

**1. PIPING and FITTINGS 22 00 20**

1. Provide isolation valves at all fixtures, appliances and equipment.
2. Provide check stops at all mixing valves.
3. Allow for thermal expansion on all piping systems conveying hot or cold vapour or liquid.
4. Provide point of use thermostatic mixing valves set to 43°C (110°F) for lavatories where indicated.
5. Tag all major zone and shut off valves with 38mm (1½") diameter brass tags. Index and list valves, insert list in each O&M Manual also frame and mount copy of list in a conspicuous area of the mechanical Room.
6. Identify all equipment with black lamacoid tags 100mm x 25mm (4"x1") with white lettering. Mechanically affix tags to equipment. Equipment names and number to match those listed on Contract Documents.
7. Identify all piping with stenciled lettering and directional arrows at intervals no greater than 6m (20') and at every change in direction. Labeling and identification to either The City's standard or the CSA standard. Confirm system with The City prior to Bid Submission.
8. Wherever pipes of dis-similar metals are joined the piping systems shall be protected and isolated by use of dielectric unions or brass valves.
9. Provide and install union or flange connections at all equipment and devices to allow for ease of service or future replacement.
10. Piping Systems:
  1. Sanitary & Storm Drainage - Above Ground: Cast iron and copper. PVC DWV as permitted by the 2010 NPC, System XFR where installed in return air plenum.
  2. Domestic Hot & Cold Water: Type L copper with wrought copper fittings and lead free solder; CPVC Dr11 Pipe and fittings as permitted by the 2010 NPC. PEX as permitted by the 2010 NPC.
  3. Building Water Services: Soft copper Type K, PVC or HDPE to approval of authorities having jurisdiction
  4. Sanitary & Storm Drainage - Buried: PVC DWV as permitted by the 2010 NPC. PVC Sewer Pipe as permitted by the 2010 NPC.
  5. Heating Systems: Schedule 40 steel, Type L copper
11. Valves:
  1. Isolate all serviceable equipment, using ball and butterfly valves where possible.
  2. All valves shall have a minimum certified rating of 150 psi.
  3. All drain valves shall be complete with cap and chain.
  4. Install ¼ turn ball valves prior to all pressure gauge devices.
  5. All gas system valves shall be CSA approved for application.
  6. PVC ball valves, double backing with union ends, solvent weld, pressure rated at 230 psi (1580kPa) at 79°F (23°C).
12. Hangers and Supports:
  1. All hangers shall be of same material as piping system, or shall be isolated from the pipe.
  2. Provide adjustable clevis hangers equal to pipe size and of same material as piping system.

3. Provide oversized hangers on all cold water piping conveying liquid less than 21°C (70°F).
  4. Use only factory made inserts, coach screw rods, c-clamps, beam clamps and expansion shields rated for the intended load.
  5. "Caddy" clip or tension clip rod supports are not allowed on this project.
  6. Duct hangers shall be rod or strap 2 gauges heavier than duct.
13. Provide and install sleeves of suitable material where piping and duct systems pass through any and all separations.
  14. Supply and install thermostats and gauges at all major pieces of equipment and where indicated on the Drawings. (Note PSN-B Snubbers required at all gauges.) Mount all gauges and thermostats vertically and place so that ease of reading is ensured. Pressure and temperature ranges shall be suitable for the application.
  15. Primer paint all miscellaneous metal supports channels and angle iron prior to installation.
  16. Pipe all water discharge from relief valves and equipment drains to nearest floor drain or suitable receptacle. Confirm locations with Contract Administrator prior to installation. Pipe all methanol and glycol discharge from relief valves back to fill tank.
  17. Install all valves, strainers, equipment, specialties, filters and the like to permit ease of operation and full access.
  18. Acceptable joining systems include mechanical joints (sanitary) soldering, silver soldering, threaded joints, welding, grooved Victaulic (black) and grooved copper Victaulic. NOTE: Tee drilling and Press-fit systems are not acceptable on this project.
  19. Where passing through roof structures, all piping must extend through the side of pitch boxes. (Exception – plumbing vents) Refer to Architectural details for co-ordination.
  20. Test all systems to 1½ times Working pressure for a minimum of two hours. All tests shall be recorded and independently witnessed. Submit recorded data for Contract Administrator's review prior to Substantial Completion and include in O&M Manuals.
  21. Provide automatic air vents at piping high points in mechanical spaces, and manual air vents at all other piping high points.
  22. Metal to PVC thread connections shall be stainless steel reinforced SCH 80, PVC female adaptors.

