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Design & Construction Standards:  
**TECHNICAL GUIDELINES**

Division 22

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**FACILITY MANAGEMENT**

April 2016

## SECTION 22 05 00

### COMMON WORK RESULTS FOR PLUMBING

#### PART 1 - GENERAL

##### 1.01 REFERENCES

- A. American National Standards Institute (ANSI)
- B. American Society of Mechanical Engineers (ASME)
- C. National Electric Code (NEC)
- D. National Electrical Manufacturer's Association (NEMA)
- E. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)
- F. American Society for Testing and Materials (ASTM)
- G. National Fire Protection Association (NFPA)
- H. Underwriters Laboratories (UL)

##### 1.02 QUALITY ASSURANCE

- A. Welder Qualifications: Welding shall be performed by ASME Certified Welders with current certificate in accordance with ANSI B31.1 for shop and project site welding of piping work.

#### PART 2 - PRODUCTS

##### 2.01 DIELECTRIC PIPE FITTINGS AND ISOLATORS

- A. Manufacturers:
  - 1. Precision Plumbing Products: Clearflow dielectric waterway.
  - 2. Perfection Corporation: Dielectric Waterway.
  - 3. Victaulic.
- B. Dielectric waterways:
  - 1. Designed to meet requirements of ASTM Standard F-492.
  - 2. Capable of continuous use at 230 °F and pressures up to 300 psi.
  - 3. IAMPO/UPC listed.
- C. Dielectric fittings:
  - 1. Water-way nipples only. No dielectric unions.
  - 2. Dielectric flanges and kits are approved.

#### PART 3 - EXECUTION

##### 3.01 INSTALLATION

- A. Access Doors:
  - 1. Coordinate standard and fire rated access doors with the Architect.
  - 2. 20" by 20" minimum size or larger as required for service use on mechanical equipment.
  - 3. Locate where required for access to valves, shock absorbers, dampers, controls, mechanical equipment and appurtenances. Lockable where accessible by students. Door must be clear in front.
- B. Sleeves, Plates and Closures:
  - 1. Protection for Insulated Pipes.
    - a. When insulated pipes penetrate floors which will be covered with finish flooring, provide a sheet metal protective covering around the insulation jacket.

- b. Sheet metal shall extend above the pipe sleeve far enough to protect the insulation from bumping by polishing machines and vacuum sweepers.
    - c. Space between the pipe sleeve and the sheet metal shall be sealed.
  - 2. Floor Sleeve Heights
    - a. Rooms with floor drains: Extend 2" above floor.
    - b. Kitchens and Mechanical Equipment Rooms: Extend 4" above floor.
    - c. Other areas where pipes are exposed: Extend 1/4" above floor finish material.
  - 3. Seals:
    - a. Where fire rated separations are penetrated by pipes or ductwork, the annular space around the pipe or ductwork shall be caulked with appropriate fire rated material.
- C. Suspension and anchorage:
  - 1. Use of powder actuated fasteners and toggle bolts is prohibited.
  - 2. Steel roof and floor decking, suspended ceilings, and hollow assemblies shall not be used for the attachment of anchorages or supports for suspended equipment, pipes, or other mechanical system components.
    - a. Exception: Attachment, anchorages, or supports specifically approved by a Structural Engineer.
  - 3. Equipment shall be anchored with anchors extending through the housekeeping pad or curb into the floor, except where the housekeeping pad is an extension of an inertia block separated from the floor structure.
  - 4. Specify use of retaining clips/clamps in locations where vibration may be a concern.
  - 5. Drilling, cutting or burning of, or welding to, structural members for attachment of hangers and supports is subject to prior approval by the A/E.
  - 6. Wall assemblies are not an acceptable replacement for hangers.
  - 7. Signs shall be secured to a fixed device or the building wall with corrosion-resistant chains or fasteners.
- D. Pipe Hangers, Supports and Guides:
  - 1. All pipe to be hung separately from structure or with trapeze hung with two hanger rods minimum.
    - a. No pipe shall be supported from another pipe. All pipe to be supported from building structure (deck, beam, joist, wall and or floor).
    - b. The use of perforated metal and/or plastic strapping, aka "holy iron" for support on any piping installation is prohibited.
  - 2. Specify hanger tolerances.
  - 3. Hangers in contact with steel, iron, cast or ductile iron shall be plated.
  - 4. Hangers in contact with copper piping shall be copper clad or have a suitable lining to prevent electrolysis.
  - 5. Hangers for hot and cold insulated pipe shall be installed around the outside of the insulation with saddles and calcium silicate inserts for 1/2" and larger.
    - a. Provide galvanized metal shields, heavy density insulation inserts, and roller support points to prevent insulation damage at these hangers.
  - 6. Plastic piping shall be supported on continuous galvanized steel trough, with clevis hangers spaced as required for metallic piping or as recommended by supplier.
  - 7. Pipes that run parallel and have similar grade or pitch may be supported on trapeze hangers with spacing determined by the smallest pipe.
  - 8. Special pipe hanger and support provisions required for control of pipe expansion, vibration, and sound transmission shall be in accordance with Section 15 24 00 - Mechanical Sound and Vibration Control.

9. Gas piping installed on flat roofs shall be at code approved height supported by a unistrut "H" support stand. Pipe shall be secured to strut brace cross member by a pipe size strut clamp. Upright strut pieces shall be secured to a 2' X 2' X 2" concrete paver using strut feet bolted to paver. Bottom of paver shall be set on a 26" X 26" square of EPDM roof material afixed to underside of paver. Supports shall be spaced per code based on pipe diameter.
  10. Pipe hangers shall be tightened with all hangers plumb and tight against the pipe or insulation saddle with all adjustment nuts and lock nuts properly installed.
  11. If any hangers are found to be out of plumb or not adjusted properly, the Contractor shall be responsible for the cost of removal and reinstallation of the ceiling in order to inspect and correct the hanger installation.
- E. Excavating and Backfilling: Refer to Division 2 standards.
- F. Cutting and Patching: Refer to standard Section 01 73 29 Cutting and Patching.

**END OF SECTION 22 05 00**

## SECTION 22 05 23

### GENERAL DUTY VALVES FOR PLUMBING PIPING

#### PART 1 GENERAL

##### 1.01 OPERATION AND MAINTENANCE DATA

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.
- C. Drinking water components shall meet NSF/ANSI Standard 61 or NSF/ANSI Standard 372.

#### PART 2 PRODUCTS

##### 2.01 ACCEPTABLE PRODUCTS

- A. Reduced Pressure Backflow Prevention Assemblies:
  - 1. "In Line" devices
    - a) Sizes 3/4" - 2": Febco LF825Y or Zurn Wilkins 975XL2 or Watts LF009QT
    - b) Sizes 2-1/2" - 8": Febco LF860 or Zurn Wilkins 375 or Watts 957
  - 2. Compact Configuration ("N" and "Vertical")
    - a) Sizes 2-1/2" - 10": Febco LF880/LF880V or Zurn Wilkins 475/475V or Watts 957
    - b) Valve Setter, 2-1/2" Flange x Flange: Febco 611 or Wilkins FLS
    - c) Valve Setter, 3" - 10" Mechanical Joint x Mechanical Joint: Febco 611 or Zurn Wilkins MJS
- B. Pressure Type Vacuum Breaker Assemblies – Angle Pattern:
  - 1. Interior Kitchen Equipment, Size 1/2": Watts LF008PCQT-SC
    - a) Satin chrome finish, spill resistant
  - 2. Exterior, Sizes 1/2" – 2": Febco 765 or Zurn Wilkins 720A or Watts 800M4QT
- C. Atmospheric Vacuum Breaker:
  - 1. Sizes 1/2" – 3/4": Febco 715 or Zurn Wilkins 35XL or Watts LF288A
  - 2. Sizes 1" - 2": Febco 710 or Zurn Wilkins 35XL or Watts LF288A
- D. Strainers:
  - 1. "Y" Pattern cast iron or bronze body
  - 2. Fusion epoxy coated cast iron – internal and external
  - 3. Blow off connection: 1" for sizes 2-1/2" & 3"; 1-1/2" for 4" size; 2" sizes 6" - 10"
  - 4. Screen
    - a) Sizes 2-1/2" - 4": Type 302/304 stainless steel with 1/16" perforation
    - b) Sizes 6" - 10": Type 302/304 stainless steel with 1/8" perforation
    - c) Blow off connection shall have removable plug.
    - d) 175 psi W.P.
- E. Building shut off valves up stream of backflow preventers, interior installations:
  - 1. Domestic Potable Systems
    - a) Resilient wedge
    - b) Fully rubber encapsulated wedge gate
    - c) Cast iron body with epoxy coating – internal and external

- d) Flanged ends
- e) 200 psi W.P.
- f) AWWA-C509 NRS (Non-rising stem)
- g) Provide plugs for test cock tapings
- h) Schedule

Make Model	<u>FEBCO</u> 781-005 thru 010	<u>WATTS</u> 405 RW 700/102 thru 700/109	<u>WILKINS</u> 48 Series
Sizes	2-1/2" thru 10"	2" thru 12"	2-1/2" thru 10"

F. Ball Valves:

- 1. Straight pattern
- 2. Bronze body
- 3. Stainless or chrome plated ball
- 4. 300 psi W.P. @ 180°F water temperature

G. Flanges Cast Iron, Ductile, and Bronze:

- 1. 250 psi min. W.P.

