**SECTION 21 10 00**

**WATER BASED FIRE SUPPRESSION SYSTEMS**

**BASED ON DFD MASTER SPECIFICATION DATED 6/5/18**

***This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.***

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

**SCOPE**

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

***The consultant is responsible for showing water supply entrance, fire protection riser, standpipes, inspectors test drain lines and large mains requiring space coordination with architectural, HVAC and electrical work. Where branch piping requires similar coordination or specific zoning it should also be shown.***

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**RELATED WORK**

Section 01 91 01 or 01 91 02 – Commissioning Process

Section 21 08 00 – Commissioning of Fire Suppression

Section 21 05 00 – Common Work Results for Fire Suppression

Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

Section 21 30 00 – Fire Pumps

**REFERENCE**

Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

ANSI A21.4

ANSI A21.11

ANSI A21.51

ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

ANSI B16.3 Malleable and Ductile Iron Threaded Fittings

ANSI B16.4 Cast Iron Threaded Fittings

ANSI B16.5 Pipe Flanges and Flanged Fittings

ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings

ANSI B16.11 Forged Steel Fittings, Socket Welded and Threaded

ANSI B16.18 Cast Bronze Solder Joint Pressure Fittings

ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A105 Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A135 Electric Resistance Welded Steel Pipe

ASTM A181 Forgings, Carbon Steel for General Purpose Piping

ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A536 Ductile Iron Castings

ASTM A795 Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

ASTM B88 Seamless Copper Water Tube

AWS A5.8 Brazing Filler Metal

AWS D10.9 Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3

NFPA 13 Installation of Sprinkler Systems. (Latest prevailing edition)

NFPA 14 Installation of Standpipe and Hose Systems. (Latest prevailing edition)

UL Underwriters' Laboratories Listing

FM Factory Mutual Approval

**SHOP DRAWINGS**

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

**QUALITY ASSURANCE**

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

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

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

**DELIVERY, STORAGE, AND HANDLING**

Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

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

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

Storage and protection methods must allow inspection to verify products.

**DESIGN CRITERIA**

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

Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

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

Where mechanical grooved fittings are used, use only ASTM standard radius fittings, short radius grooved fittings are not allowed.

Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

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

**WELDER QUALIFICATIONS**

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

***Welder certifications are required to be renewed every three years. If qualification papers are needed on a project, verify that they are current.***

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

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

**FIRE SUPPRESSION PIPING**

Steel Pipe:

Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.

Pipe wall Thickness:

Threaded pipe shall have a minimum wall thickness of schedule 40.

All other pipe shall have a minimum wall thickness of schedule 10.

Piping 2” and under shall be minimum schedule 40 unless stated otherwise herein.

***1 ½” and 2” schedule 10 may be allowed on a case by case basis for areas where the piping is exposed, and the sprinkler heads are attached directly to the pipe, similar to a storage warehouse or service garage. This must be confirmed with DFD.***

Fittings: Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable and ductile iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel. For wet pipe systems mechanical tee fittings with full iron back equal to Grinnell Figure 730 will be allowed only as needed for connection to existing systems. Outlets for drypipe and preaction systems shall be mechanical tees. Mechanical tees with U-bolt back or other fastening means are not allowed.

 ***Mechanical tees may be used for other applications where it makes sense. Consult with DFD.***

Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in drypipe and pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or grooved hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

 ***Black steel pipe should be used when nitrogen is used for the system supervisory gas.***

CPVC PIPE:

CPVC Sprinkler Pipe, ASTM F 442, SDR 13.5. 1” through 2” pipe size only.

CPVC Sprinkler Fittings, Schedule 40 and Schedule 80 dimensions for 1" through 1-1/4”, Schedule 80 for 1-1/2” through 2”. Products to be UL Listed/FM Approved for a rated working pressure of 175 psi at 150°F for sprinkler service. Spears FlameGuard or BlazeMaster.

No exposed CPVC piping material is allowed.

Plastic pipe and fittings will not be allowed for this project.

