
PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 11 55 General Instructions
- .2 Section 01 35 33 Health and Safety Requirements
- .3 Section 23 05 05 Installation of Pipework
- .4 Section 23 05 29 Hangers & Supports for Piping & Equipment
- .5 Section 23 05 48 Vibration & Seismic Controls for Ductwork, Piping & Equipment
- .6 Section 23 05 93 Testing, Adjusting and Balancing
- .7 Section 23 07 19 Thermal Insulation for Piping

1.2 References

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-2011, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-2012, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-2013, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-2011, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A307-12, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536-09, Standard Specification for Ductile Iron Castings
 - .3 ASTM B88M-13, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American Water Works Association (AWWA).
 - .1 AWWA C104-08 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
 - .2 AWWA C110-12, Ductile-Iron and Gray-Iron Fittings
 - .3 AWWA C111-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .4 AWWA C150-08, Thickness Design of Ductile-Iron Pipe
 - .5 AWWA C151-09, Ductile-Iron Pipe, Centrifugally Cast
 - .6 AWWA C153-11, Ductile-Iron Compact Fittings
 - .7 AWWA C606-11, Grooved and Shouldered Joints
 - .8 AWWA C900-89: Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution
- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242-05 (R2011), Groove and Shoulder Type Mechanical Pipe Couplings.

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- .5 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .2 MSS-SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.
 - .6 National Sanitation Foundation (NSF) / American National Standards Institute (ANSI).
 - .1 NSF/ANSI 61, Drinking Water System Components.

1.3 Submittals

- .1 Submittals in accordance with Section 01 11 55 – General Instructions
- .2 Provide maintenance data for incorporation into manual specified in Section 01 11 55 – General Instructions.

1.4 Health and Safety

- .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 Waste Management and Disposal

- .1 Separate waste materials for reuse and recycling in accordance with 01 11 55 – General Instructions.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .5 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan
- .6 Fold up metal banding, flatten and place in designated area for recycling.

1.6 Quality Assurance

- .1 All potable water system components shall conform to NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.1 Piping

- .1 Domestic hot, cold and hot recirculation water systems, within building.
 - .1 Above ground:
 - .1 Copper tube, hard drawn, type L: to ASTM B88M to NPS 4 size.
 - .2 Ductile iron, cement lined, Class 54, minimum Pressure Class 350 to ANSI/AWWA C151/A21.51. Wall thickness to ANSI/AWWA C150/A21.50. Cement-mortar lining to ANSI/AWWA C104/A21.4.

- .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
- .2 Water service pipe NPS6 or large in building shall be Ductile Iron, minimum Pressure Class 350 designed and manufactured in accordance with ANSI/AWWA C150/A21.50 and C151/A21.51. All pipe shall be cement –mortar lined in accordance with ANSI/AWWA C104/A2.4 and grooved to BS 4772/2531 standards.
- .3 Underground water supply piping 100mm [4"] or larger shall be AWWA C900 PVC pressure pipe with compatible fittings. Provide concrete thrust blocks for joint restraint at changes of pipe direction.

2.2 Fittings

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 Roll grooved: to CSA B242.
- .6 Ductile iron pipe fitting: ductile iron to ASTM A-536, grade 65-45-12. Rigid radius grooves to ANSI/AWWA C-606. Centre-to-end dimensions to ANSI A21.10/AWWA C-110. Wall thickness to ANSI A21.10/AWWA C-110.

2.3 Joints

- .1 Rubber gaskets, 1.6mm thick: to ANSI/AWWA C111/A21.11.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy or brazing.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gaskets suitable for temperature range of -34°C to 120°C [-30°F to 250°F] .
- .6 Grooved couplings for ductile iron piping: to AWWA dimensions, designed for use on radius cut grooved pipe with minimum wall thickness to ANSI/AWWA C151/A21.51, Class 53. Complete with Halogenated Butyl flush seal gaskets suitable for temperature range of -29°C to 93°C [-20°F to 200°F] to ANSI/AWWA C111/A21.11. Provide transition couplings between ductile iron pipe and piping of other material such as IPS steel piping and grooved copper. Gaskets shall be verified as suitable for the intended service prior to installation.
- .7 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.4 Gate Valves

- .1 NPS2 and under, soldered:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.
- .2 NPS2 and under, screwed:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc.