**1. MECHANICAL INSULATION**

1. Definitions:
  1. The word "exposed" where used in this Section means any Work, which is not concealed in wall, shaft, or ceiling cavities or spaces. Work in mechanical rooms, utility spaces, behind doors in closets or cupboards or under counters is considered exposed.
2. Flexible Duct Insulation (FDI):
  1. R-24 flexible blanket with foil jacket, pin at 400mm on centre and tape all joints with aluminum tape.
3. Pre-molded Pipe Insulation (PPI):
  1. Provide ULC listed sectional fiberglass pipe insulation in compliance with ASTM C335-84 in pre-molded sections 900mm (36") long, split and ready for application with a minimum Thermal Conductivity of 0.033 W/m deg C at 24°C (75°F) mean temperature and be capable of use on service from -40°C to 260°C (-40°F to 500°F) and with factory applied vapour seal jacket of vinyl coated foil Kraft laminate with reinforcing of open mesh glass fibre.
4. Rigid Duct Insulation (RDI):
  1. Rigid board: 72kg/m<sup>3</sup> (4.5 lbs/ft<sup>3</sup>) density ULC listed glass fibre board with glass fibre reinforced aluminum foil vapour seal facing and minimum thermal conductivity of 0.035 W/m deg C at 24 deg C mean temperature.
5. Non-Pre-molded Pipe Insulation (FPI):
  1. 12g/M<sup>3</sup> (0.75 lb/ft<sup>3</sup>) thick ULC listed fiberglass flexible blanket with glass fibre reinforced aluminum foil vapour seal facing with thermal conductivity of 0.036 W/m deg C.
6. Low Temperature Insulation (LT):
  1. Low temperature: fire retardant closed cell Armaflex in sheet form or pre-formed for piping.
7. Finishes & Protective Coverings:
  - C Canvas: 170 g/m<sup>2</sup> with lagging adhesive, ULC labeled.
  - A Tyvek under Protective covering (aluminum): 020 Childers corrugated aluminum pre-formed covering complete with strapping and seals.
  - M Trowelled-on weather protective coating: Bakor 110-14 asphalt mastic vapour barrier coating.
  - P 20 mil PVC, high impact, UV resistant, solvent welded, rated for 0-150°F (-17 to 65°C).

**APPLICATION SCHEDULE**

Ductwork	Thickness	Type	Finish
1. Supply ductWork concealed	25mm (1")	All FDI	None
2. Supply ductWork exposed	25mm (1")	All RDI	C
3. Outside air intake ducts	50mm (2")	All FDI	None

Ductwork	Thickness	Type	Finish
4. Rectangular ducts penetrating an exterior building surface	38mm (1½") for the last 3m (10')	All RDI	None
5. Round ducts penetrating an exterior building surface.	38mm (1½") for last 3m (10')	ALL FDI	None
6. Exhaust ducts	38mm (1½") for last 3m (10')	All FDI	None
7. Relief air ducts	38mm (1½") for the last 3m (10')	All FDI	None
8. Drip pans	25mm (1")	All RDI	C
9. Dryer vents	25mm (1")	All FDI	C

**\*\* All exposed insulated ducts in mechanical room service rooms or in occupied spaces are to be type 'C' finish.**

Piping (Provide canvas finish where exposed):	Thickness	Type	Finish (concealed)
1. Steam piping: <ul style="list-style-type: none"> <li>▪ 2" &amp; smaller piping</li> <li>▪ 2-1/2" to 4" piping</li> <li>▪ 4"&amp; over piping</li> </ul>	50mm (2") 65mm (2½") 75mm (3")	All PPI All PPI All PPI	C or P
2. Condensate Piping	38mm (1½")	All PPI	None
3. Domestic cold water	38mm (1½")	All PPI	None
4. Domestic hot, recirculation	25mm (1")	All PPI	None
5. All Refrigerant lines	25mm (1")	All LT	None
6. All Refrigerant Piping Outdoors	50mm (2")	All LT,	A
7. Plumbing vents	12mm (½") last 3m (10')	All PPI	None
8. Rain water leaders & drain bodies, sump discharge	38mm (1½")	All PPI	P