***Delete either the first paragraph or the second paragraph based on DFD and Agency determination of acceptability of CPVC for the particular project. The section for hangers and supports for plastic pipe may also need to be changed.***

PRESSURE SENSING LINE PIPE:

Seamless Red Brass pipe, ASTM 43, regular weight (Schedule 40), with ASTM B584 threaded copper alloy pressure fittings,

Type L copper water tube, H (drawn) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, lead free (<.2%) solder, ASTM B32; flux, ANSI B16.22; copper phosphorous brazing alloy, AWS A5.8 BCuP.

**UNIONS AND FLANGES**

2" and Smaller Steel:

ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Grooved couplings may be used in lieu of unions.

2" and Smaller Copper:

ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2-1/2" and Larger:

ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

2-1/2" and Larger Copper:

ANSI B16.24, Class 150 cast bronze flanges with raised face.

**MECHANICAL GROOVED PIPE CONNECTIONS**

Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil, or Grinnell may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

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

Couplings and fittings to be malleable iron, ASTM A47, or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

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

***Standard flanges are necessary so that the butterfly valve can be properly bolted to the flange and retain its place in the pipe when piping on one side is removed.***

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

**SPRINKLER HEADS**

Manufacturer: Sprinkler head model numbers establish type and style of head. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted: Tyco, Reliable, Victaulic, Viking and Globe.

Standard coverage sprinkler heads are to be the basis for design unless noted otherwise on the plans or within these specifications.

***Extended coverage sprinkler heads may not be used without prior approval by DFD.***

Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" or 17/32” discharge orifice except where greater than normal density requires large orifice.

Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (155 to 165 degree) fusible link or glass bulb type except at skylights, sealed display windows, unventilated attics and roof spaces, over cooking equipment, adjacent to diffusers, unit heaters, uninsulated heating pipes or ducts, mechanical rooms, storage rooms, or where otherwise indicated.

Provide quantity of spare heads as noted below and 1 wrench for each type of head and each temperature range installed. Provide 6 spare heads per 300 or less installed heads, 12 per 1000 or less and 24 for more than 1000. Provide steel cabinet for storage of heads and wrenches. Provide an equal number of concealed cover plates and/or sprinkler escutcheons for each spare sprinkler head.

***Edit sprinkler head models, types and features for specific applications. Specify guards where mechanical damage is likely. Specify corrosion resistant coating where subject to corrosive atmosphere.***

Quick Response Upright: Viking Microfast M (QR), brass finish.

Quick Response Vertical Sidewall: Viking Microfast M, chrome finish.

Quick Response Pendant: Viking Microfast M, chrome plated finish and escutcheon.

Quick Response Sidewall: Viking Microfast M, chrome plated finish and escutcheon.

Dry Pendant (Self-contained type): Viking Model C, brass finish with brass escutcheon.

Dry Pendant (Self-contained type): Viking Model M (Quick Response), adjustable, recessed, with chrome escutcheon.

Dry Horizontal Sidewall (Self-contained type): Viking Model M (Quick response), adjustable, recessed, with chrome escutcheon.

Concealed sprinkler: Viking Mirage (Quick Response), with adjustable concealed cover plate. Cover plate finish to be selected by the Architect/Engineer from the manufacturer’s standard finish selections.

Pendant Security: Tyco Raven, Security pendent shall not have an exposed heat sensing element.

Horizontal Sidewall Security: Tyco Raven, with sleeve, centering grommet and retainer flange. Security sidewall shall not have an exposed heat sensing element.

**FLEXIBLE SPRINKLER DROP FITTINGS**

Manufacturers: FlexHead Industries, Victaulic or Viking.

Corrugated Type 304 stainless steel hose with braided Type 304 stainless steel exterior cover, welded stainless steel or zinc plated steel inlet and outlet threaded fittings with EPDM seals. 175 PSI pressure rating. 225 oF temperature rating, 1” minimum internal hose diameter. 40” maximum hose length, straight or angle outlet configuration. Galvanized steel ceiling support bar and brackets selected to match project ceiling support system requirements. UL Listed and FM approved.