H. Hose End Anti Siphon Vacuum Breaker:

- 1. 3/4" FHT x 3/4" MHT
- 2. Non removable (break of set screws)
- 3. Finish: plain brass
- 4. Woodford (Nidel) 34HD or Zurn Wilkins BFP-8F

I. Wafer Check Valve:

- 1. Nibco # W-910/960 series or equivalent

J. Double Check Backflow Prevention Assemblies for Steam Pressure Cabinet:

- 1. Watts series LF7 or Zurn Wilkins 700XL

K. Ball Valves – up to 2":

- 1. Bronze body, tunnel balls
- 2. Acceptable manufacturers
  - a) Apollo
  - b) Kitz
  - c) Hammond
  - d) Jamesbury
  - e) Jenkins
  - f) Milwaukee
  - g) Nibco
  - h) Watts

L. U.L., F.M. Approved or Listed Valve approved manufacturers:

- 1. Grinnell
- 2. Kennedy
- 3. Keystone
- 4. Mission

5. Mueller
  6. Nibco
  7. Victaulic
- M. Bronze pressure-rated valve approved manufacturers:
1. Crane
  2. Hammond
  3. Lunkenheimer
  4. Milwaukee
  5. Nibco
  6. Stockham
  7. Walworth
- N. Iron body pressure-rated valve approved manufacturers:
1. Crane
  2. Kennedy
  3. Lunkenheimer
  4. Milwaukee
  5. Mueller
  6. Stockham
  7. Walworth
- O. Stop valves: Shall be ¼” turn ball valve type; no plastic:
- P. General valve requirements:
1. Pressure rated type
  2. Either flanged or threaded ends; solder ends are not acceptable
  3. Rising stem or ball valves
- Q. Gate valves, steam only: Refer to standard Division 23.
- R. Balancing valves: See standard Division 23.
- S. Anti Flood System:
1. Anti flood system controller equipment furnished and installed by Contractor
    - a) UPS power supply, 120VAC
    - b) 24AC volt power supply in control panel
    - c) Integral control panel: Geo Tech GT2000, relay 2 N.C., 2 N.O. 120VAC contacts, water level floats, pilot lights and reset
  2. Control valve furnished and installed by Contractor
    - a) Bermad 410 with manual override, 24VAC solenoid pilot
    - b) N.C. held open type, electrical activation and hold
    - c) ASCO (Automatic Switch Co. solenoid valve only 24VAC)
  3. Other anti flood system equipment furnished by Owner and installed by Contractor
    - a) Time Delay Relays: 2 N.O. and 2 N.C. Contacts, square D Model 9050 JCK 70V14
    - b) Water Level Floats: 24VAC
  4. Alarm

- a) Provide conduit and wire for alarming the main security system panel.
    - i) Terminate at the main security alarm panel in a junction box.
    - ii) Refer to security system standards.
  - b) Final connection to security alarm panel by DPS Security personnel
5. Control conduit: EMT
6. Controls: Coordinate controls standards with DPS and the DPS Controls Application Engineer.

**ANTI FLOOD SYSTEM CONTROL SEQUENCE**

- **Condition Normal:**

Float Switches in non detection mode

Main Valve solenoid in energized condition holding normally closed main control valve in open position

Control panel has GREEN pilot activated indicating power on

Control panel has YELLOW pilot activated indicating panel is online

- **Backflow Discharge Overflowing Containment Basin:**

Float type sensors detecting water level in containment basin

Controller de-energizes solenoid valve at supply control valve allowing normally closed, held open control valve to close discontinuing all water flow to and through the backflow preventor(s)

Activates remote alarm and local light on panel

Control panel has GREEN pilot indicating power on to control panel

Control panel has RED pilot indicating unit is tripped and control valve is in closed position

- **Loss of Power – Power Failure – UPS Failure.**

Loss of power de-energizes the control panel

At de-energization of the control panel the solenoid allows the normally closed, held open control valve to close

Contacts are closed for alarm condition - no alarm due to power failure

The control valve can be opened manually by the manual override provision on the valve

With return of power the panel will go to normal activation

- Note: Under normal power failure, the UPS system will activate immediately and keep the panel in normal operation for a minimum of thirty minutes. If UPS failure occurs, the course of operation will be as noted for “LOSS OF POWER AND UPS FAILURE.”

T. Containment Basin:

1. Field built or premanufactured; see drawings for sizes and standard details.
2. Provide necessary piping for complete drainage of basin.

U. Heated Enclosure for Backflow Preventers:

1. Provide a weatherproof heated enclosure for backflow prevention devices installed above grade exterior to building. 1” insulation for enclosures containing devices up to 2” - 1½” insulation for 2 ½” and larger. Flame Spread of 25 per ANSI/ASHRAE, service temperature of -100°F to 250°F minimum “R” factor of eight (8). Insulation shall be fastened securely to enclosure and shall not be subject to loosening and peeling. Structural components shall be aluminum. Fiberglass, wood or wood products will not be allowed in the assembly; this includes the roof, walls and access panels. All assembly shall be accomplished by the manufacturer, factory assembled; on-site assembly of any kind will not be allowed. Provide locks and



access space as required, complete with dual bolted hasps, and furnished with two heavy duty padlocks with 3 keys each.

2. Openings for drainage shall be provided and shall remain closed against wind and intrusion except when the device is discharging. Openings shall be designed to accommodate the maximum discharge of the device, and shall protect against intrusion of 40 MPH wind, debris, insects and animals, through the use of separate aluminum or stainless steel screen and wind flaps.
3. Unit and heater must be able to withstand and provide for interior temperature of +40°F with an ambient exterior temperature of -30°F and a wind velocity of 15 MPH.
4. Electric power shall be protected with a ground fault interrupter located within the basin with 18" clearance from receptacle base to grade.
5. All mounting hardware and assembly fasteners shall be Stainless Steel type 302-18-8 or better, anchor hardware to be adjustable vertically to accommodate reasonable uneven foundation slabs.
6. Make: Hot Box company or approved equivalent

Plan Code:	*HTB-___	*HTB-___	*HTB-___
Style:	HOT BOX	LOK BOX	HOT ROK
Model:	HB SERIES	LB SERIES	HR SERIES

\* (fill in unit plan code number or letter)

Specific No.	HB-___	LB-___	HR-___
Electrical Requirements	___watts -120v-60-1ph (for heater)		

7. Provide the following accessories:
  - a) Power out alarm with battery and charger, Model PLAHBO plug in 120v wireless remote temperature alarm, Model TA4, 120v
  - b) Provide duplex 120v outlets for alarms. Verify locations with manufacturer.

V. Irrigation System Backflow Preventer Strong Box:

1. Schedule 40 galvanized steel pipe end frames, 1" angle iron base, 1/2" #13 gauge diamond pattern flat rolled expanded steel with all welded construction, 4" o.c., all powder coated finish, vandal resistant, tamperproof hardware, forest green color
2. BPGI: GuardShack GS Series

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Low-pressure, compressed-air piping:
  1. Ball valves, NPS 2 and smaller: One-piece, 400-psig CWP rating, copper alloy
  2. Equipment-isolation ball valves, NPS 2 and smaller: Safety-exhaust, bronze
  3. Ball valves, NPS 2-1/2 and larger: Class 150, ferrous alloy
- B. Domestic water (hot and cold):
  1. General
    - a) NPS 1/2 - 2: threaded, solder or press fp ball
    - b) NPS 2 1/2 and larger: flanged epoxy coated resilient wedge
  2. Hot water circulating
    - a) All sizes: Threaded circuit setter or ball valve with limit stop
  3. Check valves (swing) TO BE USED IN HORIZONTAL INSTALLATION ONLY
    - a) NPS 1/2 - 2: Threaded or solder end

- b) NPS 2 and larger: Flanged iron body
- 4. Check valves (silent or lift) USED IN VERTICAL OR HORIZONTAL INSTALLATIONS
  - a) NPS ½ - 2": Threaded or solder end
  - b) NPS 2 and larger: Wafer or flanged
- C. Backflow Preventer:
  - 1. Install backflow preventers of the same size as the line sizes in which installed.
  - 2. Provide containment/detection basin, exterior drain discharge through wall, or heated exterior enclosure as detailed on drawings.
  - 3. Mount reduced pressure backflow preventer(s) in accordance with all local regulations. Where regulations do not exist mount backflow preventor a minimum of 30 inches and maximum 60 inches above finished floor and a minimum of 18 inches away from any wall.
  - 4. Provide line size strainer upstream of all backflow preventers.
  - 5. Provide wafer check valves on inlet and outlet of the reduced pressure backflow preventor assembly.
  - 6. All backflow prevention devices must be tested by a certified cross-connection control technician, with copies of report included in O & M manuals and submitted to Denver Water.
  - 7. Contractor shall provide a reinforced concrete slab of sizes required and with anchors for attachment of the enclosure. Verify requirements with enclosure manufacturer, and install per the manufacturers recommendations and requirements. Install perfectly plumb and level, provide vandal resistant construction.