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- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS & Y bronze trim.
 - .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
 - .1 Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet.

2.5 Globe Valves

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.
 - .2 Lockshield handles: as indicated.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1MPa, bronze body, screwed over bonnet, renewable composition disc.
 - .2 Lockshield handles: as indicated.

2.6 Swing Check Valves

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
- .3 NPS2-1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap.

2.7 Ball Valves

- .1 NPS2 and under, screwed:
 - .1 Class150.
 - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle.
- .2 NPS2 and under, soldered:
 - .1 To ANSI B16.18, Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle, with NPT to copper adaptors.

2.8 Drain Valves

- .1 Drain valves shall be provided with cap and chain.
- .2 Drain and hose valves 20mm (3/4") and smaller:

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- .1 Sediment Faucets.
 - .2 Ball valves.

2.9 Plumbing Piping

- .1 Water supply piping under concrete slabs or in walls shall be encased in standard weight flexible polyethylene pipe one size larger than copper tubing. All joints to be wrapped in plastic wrapping tape.

2.10 Dielectric Unions

- .1 Insulating dielectric unions and flange unions shall be installed when adapting between dissimilar metallic pipe for domestic water supply piping, and domestic water storage tanks. Elsewhere, unions and adaptors for copper piping shall be cast brass pressure fittings.

2.11 Expansion Joints

- .1 Domestic and industrial water: Annular close pitch corrugated metal hose with Type 316L stainless steel butt welded tube. Type 304 single stainless steel outer brain, flanged, welded or screwed ends. Suitable for 1034 kPa (150 psi) working pressure and 50mm traverse.

2.12 Strainers

- .1 NPS 2 and under: Full pipeline size, 1,034 kPa (150 psi) SWP bronze, with screwed ends and a removable plug type screen retainer.
- .2 NPS 2-1/2 and over: Full pipeline size, 860 kPa (125 psi) SWP cast iron, with flanged ends and a bolted screen retainer.

2.13 Balancing Fittings:

- .1 Sizes: Calibrated balancing valves, as specified this section.
- .2 NPS 2 and under: Globe type, Y-pattern, bronze body, EPDM O-ring and NPT connections.
- .3 Flow measuring valve shall be fitted with meter readout ports with check valves and caps, digital handwheel with memory stop indicator, NPS 20 hose connection, and a nameplate bearing manufacturer's name and calibrated nameplate.
- .4 Furnished with preformed rigid polyurethane insulation.

PART 3 EXECUTION

3.1 Installation

- .1 Install in accordance with Section 23 05 05 - Installation of Pipework, Section 23 05 29 – Hangers & Supports for Piping & Equipment, and Section 23 05 48 – Vibration & Seismic Controls for Ductwork Piping & Equipment.
- .2 Install in accordance with National Plumbing Code and local authority having jurisdiction.
- .3 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .4 Assemble all piping using fittings manufactured to ANSI standards.
- .5 Install tubing close to building structure to minimize furring, conserve headroom and space. Group exposed piping and run parallel to walls.

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- .6 Install CWS piping below and away from HWS and HWR and all other hot piping so as to maintain temperature of cold water as low as possible.
 - .7 Connect to fixtures and equipment in accordance with manufacturer's instructions unless otherwise indicated.
 - .8 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.
- 3.2 Valves**
- .1 Isolate equipment, fixtures and branches with gate or ball valves.
 - .2 Balance recirculation system using lockshield globe valves. Mark settings and record on as-built drawings on completion.
- 3.3 Pressure Tests**
- .1 Test pressure: 1.5 times maximum system operating pressure, and not less than 860 kPa.
- 3.4 Balancing**
- .1 Balance domestic hot water recirculation system shall be balanced by TAB Contractor under Division 23. Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.
- 3.5 Pre- Start-Up Inspections**
- .1 Systems to be complete, prior to flushing, testing and start-up.
 - .2 Verify that system can be completely drained.
 - .3 Ensure that pressure booster systems are operating properly.
 - .4 Ensure that air chambers, expansion compensators are installed properly.
- 3.6 Disinfection**
- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.
 - .2 Upon completion, provide a "Chlorination Certificate" at project closeout and provide a copy in the O&M Manual.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01 11 55 General Instructions
- .2 Section 01 35 33 Health and Safety Requirements
- .3 Section 23 05 00 Common Work Results – Mechanical

1.2 References

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 10-2013, Standard for Portable Fire Extinguishers.
 - .2 ANSI/NFPA 13-2013, Installation of Sprinkler Systems.
 - .3 ANSI/NFPA 25-2014, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter's Laboratories of Canada (ULC).
- .4 Fire Commissioner of Canada FC 403, "Sprinkler System".