Flexible drops are only allowed for use above fully accessible ACT ceilings.

**FLOW SWITCHES**

Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

**PRESSURE SWITCHES**

Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

**LOCAL ALARM**

Weatherproof electric horn/strobe with red painted metal housing, mounting base and weatherproof gasket seal, and electrical characteristics compatible with alarm system. The horn strobe should be mounted above or as close as possible to the fire department connection.

***Local alarm typically is not required at penal and mental institutions with central alarming.***

**PRESSURE GAUGES**

Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

Cast aluminum, stainless steel, brass, polycarbonate or ABS case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

**VALVES**

Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, or Watts.

BALL VALVES:

2" and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL approved @ 250 psi. Watts No. B-6000 UL.

Gate Valves:

2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

2-1/2" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

Butterfly Valves:

2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.

2" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.

SUPERVISORY/TAMPER SWITCHES:

For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

Check Valves:

3" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

2-1/2" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

Spring loaded check valves:

2" and smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 175 psig.

Drain valves:

3/4" minimum, two piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap.

Double check valves:

Manufacturers: Ames, Conbraco, Febco, Watts, or Wilkins.

ASSE 1015 \_" double check backflow preventer with 2 independent spring loaded swing type check valves, 2 isolation butterfly or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Size for minimum pressure drop. Constructed of bronze or epoxy coated cast/ductile iron or stainless steel body with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

**SPECIALTY VALVES**

Manufacturer: Tyco, Reliable, Victaulic, Viking and Globe.

Dry Pipe Valves:

Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gages, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.

Air Pressure Maintenance Device:

Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

Deluge/preaction Valves:

Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal. Provide trim for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped to floor or hub drain, fill line attachment with strainer and push rod chamber assembly. Include dry pilot trim consisting of actuator, air and water pressure gages, low air warning switch, air relief valve and diaphragm actuation device with replaceable bronze seat and resilient diaphragm.

Deluge/Preaction Control:

Single area ***(two area or single area cross zoned)*** type in NEMA 1 enclosure with detector, alarm, power supply, battery charger, standby battery, electrically supervised solenoid valves, polarized fire alarm, lamp test, wiring terminal strip, auxiliary alarm contacts.

**HOSE OUTLET VALVES**

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, Potter-Roemer, or Guardian.

Class I and Class III Systems:

2-1/2" brass angle valve, 300 psig, with removable red handwheel, 2-1/2"x1-1/2" reducing lug pin connector coupling and National Standard male hose thread outlet, cap and chain. Provide N.P.T. female outlet where hose is required.

**FIRE HOSES**

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, Potter-Roemer, or Guardian.

100' long, 1-1/2" synthetic lined and jacketed collapsible hose, 500 lb. test, with satin brass nipple and pin lug coupling, satin brass adjustable spray fog nozzle. Provide pivoting red painted steel hose rack with hose pins and collar to secure to hose outlet valve.

**FIRE DEPARTMENT CONNECTION**

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

Exposed:

Polished cast brass***(chrome plated)*** exposed fire department inlet, two-way ***(three-way)*** inlet body, swing clappers, pin-lug swivels and plugs with chains, 2-1/2" National Standard female hose thread inlets, 6"***(4")*** outlet, cast brass ***(chrome plated)*** lettered identification backplate.

Flush:

Polished cast brass***(chrome plated)*** or ductile iron flush fire department inlet, two-way ***(three-way, four-way, six-way)***inlet body, swing clappers, pin-lug swivels and caps with chains, 2-1/2" National Standard female hose thread inlets, 6"***(4")*** outlet, cast brass ***(chrome plated)***lettered identification backplate.