**END OF SECTION 22 05 23**

## SECTION 22 05 48

### MECHANICAL SOUND AND VIBRATION

#### PART 1 GENERAL

##### 1.01 QUALITY ASSURANCE

###### A. General acoustic criteria:

1. Noise levels due to equipment and ductwork to permit attaining sound pressure levels in all 8-octave bands in occupied spaces conforming to NC Curves: All spaces NC-35
  - a) Exceptions:
    - i) Spaces within 15-foot radius of supply and return ducts from shafts: NC-40/
    - ii) Lobbies, restrooms, common areas: NC-40/
    - iii) Kitchens: NC-45-50/
    - iv) Mechanical rooms: NC-50-60/

#### PART 2 PRODUCTS

##### 2.01 PIPING AND EQUIPMENT ISOLATION

###### A. Acceptable manufacturers:

1. Amber/Booth Co.
2. Korfund
3. Mason Industries, Inc.
4. Metraflex
5. Vibration Mountings and Control Co.
6. Vibrex

###### B. Double-Deflection Neoprene Mountings (not required when the system is solid-mounted)

###### C. Spring Isolator Mountings (not required when the system is solid-mounted)

###### D. Restrained Spring Isolator Mountings (not required when the system is solid-mounted)

###### E. Vibration Hangars (not required when the system is solid-mounted)

###### F. Integral Structural Steel Bases (not required when the system is solid-mounted)

###### G. Steel Cradle Bases (not required when the system is solid-mounted)

###### H. Concrete Inertia Bases (not required when the system is solid-mounted)

###### I. Flexible Butyl Hose Pipe Connectors.

###### J. Flexible Neoprene Sphere Pipe Connectors.

###### K. Braided Flexible Pipe Connectors.

###### L. Acoustical Pipe Riser Anchors.

#### PART 3 EXECUTION

##### 3.01 INSTALLATION

###### A. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

###### B. Flexible connectors shall be installed to isolate vibration and shall not support piping or allow for correction for pipe misalignment.

- C. Install a spool in the place of each flexible connector during fabrication; insulation and final hangar adjustment. Final hangar adjustment shall be completed before installing the flexible connectors

**END OF SECTION 22 05 48**

## SECTION 22 05 53

### IDENTIFICATION FOR PLUMBING

#### PART 1 GENERAL

##### 1.01 REFERENCES

- A. American National Standards Institute (ANSI):
  - 1. ANSI A13.1: Scheme for the Identification of Piping Systems/
  - 2. ANSI Z53.1: Safety Color Code for Marking Physical Hazards.
- B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)/

##### 1.02 DEFINITIONS (Excerpts from ANSI A13.1-1981)

- A. Materials inherently hazardous:
  - 1. Flammable or explosive: materials which are easily ignited, including materials known as fire producers or those creating an explosive atmosphere.
  - 2. Chemically active or toxic: Materials which are corrosive, or are in themselves toxic or productive of poisonous gases.
  - 3. At temperatures or pressures: Materials which, when released from the piping, would have a potential for inflicting injury, or property damage by burns, impingement, or flashing to vapor state.
- B. Materials of inherently low hazard: Materials which are not hazardous by nature, and are near enough to ambient pressure and temperature that people working on systems carrying these materials run little risk through their release.
- C. Fire quenching materials: This classification includes sprinkler systems and other piped fire fighting or fire protection equipment. Includes water, chemical foam, CO<sub>2</sub>, Clean Agent, etc.

#### PART 2 PRODUCTS

##### 2.01 IDENTIFICATION MATERIALS FOR PIPING AND EQUIPMENT

- A. Metal tags:
  - 1. Round brass discs, minimum 1-1/2" diameter, with edges ground smooth.
  - 2. Each tag punched and provided with brass chain for installation.
- B. Engraved nameplates:
  - 1. Laminated three-layer plastic with engraved black letters on light contrasting background color.
- C. Pressure sensitive markers: Brady Type 350 flexible vinyl film identification markers and tape, with legend, size and color-coding per ANSI A13.1.
- D. Semi-rigid plastic identification pipe markers: Seton Setmark with legend, size and color-coding per ANSI A13.1. Direction-of-flow arrows are to be included on each marker, unless otherwise specified.
  - 1. Diameters 3/4" through 5": Setmark Type SNA markers.
  - 2. Diameters 6" or larger: Setmark Type STR markers.

#### PART 3 EXECUTION

##### 3.01 IDENTIFICATION OF PIPING AND EQUIPMENT

- A. General:
  - 1. Provide pipe identification, valve tags, stencils, or engraved nameplates to clearly identify the mechanical equipment, piping and controls of the various mechanical systems and direction of flow in piping.
- B. Methods for identification:

1. Metal tags:
  - a) Stamp tags with letter prefixes to indicate service, followed by a number for location in system.
2. Engraved nameplates:
  - a) Attach nameplates with brass screws.
  - b) Pressure-sensitive embossed labels are not acceptable.
  - c) Nameplates shall bear the same identifying legend used on the Contract Documents.
3. Pressure-sensitive markers:
  - a) Apply pressure-sensitive markers with complete wrap-around.
  - b) Test marker adhesion for permanence.
  - c) Markers showing dogears, bubbles, or other failings shall be replaced.
  - d) Place markers at all branches and at a maximum of 25' on center.
4. Semi-rigid plastic identification markers:
  - a) Seton Setmark pre-molded (not pressure-sensitive) identification markers may be used at Contractor's option on service piping which is accessible for maintenance operations (but not on piping in finished spaces).
  - b) This type of marker shall not be installed on bare pipe when surface temperature exceeds 180°F unless a 1" thick insulation band is first provided under marker for protection from the hot pipe.

C. Classification of hazards of materials, designation of colors and legend

Classification	Color of Field	District Letters	Legend
<b>Flammable or Explosive:</b>			
Chemically Active or Toxic	Yellow	Black	
Acid Waste	Yellow	Black	AW
Chlorine	Yellow	Black	C
<b>Extreme Temperatures or Pressures:</b>			
Domestic Hot Water	Yellow	Black	HW
Domestic Hot Water Circulating	Yellow	Black	HWC
180° F Domestic Hot Water	Yellow	Black	180°F HW
180° F Domestic Hot Water Circulating	Yellow	Black	180°F HWC
High-Pressure Compressed Air (over 90 psig)	Yellow	Black	CA
<b>Liquid or Liquid Admixture:</b>			
Domestic Cold Water	Green	White	W
Distilled Water	Green	White	DW
Sanitary Sewer	Green	White	SAN
Waste Vent	Green	White	V
Storm Sewer	Green	White	SS
<b>Gas or Gaseous Admixture:</b>			
Medium-Pressure Compressed Air (30 to 90 psig)	Blue	White	CA XXPSI
Low-Pressure Compressed Air (less than 30 psig)	Blue	White	CA XXPSI
Vacuum	Blue	White	VAC
<b>Fire-Quenching Materials:</b>			
Water, Foam, CO <sub>2</sub> , Clean Agent	Red	White	FL
Fire Lines	Red	White	FL

D. Piping:

1. Identify all piping accessible for maintenance in crawl spaces, tunnels, above ceilings, and access spaces, as well as exposed-to-view, utilizing stenciled markings according to the following procedures.
  - a) Use an arrow marker for each pipe-content legend. The arrow shall always point away from the pipe legend and in the direction of flow. Color and height of arrow shall be same as content legend lettering
  - b) If flow can be in both directions, use a double-headed arrow indication.
  - c) Apply pipe legend and arrow indication at every point of pipe entry or exit where line goes through wall or ceiling cut.
  - d) Apply pipe legend and arrow indication within three feet of each valve to show proper identification of pipe contents and direction of flow.
  - e) The legend shall be applied to the pipe so that lettering is in the most legible position. For overhead piping, apply legend on the lower half of the pipe where view is unobstructed, so that legend can be read at a glance from floor level.
  - f) For pipes under  $\frac{3}{4}$ " O.D., fasten brass tags securely at specified legend locations.
  - g) Legends on steam piping, condensate return, compressed air, gas, and vacuum systems shall include working pressure or vacuum.
- E. Valves:
  1. System service valves, including fire protection, gas, vacuum and special service valves located inside the building shall be tagged and identified as to type of service.
  2. Valves or cocks controlling branch mains or risers to various portions of the building shall be tagged and identified as to service and location number.
- F. Controls:
  1. Magnetic starters and relays shall have engraved nameplates to identify connecting or controlled equipment.
  2. Manual operating switches, fused disconnect switches and thermal overload switches which have not been specified as furnished with indexed faceplates shall also have nameplates or be stenciled as to "connected" or "controlled" equipment.
  3. Automatic controls, control panels, zone valves, pressure electric, electric pressure switches, relays, and starters shall be clearly identified.
- G. Pumps:
  1. Pumps shall be identified as to service and zones served.
  2. Base-mounted pumps shall be stenciled or have system served nameplates.
  3. Brass tags secured by tie wires may be used on small inline pumps.
- H. Storage tanks, water treatment equipment and heaters:
  1. Tanks and heaters shall be stenciled as to service.
  2. The connecting pipes to each shall be identified and the service temperature entering and leaving the tank or heater shall be indicated.
- I. Access doors:
  1. Provide engraved nameplates to identify concealed valves, controls, dampers or other similar concealed mechanical equipment. Use the following colors for specified nameplates or labels.
    - a) Red for fire-protection devices, including dampers.
    - b) Blue for air-handling devices.
    - c) Green for plumbing devices and piping.
- J. Lift-out ceilings:

1. Provide adhesive labels on ceiling grid to identify concealed valves, filters, fire/smoke dampers or similar concealed mechanical equipment that is directly above nameplate in the ceiling space. Use the following colors for specified labels.
    - a) Red for fire-protection devices, including dampers
    - b) Blue for air-handling devices
    - c) Green for plumbing devices and piping
  2. Equipment, including motors, shall be stenciled with the proper class-subclass code and correct unit identification, using a contrasting color.
  3. The location of fire dampers above accessible ceilings shall be identified by a red circular dot at least  $\frac{3}{4}$ " in diameter or embossed tape adhered to the nearest ceiling grid member.
  4. Locations of air-handling devices which have filters and are above accessible ceilings shall be identified by a blue circular dot at least  $\frac{3}{4}$ " in diameter or embossed tape adhered to the nearest the nearest ceiling grid member.
- K. Terminal units:
1. Identify units with unique numbers corresponding to the drawings, and indicate the space being served.
- L. Motors controlled by energy management system:
1. The District may furnish the following self-adhering signs which the Contractor shall install as indicated:

**CAUTION**

**THIS EQUIPMENT IS  
UNDER COMPUTER  
CONTROL AND MAY  
CYCLE AT ANY TIME.  
BEFORE WORKING ON IT,  
DISCONNECT THE  
ELECTRICAL POWER  
AND CONTACT THE  
DISTRICT SERVICE  
DESK AT 720-423-4020.**

**END OF SECTION 22 05 53**



## SECTION 22 07 00

### PLUMBING INSULATION

#### PART 1 GENERAL

##### 1.01 QUALITY ASSURANCE

- A. Installer qualifications: Three years minimum successful installation experience on projects with mechanical insulation similar in scope and nature to that required for the project.