**\*\* All exposed insulated piping in mechanical rooms, service rooms or visible in occupied spaces are to be Type 'C' or 'P' Finish.**

**1. TESTING AND BALANCING (TAB)**

1. Contractor shall be members of AABC.
2. Balance all supply air outlets and main ducts conveying 25% or more of system volume to  $\pm 5\%$  of design. Allow to replace belts and sheaves on equipment to meet air balance volumes.
3. Balance all air moving equipment to  $\pm 5\%$ .
4. Balance all branch ductwork to  $\pm 10\%$ .
5. Test all fire dampers, stops and flaps to industry standards. Tag each device listing company information and testing information.
6. The reports to contain recorded data and schematics and be formatted as per AABC.
7. Balance all heating/cooling systems to  $\pm 5\%$ .
8. Balance all terminal heating and cooling units to  $\pm 10\%$ .
9. Adjust circuit balancing valve set screw to final position.
10. Advise Ventilation Subcontractor where balancing dampers are required to facilitate balancing of ventilation system.
11. Advise HVAC Subcontractor where circuit balancing valves are required to facilitate balancing of heating and cooling systems.
12. Arrange with Mechanical Subcontractor to have any necessary modifications to achieve the design and flow rates at no extra cost to The City.
13. Three (3) copies of the TAB report, including certification of fire dampers, stops and flanges shall be provided directly to the Contract Administrator prior to certification for occupancy. Include Drawings, room numbers and identification numbers of fire dampers, types, and flaps on the schematics.
14. TAB report shall include final valve position for all circuit balancing valves.
15. TAB report shall include schematic Drawings identifying all fire dampers and circuit balancing valve locations.
16. TAB report shall include pump curves on all balanced pumps.
17. Allow for an additional Site review and adjustments at the request of the Contract Administrator after submission of final report.

**1. PLUMBING**

1. Supply and install fixtures indicated under Contract Documents to provide a complete and functional plumbing system.
2. Provide thermostatic mixing valves on all sinks and lavatories.
3. Use only lead free solders when joining piping components.
4. Provide access doors at all concealed cleanouts, valves and water hammer arrestors.
5. Install water hammer arrestors at each group of fixtures.
6. Install trap primers as indicated on the Contract Documents and as required by local code authorities.
7. Install deep seal trapped condensate drains from all cooling equipment.
8. Fixtures shall be white and complete with chrome trim, fixture stops shall be screwdriver type where exposed, wheel handle where concealed.
9. Water closet MAP test minimum: 800 grams.
10. Water closets ball pass test: 2 $\frac{1}{8}$ " (54mm) glazed, minimum.

## 1. CHEMICAL TREATMENT

1. Work Performed by this Section:
  1. Supervision of all degreasing procedures, initial fill/start, commissioning and monitoring of treated systems and training of The City's staff in operating and maintenance procedures.
2. System Flushing:
  1. Thoroughly flush and clean all water circulating systems and as often as necessary to ensure that scale, metal particles, etc. have been completely removed.
  2. Refill all systems and inject degreasants and circulate at temperatures and for periods as required to ensure that the systems are thoroughly cleaned. Flush systems and refill in preparation for administration of chemical treatment.
3. Monitoring & Instructions:
  1. Advise Contractor where drains and fill points are required in the piping systems to facilitate proper drainage and fill/injections of fluids.
  2. Carefully monitor the condition of all systems from initial fill to the point at which the systems are considered under stable operating conditions.
  3. Provide oral and written instructions to operating personnel for the maintenance and control of the water conditioning program.
  4. Submit a written report of system start-up showing water analysis and corrosion check test as part of documentation at the completion of the Work. Ensure report is included in O&M Manuals.
4. Sanitizing – Domestic Water:
  1. Potable water supply systems:
    1. Thoroughly flush and disinfect (chlorinate) water supply systems in accordance with municipal requirements and AWWA C601-68. The rates of chlorine application to be proportional to the rate of water entering the pipe.
    2. Flush domestic water piping prior to introducing chlorine with a sufficient flow to produce a velocity of 1 metre per second for ten minutes, or until all foreign Materials have been removed and the flushed water is clear. Provide connections and pumps as required.
    3. Arrange and pay for water quality tests to be performed by an independent testing laboratory acceptable to the Contract Administrator.
  2. Cleanup:
    1. Leave systems operating with Work areas clean to acceptance of The City and Contract Administrator.