**FIRE PUMP TEST CONNECTION**

Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

Flush:

Polished cast brass***(chrome plated)*** or ductile iron flush fire pump test connection outlet, two-way ***(three-way, four-way, six-way)***outlet body, male snoots, pin-lug caps with chains, removable swivel hose gate valves with 2-1/2" National Standard male hose thread outlets, 4"***(6")*** inlet, cast brass ***(chrome plated)***lettered identification backplate.

**AIR COMPRESSOR**

Manufacturer: Quincy, Ingersoll Rand, Nash, and Viking.

Multi-Zone and large systems: Simplex electric motor belt driven oil lubricated compressor mounted on ASME rated galvanized receiver tank, pressure operated electric switch, motor, magnetic motor starter with three phase overload protection, fused disconnect switch, safety relief valve, check valve, shutoff valve, pressure gauge, automatic tank drain, intake muffler-filter, belt guard and adjustable operating pressure control.

***Consult with DFD regarding the possible use of a nitrogen generator as this is becoming more common for large systems.***

Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.

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

**GENERAL**

Install pipe fittings, and other fire suppression system components in accordance with reference standards, manufacturers recommendations and recognized industry practices.

**PREPARATION**

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

**ERECTION**

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

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

Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

Maintain piping in clean condition internally during construction.

Provide clearance for access to valves and piping specialties.

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

Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

Do not route piping within exterior walls.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

***This requirement is based on NFPA 70, 384-4 and 450-47.***

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

**COPPER PIPE JOINTS**

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation and assemble joint to socket stop. Apply flame to fitting until brazing alloy melts when placed at joint. Wipe excess alloy from joint.

**WELDED PIPE JOINTS**

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used up to following sizes:

Maximum

Weldolet/ Main

Threadolet Pipe

Diameter Diameter

¾” 1¼”

1” 1½”

1¼” 2”

1½” 2½”

2” 3”

3” 4”

4” 6”

6” 8”

**THREADED PIPE JOINTS**

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

**MECHANICAL GROOVED PIPE CONNECTIONS**

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

**UNIONS AND FLANGES**

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

**FLEXIBLE SPRINKLER DROP FITTINGS**

Install in accordance with manufacturer’s installation instructions following minimum bend radii, maximum number of bends and bend distance from end requirements.

**PIPING SYSTEM LEAK TESTS**

Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the Division's representative.

Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

All pressure tests are to be documented on NFPA Contractor's Material and Test Certificate forms.

**UNDERGROUND WATER MAIN FLUSHING**

Conduct flushing of the underground water/fire main service as required by NFPA 13. The 200 PSI pressure test of the main shall be conducted by the installer of the main. The flushing operation is to be documented on NFPA Underground Contractor's Material and Test Certificate forms.

**INSTALLATION**

Install fire protection system components in accordance with NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.

Sprinkler Heads: Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler heads level in locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, etc.

***The consultant is responsible for showing sprinkler head locations on drawings and coordinating with architectural, HVAC and electrical work to avoid conflicts If heads need to be centered within ceiling tiles, this requirement must be added to specification language (extra cost involved).***

Switches: Locate flow and pressure switches where indicated and where required to obtain specified zoning to isolate floors and major areas of floors. Provide valved test connection for flow switch adjacent to flow switch. Pipe to floor drain. Test flow switch to verify proper operation.

***Locations of switches should be shown on drawing for coordination with electrical work.***

Gauges: Provide a valved pressure gauge in main fire protection riser, at the top of each piping riser, at inlet and outlet of pump and elsewhere as indicated.

Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide a riser shutoff valve and a capped hose thread drain valve at the bottom of each riser. Provide capped hose thread drain valves to allow draining of each portion of piping.

Specialty Valves: Install in vertical position fire protection riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge/preaction controls.

Hose Outlet Valves: Install at each standpipe outlet and elsewhere where indicated approximately 4' above floor.

Fire Department and Fire Pump Test Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 2' to 3' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weathertight.

Air Compressor: Install on concrete housekeeping pad, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

# CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 2108 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

END OF SECTION