##### 1.02 PERFORMANCE CRITERIA

- A. Insulation and accessory materials shall meet the following criteria.
  - 1. Insulation Materials: Non-combustible as defined in National Fire Protection Association Pamphlet 220 and Underwriters' Laboratory Listed or Labeled.
  - 2. Flame/Smoke Ratings: Composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) flame-spread rating 25 or less, smoke-developed rating 50 or less, as tested by ANSI/ASTM E-84 (NFPA 255) method.

#### PART 2 PRODUCTS

##### 2.01 APPROVED MANUFACTURERS

- A. Armstrong
- B. Certain-Teed
- C. Knauf
- D. Manson
- E. Owens Corning
- F. Schuller (Johns-Manville)

##### 2.02 MATERIALS

- A. Insulation:
  - 1. Fiberglass
  - 2. Flexible Closed-Cell
- B. Adhesives, Sealers, Facings and Vapor Barrier Coatings must be able to accept paint where painting is required.

##### 2.03 JACKETS

- A. Puncture resistance rating based on ASTM D781 test method.
- B. Permeance ratings based on ASTM E96, Procedure A.
- C. Type AA-1 jacket:
  - 1. Material: T3003, H14 to H19 aluminum alloy.
  - 2. Thickness: 0.016" (0.4mm), minimum.
  - 3. Factory applied to insulation with 1 mil thick polyethylene moisture barrier continuously laminated across full width of jacketing.
  - 4. Seal: Integral longitudinal Pittsburgh seam with butt joint strips and weatherproof mastic.
  - 5. Approved manufacturer: Insul-Coustic "Alcorjac" or equivalent.
- D. Type GFR-1 jacket:
  - 1. Material: Heavy-duty, fire-retardant, glass fiber reinforced material with self-sealing lap.

2. Factory applied to insulation.
  3. Finish: White vinyl or white kraft suitable for painting.
  4. Bench puncture resistance: 50 units minimum.
  5. Permeance: 0.02 perms, maximum.
  6. Vapor barrier: 0.001" aluminum foil adhered to inner surface of jacket.
  7. Approved manufacturer: Owens Corning Type ASJ or equivalent.
- E. Type GFR-2 jacket:
1. Material: Heavy-duty, fire-retardant, glass fiber reinforced material.
  2. Factory applied to insulation.
  3. Finish: White vinyl or white kraft suitable for painting.
  4. Bench puncture resistance: 25 units minimum.
  5. Permeance: 0.02 perms, maximum.
  6. Vapor barrier: 0.001" aluminum foil adhered to inner surface of jacket.
  7. Approved manufacturer: Owens Corning type ASJ or equivalent.
- F. Type GFR-3 jacket:
1. Material: Glass fiber reinforced.
  2. Factory applied to insulation.
  3. Finish: White kraft.
  4. Bench puncture resistance: 15 units, minimum.
  5. Permeance: 0.01 perms, maximum.
  6. Vapor barrier: Aluminum laminated to inner surface of jacket.
  7. Approved manufacturer: Owens Corning type FRK or equivalent.
- G. Type GF-1 jacket:
1. Material: 20 x 20 mesh glass fabric.
  2. Embed in coat of lagging adhesive; finish with second coat of lagging adhesive.
  3. Approved manufacturers: Manville "Duramesh" Type 205 or equivalent.
- H. Banding:
1. Over aluminum jacketing with insulation less than 13" diameter: Stainless steel, 1/2" x 0.020.
    - a) Approved manufacturer: AJ Gerrard & Co., No. 305-SS with No. 202-SS seals.
  2. Maximum spacing 12" on center.

**2.04 PIPING INSULATION MATERIALS**

- A. Fire-retardant, moisture- and mildew-resistant, and verminproof.
- B. Suitable to receive jackets, adhesives, and coatings as indicated.
- C. Glass fiber insulation: Inert inorganic material, noncorrosive to mechanical surfaces, preformed into flexible or rigid board as indicated, suitable for temperatures to 450°F.
- D. Insulation blankets shall be the same surface temperature as the rest of the pipe.
- E. Jackets shall have all seams turned under, double stitched.
- F. Insulating cement:
  1. Dry density 34 lb/cu ft, thermal conductivity 0.91 Btu-in/hr-sq ft-°F at 400°F.

2. Approved manufacturers:
    - a) PK “Super Stick”.
    - b) Ryder “GP”.
- G. Filling and finishing cement:
1. Dry density 40 lb/cu ft, thermal conductivity 0.89 Btu-in/hr-sq ft-°F at 400°F.
  2. Approved manufacturers.
    - a) PK “Quick Cote”.
    - b) Ryder “MW”.
- H. Rigid fiberglass insulation (RFG):
1. ASTM C547, Class 1.
  2. Temperature rating: -20 to 850°F only for pipe insulation.
  3. Density: 3 lb/cu ft.
  4. Conductivity: Not more than 0.24 Btu-in/hr-sq ft-°F at 75°F.
  5. Approved manufacturers: Owens Corning “Fiberglas 25” or equivalent.
- I. Mineral wool fiber pipe insulation (MW):
1. ASTM C547.
  2. Temperature rating: 1,200°F.
  3. Density: 10 lb/cu ft.
  4. Conductivity: Not more than 0.45 Btu-in/hr-sq ft-°F at 450°F.
  5. Approved manufacturers: Roxul 1200 or equivalent.
- J. Cellular glass pipe insulation (CG):
1. ASTM C552, Type II, Class 2.
  2. Temperature rating: -450°F to 900°F.
  3. Density: 7.5 lb/cu ft.
  4. Conductivity: Not more than 0.29 Btu-in/hr-sq ft-°F at 75°F.
  5. Approved manufacturers: Pittsburgh Corning Foamglas or equivalent.
- K. Elastomeric thermal insulation (ET):
1. ASTM C534, Type 1 for piping materials; Type II for sheet materials.
  2. Temperature rating: -40 to 220°.
  3. Density: 5.5 lb/cu ft.
  4. Conductivity: Not more than 0.27 Btu-in/hr-sq ft-°F at 75°F.
  5. Permeance: 0.19 perms per inch.
  6. Approved manufacturers: Armstrong “Armaflex II” or equivalent.
- L. Expanded urethane insulation (EU):
1. ASTM C591.
  2. Temperature rating: -100°F to 220°F.
  3. Conductivity: Not more than 0.16 Btu-in/hr-sq ft-°F at 75°F.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Do not insulate cleanouts, access openings or identification plates.
- B. Neatly bevel insulation and finishes up to edges of openings, and seal edges.
- C. Hangers shall be plumb and tight against the pipe or insulation saddle with adjustment nuts and lock nuts installed. If hangers are found to be out of plumb or not properly adjusted, the contractor shall be responsible for the cost of removal and reinstallation of the ceiling in order to inspect and correct the hanger installation.
- D. Provide saddles and shields under pipe hangers.
- E. Prepare a schedule of mechanical insulation showing systems insulated, types, thickness for various sizes, temperatures and special conditions. Include saddles and shields per standard Section 23050. Include schedule on drawings or include in specifications.
- F. Plumbing system insulation:
  - 1. Domestic cold water.
  - 2. Roof drains (horizontal only but including drain bowls and initial vertical drop to horizontal).
  - 3. Domestic hot and tempered supply and circulating water.
  - 4. Domestic water heaters, storage tanks and Accumulators (not factory insulated).
  - 5. Under lavatories: Pre-molded insulation to meet ADA requirements.
  - 6. Chilled Drinking Water.
  - 7. Fittings.
  - 8. Valves.
- G. Protective jackets:
  - 1. Provide protective jackets where piping insulation is exposed to weather and where abrasion is likely.

**3.02 INSULATION SCHEDULE**

- A. Minimum insulation thicknesses shall comply with IECC 2015.