1.3 Design Requirements

- .1 Design and provide automatic wet and dry pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.
- .2 The "Authority Having Jurisdiction" will be designated by the Departmental Representative.
- .3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in sprinkler systems.
- .6 Design systems for earthquake protection for buildings in seismic zone applicable.
- .7 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13.
 - .2 Uniformly space sprinklers on branch.
- .8 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
- .9 Water Supply:
 - .1 Base hydraulic calculations on static and residual pressures indicated on drawings. For design purpose, the available water supply pressures shall be de-rated by a 10% safety factor.

- .10 Sprinkler drawings and specifications are to give the bidder concept of the work involved. The design intent shall not be changed. Significant design features such as the location of exposed pipes and the method of zoning the sprinkler system may not be changed without prior discussion and approval by the Departmental Representative. Field changes may be required to accommodate lighting, and hidden obstructions. Possible additional sprinkler heads may be required if blind spaces and ceiling drops have not been noted and/or dry type heads may have to be implemented if the area is not frost free.
- .11 The contractor shall make access to blind spaces in a professional manner. Honeycombing required to establish joist locations and/or similar endeavours to establish sound pipe hangers, are acceptable.

1.4 Submittals

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 11 55 – General Instructions.
 - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 11 55 – General Instructions.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 11 55 – General Instructions.
 - .2 Shop drawings: submit drawings stamped sealed and signed by professional engineer registered or licensed in Province of British Columbia. Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.
 - .7 Assembly details.
 - .8 Accessories.
 - .3 Drawings: Sprinkler heads and piping system layout.
 - .1 Prepare detail working drawings of system layout in accordance with NFPA 13 using full size contract drawings.
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings.
 - .4 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design density of each system.

- .3 Assurance of Professional Design and Commitment for Field Review.
 - .1 Provide Assurance commitment letters (Schedules B-1 and B-2) at the commencement of the project, in accordance with the building code and for submission to the Departmental Representative and review by the Authority Having Jurisdiction.
 - .2 Provide Assurance of Professional Field Review and Compliance (Schedule C-B) at the completion of the project.
- .4 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 11 55 – General Instructions in accordance with ANSI/NFPA 13.
 - .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Sprinkler heads.
 - .3 Pipe hangers and supports.
 - .4 Mechanical couplings.
 - .3 Field Test Reports:
 - .1 Preliminary tests on piping system.
 - .2 Formal tests and inspections
 - .4 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings (prints) of each system for record purposes.
 - .2 Submit drawings in digital file versions with title block similar to full size contract drawings.
 - .5 Operation and Maintenance Manuals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 11 55 – General Instructions.
 - .2 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual specified in Section 01 11 55 – General Instructions in accordance with ANSI/NFPA 13.

1.5 Quality Assurance

- .1 Qualifications:
 - .1 Installer: company or person specializing in sprinkler systems with documented experience.
 - .2 All work shall be carried out by Sprinkler Pipe Fitters who carry a "Certificate of Qualification" for this trade as issued by the Ministry of Labour.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

- .3 Inspections and Tests:
 - .1 All inspections, examinations and tests required by the "Authorities and Agencies having jurisdiction" specified shall be arranged and paid for by the fire protection contractor, as necessary to obtain complete and final acceptance of the fire protection system.
 - .2 Provide Contractor's Material and Test Certificates and all required test papers as may be requested by all parties having jurisdiction and duly witnessed by Departmental Representative, showing proof of:
 - .1 Underground hydrostatic test of 1400 kPa (200 PSI).
 - .2 Flushing of underground main through 100mm (4") drain pipe.
 - .3 Hydrostatic test of overhead piping @ 1400 kPa (200 PSI).
 - .4 Verification of all alarm and trouble devices installed under this contract.
 - .3 Provide the services of the Professional Engineer who designed the fire protection systems for "Field Review" of the installation. Construction period review reports shall be submitted during the construction period.
 - .4 If welding is required, the Contractor shall submit a copy of the welder's certification to the Sprinkler Engineer for Record purposes prior to starting work.

