of State certified laboratory or testing facility that performed tests (include lab certification number).
         3) The coliform organism count.

PART 2 - EXECUTION

2.01 DOMESTIC WATER SYSTEM

A. Notify Architect twenty-four (24) hours prior to performing disinfection.

B. Disinfection: The domestic (potable) water system shall be disinfected prior to use in accordance with Oregon Administrative Rules, Section 333-61-0050; Oregon Health Division, Public Water Systems, Part (11), "Disinfection of Facilities" and AWWA C651, in addition to the following procedure:

1. Option #1:
    a. Flush piping system with clean, potable water to remove any debris or foreign material until only potable water discharges from outlets. Provide temporary piping or hoses, remove any plugs or caps, and open valves as necessary to flush entire system including dead-end headers and risers. Sectionalize piping system to obtain a minimum of six (6) feet per second flushing velocity. Remove all temporary hoses and piping after flushing. Clean all strainers and remove faucet aerators, to be replaced after disinfection is complete.
    b. Provide a valved service tap at the water service entrance, downstream of the backflow preventer, for use as a chlorine injection point. Inject chlorine at a constant rate using a proportioning pump or similar device. Open section and zone valves.
    c. Fill piping system and/or parts thereof with a water-chlorine solution of least fifty (50) parts per million chlorine. Fully open each outlet during injection until chlorine residual concentration at all outlets is no less than fifty (50) parts per million.
    d. Close outlet valves and faucets and secure. Allow solution to stand in retention for minimum twenty-four (24) hours. After retention, verify residual level of chlorine remains at fifty (50) parts per million. If less, repeat process as described above.
    e. Following the twenty-four (24) hour retention, flush the system with clean, potable water until the chlorine residual in the discharged flushing water does not exceed the chlorine residual in the potable water source, or is less than one (1) part per million.
2. Option #2:
    a. Follow steps (a.) through (e.) using water-chlorine solution of at least two hundred (200) ppm chlorine for a minimum of three (3) hours retention.

C. Bacteriological Water Analysis: Upon completion of disinfection, contractor shall obtain and submit for testing one water sample from each of the most remote hot and cold water outlets in building.

D. Approval: If the disinfection certification or bacteriological analysis report does not satisfy the above minimum requirements, the entire disinfection and testing procedure must be repeated. Under no circumstances shall the contractor permit the use of any portion of the domestic water systems until disinfection and testing results have been accepted by the Engineer.

END OF SECTION