<b>Item</b>	<b>Insulation Type</b>	<b>Jacket Type</b>	<b>Insulation Thickness</b>
Potable Hot Water Piping (140°F)	RFG	GFR-1	1-1/2"
Potable Cold Water Piping (45°F)	RFG	GFR-1	1"
Heating Water Return Piping (125°F)	RFG	GFR-1	1-1/2"
Roof Drain Piping (-6°F)	ET	---	2"
Heat Exchangers	CS	GF-1	3-1/2"
Storage Tanks	RFG	GF-1	2"

**END OF SECTION 22 07 00**

## SECTION 22 11 16

### DOMESTIC WATER PIPING

#### **PART 0 GENERAL**

##### **0.01 OPERATING AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 1 PRODUCTS**

##### **1.01 MATERIALS**

- A. Domestic Hot and Cold Water:
  - 1. Copper tube Type L soldered to wrought copper fittings or to cast bronze tensile strength.
  - 2. Fittings using low-liquidus/solidus solder, which does not contain lead or antimony, with a shear strength equal or greater than 10,000 psi.
  - 3. Meet ASTM B 88.
  - 4. Approved solder/flux manufacturer: All-State Aquasafe 100 or equal.
  - 5. The Viega ProPress and/or Appollo/Elkhart press technology systems are allowed for potable water piping only. System valves to be Viega and/or Appollo ball valves up to 2". Appollo is approved for 2-1/2" sizes and larger.
  - 6. Saddle tee fittings are not allowed on domestic water.
- B. Compressed Air:
  - 1. Shop and industrial use (less than 250 psi and less than 200°F).
    - a) Type L copper tubing and wrought copper fittings with soldered joints (same as domestic water)
  - 2. Laboratory
    - a) Use tubing material as required by laboratory needs.
- C. Laboratory Vacuum (Classroom and Industrial Use)
  - 1. Type L copper tubing and wrought copper fittings with soldered joints (same as domestic water)

#### **PART 2 EXECUTION**

##### **2.01 INSTALLATION**

- A. Underground plumbing shall be surrounded by a minimum of 6" of "squeegiee."
- B. Pipe shall be accurately cut and set in place without springing or forcing.
- C. Structure of the building shall not be compromised.
- D. Above ground piping shall run parallel with the lines of the building unless otherwise indicated.
- E. Bare, uninsulated pipe shall not bear directly on structural elements so as to transmit sound to the structure or prevent flexible movement of the lines.
- F. Change in direction of piping shall be made with fittings.
- G. Allowance shall be made for expansion and contraction of hot water piping. Provide expansion loops where required.
- H. Braided domestic water piping tubes not allowed on any fixture.
- I. Joints shall be made with fittings of compatible material and for the specific purpose intended.
- J. All domestic water branches to be valved.
- K. Piping runs are prohibited above or in the following locations:

1. Elevator machine rooms.
  2. Telephone or computer equipment rooms.
  3. Sensitive instrument and equipment rooms.
  4. Electrical switchgear, busways and equipment rooms.
- L. Pipes passing through concrete or masonry walls, floors, or roofs shall be provided with pipe sleeves fitted into place at the time of construction.
- M. Caulking of screwed joints or holes is not acceptable.
- N. Maximum waste arm distance between trap and vent (dirty Arm).
1. 1 ¼" and 1 ½" – 3'-0" Max.
  2. 2" – 5'-0" Max.
- O. Minimum water closet waste to be 4" line.

## **2.02 FIELD QUALITY CONTROL**

- A. Plumbing piping and fixtures shall be installed under the direct, on-site supervision of a journeyman plumber licensed by the State of Colorado. The ratio of plumbing apprentice-helpers shall not exceed two apprentice-helpers for each journeyman.
- B. Defective work found during tests and inspections shall be corrected and the tests repeated before acceptance.
- C. Plumbing systems shall be tested in accordance with NAPHCC Plumbing Code and other applicable codes.
- D. System Flushing:
1. Before operational tests or disinfection, potable piping systems shall be flushed with potable water.
  2. Sufficient water shall be used to produce a minimum velocity of 2.5 feet/sec through the piping.
  3. Flushing shall continue until all the dirt and other material is removed and the water is not discolored.
  4. Drain the system at low points.
- E. Operational tests shall be performed after flushing and before disinfecting. Operational tests shall last not less than 8 hours for each system and shall include the following:
1. Time, date, and duration of the test.
  2. Water pressure at most remote and highest fixture.
  3. Operation of each fixture and trim.
  4. Operation of each valve, hydrant, and faucet.
  5. Pump suction and discharge pressure (if applicable).
  6. Temperature of domestic water supply. Hot water must reach spout within 30 seconds or less.
  7. Operation of each floor and roof drain (if applicable) by flooding with water.
  8. Operation of each vacuum breaker and backflow preventer.
  9. Operation of the water booster system including pump start and stop pressure (if applicable).
  10. Compressed air reading at each compressor inlet and outlet.
  11. Laboratory piping shall be tested in accordance with the manufacturer's recommendations.
- F. Disinfection:
1. After flushing and operational testing is complete, the domestic hot and cold water system shall be disinfected with chlorinated water.
  2. The chlorination procedure shall be in accordance with AWWA M20.
  3. The chlorinated water shall remain in the system for a minimum of 24 hours.
  4. Each valve shall be opened a minimum of 2 times during the testing period to ensure proper disinfection.

5. After disinfection the piping system shall be flushed so that not more than 25 ppm of chlorine is present.
6. Test results provided to DPS and/or QA.

**END OF SECTION 22 11 16**

## SECTION 22 11 19

### DOMESTIC PIPING SPECIALTIES

#### **PART 1 GENERAL**

##### **1.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Sillcocks:
  - 1. Woodford.
- B. Hose Bibbs:
  - 1. Finished rooms: Chicago Faucet.
  - 2. Unfinished & equipment rooms: Woodford.
- C. Shock Arresters:
  - 1. Precision Plumbing Products Co. ("P.P.P.")
- D. Water Pressure Regulation Valve (Only):
  - 1. Manufacturers:
    - a) Mueller
    - b) Watts
  - 2. General:
    - a) Use self-contained pressure regulating valves with stainless steel seat ring.
    - b) Valves shall have bronze bodies for 200 psi working pressure.
    - c) Use two valves, one to have capacity each for 70 percent of total load and one valve with capacity of 00 percent.
    - d) Reduced pressure for 30 percent valve shall be 68 psi, one of the 70 percent valves set at 64 psi.
    - e) Provide full-size wye-pattern strainer on inlet side of valve assembly. If strainer is used, install bypass for service.
    - f) Install pressure gages, complete with ball valves.
    - g) Gauge range 0 psi to 200 psi.
    - h) Gauges shall be on house side and on service side of each reducing valve inside of each shut-off valve for each PRV.
    - i) Entire PRV station shall have one full-size bypass with ball or resilient seat gate valve.
- E. Temperature and Pressure Relief Valves (Bronze or Brass):
  - 1. Kunkle
  - 2. Watts
- F. Trap Primers:
  - 1. Hersey
  - 2. J. Water Meters
  - 3. Precision Plumbing Products, Inc. ("P.P.P.")
- G. Water Meters:



1. Hersey
  2. Niagara Meter Line
  3. MTX Series, Model 433,
  4. Contact closure output
  5. 1 percent accuracy, standard totalizer and calibrated contacts for remote monitoring
- H. Under-lavatory scald protectors:
1. Skal-Gard
  2. Brocar Trap-Wrap
  3. Truebro Lav-guard
- I. Trap Guards:
1. Hersey
  2. J. Water Meters
  3. Precision Plumbing Products, Inc. ("P.P.P.")

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
- B. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
- C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
  1. Provide trap primers where traps in floor drains may dry out and allow sewer gas to escape into building spaces, toilet rooms, and mechanical rooms.
  2. Water supply lines should not be insulated.
- D. Tail piece style trap primers and mechanical style trap seals are not allowed. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- E. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- F. Under-lavatory scald protection: Install insulation covers for drains and water supplies to ADA-accessible lavatories.
- G. Fasten wall-hanging plumbing specialties securely to supports attached to building floor. Floor mounted carriers are required for wall-mounted plumbing fixtures.
- H. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- I. Valves:
  1. Install individual shutoff valve in each water supply to plumbing specialties.
  2. Use ball valve if specific valve is not indicated.
  3. Install shutoff valves in accessible locations.
  4. Refer to Specification Section 15 11 00 Valves for general-duty ball, check, and gate.
  5. All branch and fixture isolation valves to be installed on the same floor level as the fixtures being serviced.
- J. Install air vent at piping high points. Include ball or globe valve in inlet and drain piping from outlet to floor drain.
- K. Water Hammer Arrestors
  1. Provide shock arresters in accordance with Plumbing Drainage Institute (PDI) Standard WH-201.

2. Mount as close to the line or quick-closing valve as possible. Remote mounting or excessive (over 6") nipple mounting will not be acceptable.
  3. Provide line size full port ball valve and FIP threaded fitting to accept MIP threaded shock arrester device.
  4. Provide 12" by 12" minimum access panel centered on each shock arrester that is otherwise inaccessible.
- L. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.
- M. Reduced-Pressure Backflow Preventers:
1. Provide backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination.
  2. Locate backflow preventers in same room as connected equipment or system.
  3. Provide drains for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  4. Do not install bypass piping around backflow preventers.
  5. Refer to other Division 22 standards for additional requirements.
  6. Installation height is 48" aff.

**END OF SECTION 22 11 19**

## SECTION 22 11 23

### DOMESTIC WATER PUMPS

#### **PART 1 GENERAL**

##### **1.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 2 PRODUCTS**

##### **2.01 ACCEPTABLE PRODUCTS**

- A. Acceptable Domestic Hot Water Circulating Pump manufacturers:
  - 1. Armstrong
  - 2. Bell and Gossett
  - 3. Grundfos
  - 4. Wilo
- B. All-bronze construction.

#### **PART 3 EXECUTION**

##### **3.01 INSTALLATION**

- A. Hot water circulating pump shall be supported on each side of the pump. Provide isolation valves on each side of pump.
- B. Vibration Isolation: Mount equipment with motors larger than 5 hp on vibration isolation equipment base per standard Section 22 05 48 Mechanical Sound and Vibration.
- C. Connections: Coordinate piping installation and specialty arrangement requirements with schematics on drawings.
- D. Drawings shall indicate general arrangement of piping and specialties. The following are specific connection requirements:
  - 1. Install discharge pipe sizes equal to or greater than diameter of pump nozzles, and connect to sanitary drainage piping.