1.6 Maintenance

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 11 55 – General Instructions.
- .2 Provide spare sprinklers and tools as required by ANSI/NFPA 13.

1.7 Delivery, Storage and Handling

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 11 55 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 11 55 – General Instructions.

PART 2 PRODUCTS

2.1 Underground Pipe And Fittings

- .1 Underground water pipe shall be PVC pipe conforming to AWWA Standard C900-75 "Poly (Vinyl Chloride) (PVC) Pressure Pipe 4 through 12 inch (100 through 300mm) for water", CSA B137.3 ULC CEx448, and UNI-B-3-80. The pipe is to be Class 150psi (Dimensional Ratio (DR)-18 with cast iron outside diameter) and integral bell gasket joint. Gaskets are to be bonded into the ring groove prior to shipment. Underground fittings shall have joints and pressure rating compatible with pipe used. Risers shall be cement lined ductile iron conforming to AWWA Specification 50.
- .2 All underground piping for fire mains shall be installed, clamped and anchored and flushed and hydrostatically pressure tested according to requirements of NFPA 13 and NFPA 24 latest Editions. Flushing shall be done through 100mm (4") minimum diameter piping.
- .3 At all changes in direction and at tees, ells, plugs, caps, bends, and hydrants, anchor mains as per NFPA 24 latest Edition. Pipe clamps and tie rods, thrust blocks, or other approved methods or devices may be used. Continuously threaded rod shall not be used for underground applications.

2.2 Pipe, Fittings & Valves

- .1 Pipe:
 - .1 Piping shall meet or exceed one of the following standards:
 - .1 Black and Hot-Dipped Galvanized Welded and Seamless Steel Pipe – ASTM A795
 - .2 Welded and Seamless Steel Pipe – ANSI/ASTM A53
 - .3 Wrought Steel Pipe – ANSI B36.19M
 - .4 Elec.-Resistance Welded Steel Pipe – ASTM A135
 - .2 All thickness for pressures up to 2070 kPa (300 psi) shall be as follows:
 - .1 Joined by shop welding or roll grooving:
 - .1 Up to and incl. 125mm (5") – Schedule 10
 - .2 150mm (6") – 3.40mm (0.134)
 - .3 200mm, 250mm (8", 10") – 4.78mm (0.188")
 - .2 Joined by threaded fittings or cut grooves:
 - .1 up to 200mm (8") – Schedule 40
 - .2 200mm (8") and larger – Schedule 30
- .2 Fittings and joints to ANSI/NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .2 Copper tube: screwed, soldered, brazed. Not permitted in any inmate areas.
 - .3 System piping 50mm (2") and smaller shall be Schedule 40 and threaded joints, or Schedule 10 lightwall with grooved joints, material and IPS dimensions conforming to NFPA