**END OF SECTION 22 11 23**

## SECTION 22 13 19

### SANITARY WASTE PIPING SPECIALTIES

#### **PART 1 GENERAL**

##### **1.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Floor drains, floor sinks, planter drains, deck drains, garage drains, trench drains, , cleanout fittings, sanitary vent terminal, and air gap fittings.
  - 1. Josam
  - 2. J.R. Smith
  - 3. Wade
  - 4. Zurn (Kitchen Floor Sinks: Zurn Z-1751 Sani-Flor Receptor)
  - 5. Froet (To be considered on all new buildings).
- B. Trench Drains (Heavy Duty Cast Iron Grate and Frame):
  - 1. J-Mark Foundry
  - 2. Maclear Manufacturing Co.
  - 3. Neenah Foundry
- C. Trap Primers:
  - 1. Hersey
  - 2. J. Water Meters
  - 3. Precision Plumbing Products, Inc. ("P.P.P.")
- D. Acid Neutralization Basins:
  - 1. Town and Country Plastics Inc.
  - 2. Orion
- E. Laboratory Equipment:
  - 1. Acceptable Manufacturer: Orion
  - 2. Traps: Polypropylene, Cast brass, or Duriron, complete with tailpiece and arm
  - 3. Escutcheons: Nickel plated brass
  - 4. Stops & Supplies: Nickel plated brass wheel handle operated stops and nickel plated copper supplies.
  - 5. Water piping: Chrome or nickel plated finish where exposed, with wrought copper fittings of same finish.
  - 6. Waste & vent piping
    - a) Acid-resistant: Same material as rest of building waste and vent system
    - b) Non-acid resistant: Same material as balance of building waste system: Cast iron with no-hub joints.
  - 7. Gas: Schedule 40 A-53 black steel T&C with malleable fittings up to 1-1/2". For 2" and larger schedule 40 A-53 with butt weld steel fittings and couplers.
  - 8. Science rooms to be solid piped for any gas fixtures. Flex connections are not allowed.

9. Solenoid valves: "ASCO" gas air or water rated (115 psi) 2-way valves with actuation and control as required. Refer to Section 15485 - Natural Gas System.
- F. Grease interceptors:
1. In accordance with jurisdictional authority requirements, including NSF for "inside" traps.
  2. Bolts for interceptor lid access stainless steel type 316 only. Cast iron, steel, or brass not acceptable.
  3. Preferred location of traps to be located outside of the building.
  4. Traps & Interceptors shall have their own designated vent.
- G. Sand-Oil-Gas Interceptor:
1. In accordance with jurisdictional authority requirements, including EPA.
- H. Acid Neutralization Basin:
1. Follow requirements of Denver Wastewater Management Division.
  2. Locate Acid Neutralization Basins outside of the building when possible
  3. Provide one basin for each building. Do not allow multiple basins to be used.
    - a) Individual interceptors and traps to be considered on a case by case basis

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
1. Provide trap primers where traps in floor drains may dry out and allow sewer gas to escape into building spaces, toilet rooms, and mechanical rooms.
  2. Water supply lines should not be insulated.
- B. Tail piece style trap primers and mechanical style trap seals are not allowed. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- C. Cleanouts in aboveground piping and building drain piping
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for all piping.
  4. Locate above the floor at the base of each vertical soil and waste stack.
  5. Place two-way cleanouts on all building sewers.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
1. Provide cleanouts above urinals (56" AFF) and lavatory gangs (42" AFF or at least above flood level of lavatory). If wall is partially covered with tile, the cleanout shall be within the tile field or above it, not partially in each.
  2. Provide cleanouts 6" above highest trap on that floor on the main vent of each group of fixtures and in vent stacks for isolated fixtures on each floor.
  3. Provide full size cleanouts at base of each stack, maximum 50 foot intervals on horizontal runs, and at end of each horizontal run.
  4. Provide cleanout plugs line-size up to 3", and 4" for line sizes 4" through 6".
  5. Provide wall cleanouts where piping is concealed in walls or non-accessible chases, 42" AFF.
  6. Where cast iron pipe is used, specify cleanouts with cast iron bodies and threaded "ABS" or "Delrin" plugs.

- F. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- G. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing.
- H. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
- I. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii.
  - 3. Radius, 30" or less: Equivalent to 1% slope, but not less than 1/4" total depression
  - 4. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 5. Install individual traps for floor drains connected to sanitary building drain.
  - 6. Provide floor drains in custodial, shower, toilet rooms, mechanical rooms and fan rooms and other areas as required, such as near reduced-pressure backflow preventers.
  - 7. Floor sinks are required for indirect drains and are preferred in mechanical rooms.
  - 8. Provide trap guard device on all floor drains. In extenuating circumstances a trap primer may be deemed necessary by engineer. Floor sinks to have trap primers.
- J. Interceptors, including trapping, venting, and flow-control fittings:
  - 1. Install with adequate clear space for servicing.
  - 2. Above-Floor Installation: Set unit with bottom resting on floor.
  - 3. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  - 4. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
  - 5. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
  - 6. Place two-way cleanouts (Texas Twin Cleanout) on all interceptors (grease, oil, acid neutralization, ect.) inlet and outlet.
- K. Fasten wall-hanging plumbing specialties securely to supports attached to building floor. Floor mounted carriers are required for wall-mounted plumbing fixtures.
- L. Fasten recessed-type plumbing specialties to reinforcement built into walls.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is required.
- N. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

**END OF SECTION 22 13 19**

## SECTION 22 14 23

### STORM DRAINAGE PIPING SPECIALTIES

#### **PART 1 GENERAL**

##### **1.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Planter drains, deck drains, garage drains, trench drains, roof drains, downspout nozzles, storm drain expansion joints, cleanout fittings:
  - 1. Josam
  - 2. J.R. Smith
  - 3. Wade
  - 4. Zurn (Kitchen Floor Sinks: Zurn Z-1751 Sani-Flor Receptor)
  - 5. Froet (To be considered on all new buildings).
  - 6. Roof and overflow drains shall be equipped with a cast iron dome. Poly domes are not allowed.
- B. Trench Drains (Heavy Duty Cast Iron Grate and Frame):
  - 1. J-Mark Foundry
  - 2. Maclear Manufacturing Co.
  - 3. Neenah Foundry

#### **PART 3 EXECUTION**

##### **3.01 INSTALLATION**

- A. Install expansion joints on vertical risers, stacks, and conductors if indicated.
- B. Cleanouts in aboveground piping and building drain piping:
  - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet for all piping.
  - 4. Locate above the floor at the base of each vertical soil and waste stack.
  - 5. Place two-way cleanouts on all building sewers.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
  - 1. Provide cleanouts above urinals (56" AFF) and lavatory gangs (42" AFF or at least above flood level of lavatory). If wall is partially covered with tile, the cleanout shall be within the tile field or above it, not partially in each.
  - 2. Provide cleanouts 6" above highest trap on that floor on the main vent of each group of fixtures and in vent stacks for isolated fixtures on each floor.
  - 3. Provide full size cleanouts at base of each stack, maximum 50 foot intervals on horizontal runs, and at end of each horizontal run.

4. Provide cleanout plugs line-size up to 3", and 4" for line sizes 4" through 6".
  5. Provide wall cleanouts where piping is concealed in walls or non-accessible chases, 42" AFF.
  6. Where cast iron pipe is used, specify cleanouts with cast iron bodies and threaded "ABS" or "Delrin" plugs.
- E. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
- F. Roof drain installation:
1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  2. Roof and overflow drains to be installed in the same sump.
  3. Position roof drains for easy access and maintenance.
  4. Also refer to Division 7 standards.
  5. Coordinate location and depth of drains to assure adequate pitch of the drainage area to drain.
- G. Fasten wall-hanging plumbing specialties securely to supports attached to building floor. Floor mounted carriers are required for wall-mounted plumbing fixtures.
- H. Fasten recessed-type plumbing specialties to reinforcement built into walls.

**END OF SECTION 22 14 23**



## SECTION 22 14 29

### SUMP PUMPS

#### **PART 0 GENERAL**

##### **0.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 1 PRODUCTS**

##### **1.01 ACCEPTABLE PRODUCTS**

- A. Acceptable Sump Pump manufacturers:
  - 1. Weil
  - 2. Zoeller
- B. Acceptable Sewage Ejector manufacturers:
  - 1. Weil Pump Company
  - 2. Federal Pump Corporation
- C. Sump pumps Information:
  - 1. Duplex, submersible
  - 2. Mechanical float switches
  - 3. Remote-mounted pump panels with H.O.A. switch for each pump
  - 4. Alternator
  - 5. High-water audible and visual alarms, and dry contacts if connected to remote alarm (DDC or other)
  - 6. Two-pump run control
  - 7. Three phase protection for three phase motors
  - 8. NEMA 12 enclosure
  - 9. Gas-tight gasketed cover with grommets openings for piping and wiring
  - 10. Gas tight manhole
  - 11. Vent through dedicated vent stack. Label as such throughout.
  - 12. Quick-removal system for pumps

#### **PART 2 EXECUTION**

##### **2.01 INSTALLATION**

- A. Vibration Isolation: Mount equipment with motors larger than 5 hp on vibration isolation equipment base per standard Section 22 05 48 Mechanical Sound and Vibration.
- B. Wet-Pit-Mounted, Vertical Sewage Pumps: Suspend pumps from basin covers.
- C. Submersible Sewage Pumps: Set pumps on basin floor.
- D. Anchor quick-disconnect systems to bottom of basins and basin sidewalls or covers.
- E. Sewage Pump Basins: Set basin cover and fasten to basin top flange. Install cover so top surface is flush with finished floor.
- F. Connections: Coordinate piping installation and specialty arrangement requirements with schematics on drawings.
- G. Sanitary drainage and vent piping installation requirements are included in Division 23.

- H. Drawings shall indicate general arrangement of piping and specialties. The following are specific connection requirements:
1. Install discharge pipe sizes equal to or greater than diameter of pump nozzles, and connect to sanitary drainage piping.
  2. Install swing check valve and gate or ball valve on each sewage pump discharge. Include spring-loaded or weighted-lever check valves for piping NPS 2-1/2 and larger.

**END OF SECTION 22 14 29**

## SECTION 22 16 16

### SANITARY WASTE AND VENT PIPING

#### PART 1 GENERAL

##### 1.01 OPERATING AND MAINTENANCE DATA

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS

- A. Interior Storm Drain, Sanitary Sewer, Waste and Vent:
  - 1. Buried pipe:
    - a) Cast iron soil pipe with cast iron drainage fittings meeting ASTM A 74.
    - b) Joint materials and systems shall be hub and spigot with neoprene gaskets and lubricant.
    - c) PVC schedule 40 solid wall pipe and DWV fitting system:
      - i) Pipe and fittings shall be manufactured from PVC compound with a cell class of 12454 per ASTM D 1784 and conform with National Sanitation Foundation (NSF) standard 14. Pipe shall be iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665. Injection molded fittings shall conform to ASTM D 2665. Fabricated Fittings shall conform to ASTM F 1866.
      - ii) All pipe and fittings to be produced by a single manufacturer and to be installed in accordance with manufacturer's recommendations and local code requirements.
      - iii) WARNING – Never test with or transport/store compressed air or gas in PVC pipe or fittings.
      - iv) Solvent cements shall conform to ASTM D 2564. Primer shall conform to ASTM F 656. The system is intended for non-pressure drainage applications where the temperature will not exceed 140 degrees F.
  - 2. Suspended pipe:
    - a) Service weight (SV) cast iron pipe
    - b) "No Hub System" using hubless cast iron soil pipe couplings certified to withstand a minimum of 13 psig internal pressure.
    - c) No-Hub couplings shall be Husky SD 4000 or equivalent. Made in USA. All band sizes shall have minimum 4 straps. (larger bands may have 6 straps)
    - d) Meet CISPI 301 and ASTM A 888.
    - e) Where stack pressure may theoretically exceed 50 psig, use couplings with restrained joints horizontal and vertical up to 80 psig.
    - f) Where copper pipe is used, specify Type L.
    - g) PVC piping is strictly prohibited for any application within buildings. Exceptions can only be used for small diameter schedule 40 PVC piping being used for condensate drain piping from condensing boilers and HVAC coils routed to floor drains. Solid core schedule 40 PVC may be used for condensing boiler flue pipe permitted by manufacturer.
    - h) DWV copper piping is strictly prohibited on DPS projects.
- B. Acid Resistant Drain, Waste and Vent:
  - 1. Approved manufacturers:
    - a) Spears Lab Waste system, listed ASTM F 2618.
      - i) CPVC corrosive waste drainage system.

2. Meet requirements of ASTM D4101.

C. Air admittance valves not allowed.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION**

- A. Locate sewer vents away from air intakes. Avoid placing vents in lower roof areas. Extend vents to a height above adjacent construction when vents are within 20' of a change in roof elevation.
- B. Underground plumbing shall be surrounded by a minimum of 6" of "squeegee."
- C. Pipe shall be accurately cut and set in place without springing or forcing.
- D. Structure of the building shall not be compromised.
- E. Above ground piping shall run parallel with the lines of the building unless otherwise indicated.
- F. Bare, uninsulated pipe shall not bear directly on structural elements so as to transmit sound to the structure or prevent flexible movement of the lines.
- G. Change in direction of piping shall be made with fittings.
- H. Allowance shall be made for expansion and contraction of hot water piping. Provide expansion loops where required.
- I. Joints shall be made with fittings of compatible material and for the specific purpose intended.
- J. Pipes passing through concrete or masonry walls, floors, or roofs shall be provided with pipe sleeves fitted into place at the time of construction.
- K. Piping runs are prohibited above or in the following locations:
  - 1. Elevator machine rooms
  - 2. Telephone or computer equipment rooms
  - 3. Sensitive instrument and equipment rooms
  - 4. Electrical switchgear, busways and equipment rooms
- L. Caulking of screwed joints or holes is not acceptable.
- M. Air admittance valves not allowed. Always tie into existing vent or run new vent through roof. Island venting to be considered on case by case basis.
- N. Maximum waste arm distance between trap and vent (dirty Arm)
  - 1. 1 ¼" and 1 ½" – 3'-0" Max.
  - 2. 2" – 5'-0" Max.
- O. Minimum water closet waste to be 4" line.
- P. Liquid waste removal:
  - 1. The District's sanitary sewerage system is connected to the City of Denver Wastewater Management Division and must conform to requirements of the City and County of Denver.
  - 2. Design sanitary waste systems to allow for future addition of laterals to accommodate 20 percent building revisions.
  - 3. Per code, "vent pipe shall rise at least 6" in height above flood level of fixture (including floor drains) before offsetting horizontally." If this is not possible, combination waste and vents are required.
  - 4. Sanitary crosses are prohibited. For common drains between lavatories, use double wye or combo (Tyler, Fig. 1 or 5) or equivalent.
  - 5. Sanitary Tee's shall not be installed on back or side of any application.
  - 6. The use of sewage ejectors is strongly discouraged. However, if needed, obtain approval of DPS and specify submersible ejector pumps.
  - 7. Grease interceptor to have a designated vent. Do not tie into building vent system.

8. DPS now accepts individual interceptors for acid and chemical neutralization or dilution. Large capacity acid neutralization basins, installed outdoors, are still preferred for new construction.

### **3.02 FIELD QUALITY CONTROL**

- A. Plumbing piping and fixtures shall be installed under the direct, on-site supervision of a journeyman plumber licensed by the State of Colorado. The ratio of plumbing apprentice-helpers shall not exceed two apprentice-helpers for each journeyman.
- B. Defective work found during tests and inspections shall be corrected and the tests repeated before acceptance.
- C. Plumbing systems shall be tested in accordance with NAPHCC Plumbing Code and other applicable codes.
- D. A smoke test shall be performed on sanitary vent lines prior to applying wall finishes. The test shall be witnessed by the DPS representative.

**END OF SECTION 22 16 16**

## SECTION 22 34 00

### FUEL-FIRED DOMESTIC WATER HEATERS

#### **PART 1 GENERAL**

##### **1.01 OPERATION AND MAINTENANCE DATA**

- A. Include documentation of inspections and tests performed, including logs, curves, and certificates.
- B. Documentation shall note replacement of equipment or components that failed during testing.

#### **PART 2 PRODUCTS**

##### **2.01 ACCEPTABLE PRODUCTS**

- A. Copper-tube Water Heaters:
  - 1. Acceptable product:
    - a) Aerco Innovation 1060, 800, 600.
- B. Fuel-fired Tank Type:
  - 1. Acceptable manufacturers: PVI Conquest.
- C. Venting:
  - 1. Acceptable product: AL29-4C by Security Chimney.

#### **PART 3 EXECUTION**

##### **3.01 INSTALLATION**

- A. No valves shall be installed between the relief valve and its water heater or storage tank. The P & T relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly to a tapping in the tank or heater. Otherwise, install in the hot water outlet piping.
- B. Connections to water heaters shall be made with dielectric waterways.
- C. Install check valves on cold water supply lines to heaters and hot water storage tanks, to prevent backflow of hot water into the cold water system.
- D. Connections: Coordinate piping installation and specialty arrangement requirements with schematics on drawings.
- E. Sanitary drainage and vent piping installation requirements are included in Division 23.
- F. Provide inlet and outlet pressure gauges on water, compound gauges on inlet and outlet of steam valves, and linear thermometers on hot water outlets and hot water recirculating inlets.
- G. Gas-fired water heaters shall have power burners as a minimum and shall have forced draft if sharing a flue with a forced draft boiler, in which case the water heater's positive pressure at the collar shall be specified.
- H. Provide an expansion tank at DHW system. Tank shall be ASME rated for 200 MBH and above.

**END OF SECTION 22 34 00**

**SECTION 22 40 00**

**PLUMBING FIXTURES**

**PART 1 GENERAL**

**1.01 SUBMITTALS**

A. Product Data.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. General:

1. Manufacturers and catalog numbers are indicated to establish type and quality. Other equivalent products may be selected from lists of acceptable manufacturers.
2. Where color is an option, provide white fixtures.
3. Provide acid-resisting finish.
4. Except for washers, all parts shall be metal. Plastic parts are prohibited.
5. Emergency showers to have adequate drainage (basin/pan required)
6. All thermal mixing valves for emergency showers and eye wash equipment to be in locked box located at 5'-0" above finish floor.
7. All thermal mixing valves located outside of boiler room need to be in locked box located at 5'-0" above finish floor.

B. Kitchen Equipment:

1. Traps: Chrome plated cast brass.
2. Tailpieces: Chrome plated 17 gauge copper.
3. Arms: Chrome plated 17 gauge copper.
4. Escutcheons: Chrome plated, cast brass.
5. Stops: Chrome plated brass with wheel handle operators.
6. Supplies: Chrome plated type L copper tube.
7. Indirect wastes: Chrome plated Type L copper tube.
8. Water piping: Type L copper, chrome plated when located outside of walls or ceilings.
9. Waste & vent piping: No-Hub Cast Iron System.
10. Joints: Where joints of piping systems are welded, soldered or brazed and are exposed to view or cleaning, buff joints to smooth cleanable surface in accordance with NSF.