13. Larger sizes shall be Schedule 10 and joined by welding or groove joining methods in accordance with NFPA 13.
- .4 All grooved products shall be of one manufacturer. All grooved end fittings shall be of "full flow" design and manufactured from ductile iron conforming to ASTM A-536. Grooved coupling shall be designed with angle bolt pads to provide a rigid joint except where flexibility is required. "Flush cap" or "flush seal" gaskets shall be used with couplings in dry pipe systems.
 - .5 Cast iron floor and ceiling plates with set screws shall be provided whenever pipe passes through walls, floors and partitions. In finished areas, plates shall be chrome plated.
 - .6 CPVC piping is not acceptable for this project.
- .3 Valves:
- .1 ULC listed for fire protection service.
 - .2 Up to NPS 2: bronze, screwed ends, O. S. & Y. gate.
 - .3 NPS 2 1/2 and over: cast iron, flanged or roll grooved ends, indicating butterfly valve; OS & Y gate.
 - .4 Swing check valves.
 - .5 Ball drip.
 - .6 All water supply and zone isolation valves shall be monitored with tamper switches. Electric wiring for control and alarm components will be provided Under Division 16.
 - .7 Valves controlling water supply and alarm shut-off shall be of O. S. & Y. type with rising stem or approved gear operated butterfly valves with supervisory switch. Where a grooved piping system is installed, grooved end isolation/control valves may be used. Valves shall be supervised by a factory installed double throw/double pole switch.
 - .8 All O. S. & Y. gate valves shall be monitored with tamper switches. Electric wiring for control and alarm components shall be provided under Division 16.
- .4 Pipe hangers:
- .1 ULC listed for fire protection services.
 - .2 Hanger standards shall conform to Section 3-10 of NFPA 13. Use "C" clamps complete with lock nuts and restraining straps. Hangers shall be supplied and installed in accordance with NFPA 13. C-type clamps used to attach hangers to the building structure shall be equipped with lock nuts and retaining straps.
 - .3 Sway bracing shall be installed as per Section 3-5.3.5 of NFPA 13.

2.3 Backflow Prevention

- .1 Provide a double check valve assembly as indicated on the Fire Protection Drawings.
- .2 Backflow prevention stations shall be listed by Underwriter's Laboratories Canada (U.L.C.).
- .3 Backflow prevention stations shall be in complete accordance with CSA B64.10-M88 "Selection, Installation, Maintenance and Field Testing" and American Water Works Association - Western Canada Section and Pacific Northwest Section - 1990 Fifth Edition.

- .4 Complete testing of all reduced pressure principle backflow prevention devices shall be carried out under this Section prior to final acceptance of fire protection systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

2.4 Sprinkler Heads

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 All sprinklers in suspended ceiling areas shall be chrome finish recessed type with chrome flush type escutcheon plates. All sprinklers in open ceiling areas shall be of brass finish upright or pendent types. All sidewall sprinklers shall be chrome finish horizontal type.
- .3 Sprinkler shall be protected from mechanical injury by standard guards where necessary. The proximity of sprinklers to heating units shall be taken into consideration in determining the temperature rating.
- .4 Adjacent to each sprinkler alarm valve, provide one (1) 12-sprinkler capacity Underwriters approved cabinet complete with various type and temperatures of sprinklers in ratio to the numbers installed of each type along with a standard sprinkler wrench.

2.5 Supervisory Switches

- .1 General: to ANSI/NFPA 13 and ULC listed for fire service.
- .2 Valves:
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .3 Pressure or flow switch type:
 - .1 With normally open and normally closed contacts and supervisory capability.
 - .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
 - .3 Connect into building fire alarm system.

2.6 Pressure Gauges

- .1 Provide pressure gauges at the following locations:
 - dry pipe valve
 - compressor
 - pump suction and discharge
 - top of all standpipe risers
- .2 Pressure gauges shall be ULC listed stem mount or wall mount type with Bourdon phosphor bronze tube, brass socket, 6 mm [1/4"] lower connection, aluminum case in black enamel finish, chrome removable slip ring, stainless steel rotary type movement, minimum 90mm [3 1/2"] dial of 1% of full scale range and pressure range to suit application, with lever handle cock and brass 6 mm [1/4"] NPT snubber to suit service.

2.7 Flow Switches

- .1 Provide alarm indication for each system or zone indicated. Flow switches shall be vane type with retard for pipes 50mm [2"] or larger; without retard for smaller pipe sizes.
- .2 All zones shall have a flow switch, an isolation valve and an integral test and drain.

2.8 Fire Department Connection

- .1 Provide connections approximately 1.5 m above finish grade, location as indicated.
- .2 To ANSI/NFPA 13 and ULC S543 listed, Siamese type.
- .3 Polished bronze exposed of approved two-way type with 2.5 inch National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
- .4 Thread specifications: compatible with local fire department.

2.9 Pipe Sleeves

- .1 Provide pipe sleeves where piping passes through walls, floors, and roofs.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
- .4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
- .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.

2.10 Escutcheon Plates

- .1 Provide split hinged type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.
- .2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.11 Spare Parts Cabinet

- .1 For storage of maintenance materials, spare sprinkler heads and special tools.
- .2 Construct to sprinkler head manufacturer's standard.