C. Spray nozzles for kitchen sinks, kettles and garbage disposals shall be T&S spray rinse assembly. Identification and tagging.

1. Provide valve tags in accordance with standard Section 220553.

<b>FIXTURE</b>	<b>MANUFACTURERS</b>	<b>INFO</b>	<b>GPM/GPF</b>
Master Mixing Valves	Bradley (preferred), Powers	Thermostatic or pressure balanced. Integral check valves and strainers	
Mixing Valves (point of use)	Bradley (preferred), Watts, Apollo, Powers		
Traps, Stops,	American Standard,	Chrome w/ cleanout plug 17 ga, All metal	

Supplies, Air Gap Fittings, Drains	Brasscraft, Eljer, Kohler		
Chair Carriers	Josam, J.R. Smith, Wade, Zurn	4-bolt, Cast iron nipple	
Electric Water Coolers	Haws, Halsey-Taylor, Acorn, Elkay	Vandal resistant bubbles	
Drinking Fountains	Haws, Halsey-Taylor, Acorn, Elkay	Vandal resistant bubbles	
Emergency Showers/Eye Wash Equipment	Haws, Bradley, Acorn		
Laboratory Faucets	Chicago, T&S Brass	Gas Cocks shall have integral check valves.	
Garbage Disposers	In-Sink-Erator	¾ HP, Stainless Steel	
Faucets (classroom, lounge, community use, etc.)	Chicago, Kohler, Delta 100LF Series		
Faucets (restroom, classroom LAVs)	Sloan Basys	EFX-25-.500.0100 Sensor Faucet (4" centers)	
Faucets (kitchen hand sinks)	Moen 8800	No flow restrictions	
Water Closets	American Standard, Sloan, Kohler, Toto	White, vitreous china, wall hung, siphon jet, valve-operated, Water Saver, 5" rough. Certified by an approved agency for flush rate. Provide: supply pipe support, vandal-proof trim.	1.6 gpf (1.28 gpf for new construction)
Water Closets (tank)	Toto	See above for trim.	1.6 gpf (1.28 gpf for new construction)
Toilet Seats	Bemis, Beneke, Church, Olsonite	White, all-plastic, open front, elongated bowl, no seat cover.	
Urinals	American Standard, Sloan, Kohler, Toto	Certified by an approved agency for flush rate. Supply: ¾". Vandal resistant strainer.	1.0 gpf (0.125 gpf for new construction)
Flush Valves (sensor)	Sloan, Hydrotek HB8000 Series	Battery-powered, sensor activated. Electrically hard-wired flush valves are prohibited.	
Flush Valves (manual)	Toto		
Lavatories (vitreous china)	American Standard, Sloan, Kohler, Western Pottery	4" centers. Concealed arm carriers.	
Lavatories (cast iron)	Ceco, Kohler, Zurn, American Standard	To be installed with heavy duty brackets and backing. Provide continuous 2"x12" fire retardant treated lumber blocking.	
Lavatories (self rimming)		Not allowed	
Classroom Sinks	Elkay, Just	ADA Accessible, Stainless Steel, 18 gauge minimum, with sound dampening	
Classroom Sinks	Kohler, American	Food Labs and General Installation, non-ADA compliant,	



	Standard, Sloan, Eljer	Enameled Cast iron	
Lab Sinks		Epoxy Resin (same as countertop)	
Mop Service Basins	Fiat, Florestone – Molded Stone Bradley, Fiat, Floreston - Terrazzo	Stainless steel drains, provide stainless steel edge protectors for custodial sinks and mop basins. At custodial sinks and basins, provide vacuum breaker, bucket hook, threaded hose end faucet with 48” hose, and mop hanger	
Showers	Bradley, Fiat, Florestone	Terrazzo Base, Delta valves and head, stainless steel drains.	2.5 gpm max
Coffee bar sinks		Stainless steel sink with drainboard. Faucet: single handle with goose-neck spout.	
Hand wash fountain	Intersan, Bradley	(Provide when individual hand sinks or lavatories cannot be installed)	

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Flushometers shall be installed rigid, plumb and at proper critical level heights per the relevant codes.

#### **3.02 CARRIERS**

- A. Provide floor mounted chair-type carriers for wall-mounted fixtures including lavatories, water closets, urinals, drinking fountains, electric water coolers, etc.
- B. Lavatories shall be hung with concealed arm type carriers only.
- C. Wood or metal mounting plates anchored to the wall framing or studs are strictly prohibited.
- D. Carrier shall transfer the load to the floor and shall be capable of fully supporting the fixture.
- E. Provide adjustable carriers to locate the fixture at the desired mounting height.

#### **3.03 FLUSH VALVES**

- A. Flush valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to the wall adjacent to the valve with metal bracket.
- B. Coordinate flush valve heights with ADA accessibility requirements, grab bars, and fixture heights.

#### **3.04 INSTALLATION**

- A. Provide stop valves at fixtures and equipment and at rough-in locations. All stops to be chrome one quarter turn ball valve type.
- B. Provide loose key stops with fixtures. All stops to be chrome one quarter turn ball valve type.
- C. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping system at the wall.
- D. Require rigid anchors behind walls for supplies and stops, to eliminate push or pull movement.
- E. Provide finished floor and wall escutcheons at wall and floor penetrations.
- F. Provide access panels for maintenance access to concealed valves and controls.

#### **3.05 KITCHEN EQUIPMENT**

- A. All kitchen trim and specialties, including valves and piping, shall be chrome plated brass or chrome plated copper where components are not concealed in walls or ceilings. Trim and specialties within cabinets and under sinks will not be considered concealed.
- B. Provide traps with clean-outs, tubing waste to wall including escutcheons, of sizes as required.
- C. Provide chrome-plated water supplies and branches complete with individual and branch shut-off chrome-plated valves (globe pattern), and chrome-plated brass escutcheons.

- D. Provide gas supplies, complete with isolation valves at point of entry through walls or floors, flexible hose with armor shield and plastic coating from branch to appliance, and connections to the appliance made with "Hanson Gas-Mate" quick coupler type valves only.
- E. Provide extensions of chrome-plated brass indirect waste piping from unit connection to air gapped connections to floor drains or waste receptacles at termination point.
- F. Provide necessary solenoid or motorized valves not furnished as parts of kitchen equipment.
- G. Provide necessary specialties not specifically mentioned, but necessary for complete operation of each unit.

**3.06 LABORATORY EQUIPMENT**

- A. Verify items of trim and fixtures not furnished by these suppliers and specify all items necessary to complete the installation.
- B. Ensure that Fuseal cleanout above sink fits within ceiling-to-bench chase.
- C. Traps and wastes shall conform to materials as specified for soil waste and vent, acid resistant drain, waste and vent in Division 23.
- D. Supplies, stops, and valves shall be nickel-plated brass where installed in areas subject to acid fumes.
- E. Provide shut-off valves at each piece of laboratory equipment and each piece of laboratory furniture for all services in accordance with the following schedule and as specified in Division 23.

1. Schedule

<u>Service</u>	<u>Valve Type</u>
Water	Ball, or loose key compression stop
Air	Ball
Vacuum	Ball
Gas	Plug or Ball certified for gas service
Special	As noted on drawings or as specified herein

- 2. Plumbing through walls or floors shall be provided with nickel-plated brass escutcheons; set screw type or screw-on type. Loose or split type escutcheons will not be accepted.
- 3. Potable water supplies to water faucets provided with means for hose or tubing connections shall be installed with branch vacuum breaker, atmospheric or pressure type, with the ASSE Seal affixed to each vacuum breaker, in accordance with ASSE Standard #1001.
- 4. Lab fume hoods shall have exterior mounted vacuum breakers on domestic and laboratory water lines serving the hood. Atmospheric breakers inside the hood are not allowed.
- 5. Casework Equipment
  - a) Verify items of trim and fixtures not furnished by these suppliers and specify all items necessary to complete the installation.
- 6. Provide traps with cleanouts, tubing waste to wall including escutcheons, of sizes as required.
- 7. Provide chrome-plated water supplies and branches complete with individual and branch shut-off chrome-plated valves (globe pattern), and chrome-plated brass escutcheons as required.
- 8. Provide gas supplies, complete with isolation valve, flexible hose with armor shield from branch to appliance, and connections to the appliance made with "Hanson Gas-Mate" quick coupler type valves only.
- 9. Provide extensions of chrome-plated brass indirect waste piping from unit connection to air gapped connections to floor drains or waste receptacles at termination point.
- 10. Provide necessary solenoid or motorized valves not furnished as parts of casework equipment.
- 11. Provide necessary specialties not specifically mentioned but necessary for proper and complete operation of the unit, or for good appearance and a clean finished contract.
- 12. Trim and specialties, including valves and piping, shall be chrome plated brass or chrome plated copper where components are not concealed from view. Trim and specialties within cabinets will not be considered concealed.

a) Schedule:

<u>Service</u>	<u>Valve Type</u>
Water	Ball, or loose key compression stop
Air	Ball
Vacuum	Ball
Gas	Plug or ball certified for gas service
Special	As noted on Drawings or as specified herein

13. All plumbing through walls for floors shall be provided with chrome-plated brass escutcheons, set-screw type or screw-on type. Loose or split type escutcheons will not be accepted.
14. Locate shut-off/isolation valves under sinks in the cabinet under the sink. Shut-offs behind casework will not be allowed.
15. All potable water supplies to water faucets provided with means for hose or tubing connections shall be installed with branch vacuum breaker atmospheric or pressure type with the ASSE Seal affixed to each vacuum breaker, in accordance with ASSE Standard #1001.

**END OF SECTION 22 40 00**