2.12 Inspector's Test Connection

- .1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.
- .2 Provide test connection piping to location where discharged without property damage.
- .3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.13 Signs

- .1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

2.14 Dry Pipe Valve

- .1 ULC listed.
- .2 Cast iron, flanged type, sized to suit water main.
- .3 Components:
 - .1 Accelerator.
 - .2 Air maintenance device with low pressure alarm.
 - .3 Alarm pressure switch with supervisory capability.
 - .4 Pressure gauges.
 - .5 Drain valve.
 - .6 Test valve with associated piping.
 - .7 Shut off valve - OS & Y with tamper-proof device wired back to fire alarm panel.

2.15 Compressed Air Supply

- .1 Automatic Air Compressor.
- .2 ULC listed.
- .3 Capacity:
 - .1 To restore normal air pressure in system within 30 minutes for low differential systems.
 - .2 To provide air pressure of 140 kPa in excess of calculated trip pressure of dry pipe valve] [in accordance with instruction sheet furnished with dry pipe valve.
- .4 Piping: ferrous, NPS 3/4 screwed joints and fittings, to ANSI/NFPA 13.

2.16 Portable Fire Extinguisher

- .1 Provide Ansul dry chemical, multi-purpose fire extinguishers with U.L. rating 2-A:10-B:C.
- .2 Provide extinguishers in all fire extinguisher cabinets as located on the Architectural drawings. Provide wall bracket and mount additional surface mounted extinguishers, where shown on Mechanical drawings. Locations of extinguishers and minimum travel distances shall comply with NFPA 10 regulations.

PART 3 EXECUTION

3.1 Manufacturer's Instruction

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 Above Ground Piping Systems

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
 - .2 Perform welding in shop; field welding will not be permitted.
 - .3 Conceal piping in areas with suspended ceiling.

3.3 Pipe Installation

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.
- .5 Install spare parts cabinet as indicated.
- .6 Pressure gauges:
 - .1 Location:
 - .1 On water side and [air] [nitrogen] side of dry pipe valve.
 - .2 At air receiver.
 - .3 In each independent pipe from air supply to dry pipe valve.
 - .4 At exhausters and accelerators.
 - .2 Install to permit removal.
 - .3 Locate so as not subjected to freezing.
- .7 Valve identification:
 - .1 Identify drain valve and auxiliary valves.

3.4 Field Painting

- .1 Clean, pre-treat, prime, and paint new systems including piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:
 - .1 Piping in Finished Areas:
 - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
 - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
 - .3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
 - .2 Piping in Unfinished Areas:
 - .1 Finish painting not required in spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a pre-finished material.
 - .2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.5 Field Quality Control

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of the Sprinkler Engineer of Record.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Preliminary Tests:
 - .1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.
 - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .4 Test alarms and other devices.
 - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
 - .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

- .2 Submit written request for formal inspection at least 15 days prior to inspection date.
- .3 Repeat required tests as directed.
- .4 Correct defects and make additional tests until systems comply with contract requirements.
- .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
- .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .7 Altered and relocated sprinkler system to be inspected and tested in conformance with NFPA.

3.6 Placing In Service

- .1 When the entire fire protection system has been completed to the satisfaction of the Departmental Representatives and when operating and maintenance instructions have been provided, the Fire Protection Contractor shall, in the presence of the Sprinkler Engineer of Record, demonstrate the complete operation and maintenance required to the operating personnel. A complete operational test conducted on the entire installation for the purpose of verification of compliance with all applicable standards and codes shall be carried out.
- .2 Operating manual shall include the following:
 - .1 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and trouble shooting instructions.
 - .2 Valve schedule for all valves including location, service type and normal position for all systems.
 - .3 Schematic showing the location of each excess pressure pump breaker, inspectors test valves, low point drains and flow switches where applicable.
 - .4 Warranties and certificates.
 - .5 Manufacturer's operating and maintenance manuals.
 - .6 Description of the operation of each system and the function of each piece of equipment.
 - .7 Lubrication schedule for all lubricated equipment including recommended lubricants.

END OF SECTION