

DIVISION 22 PLUMBING

Section 22 00 00 Plumbing - General

1 Codes, Standards and Approvals

- 1.1 The more stringent requirements of the latest National Plumbing Code of Canada and these requirements shall be used for the design.
- 1.2 Connection to municipal water supply shall have municipal approval.
- 1.3 Varying, or deviating from any item(s) indicated in this document must be approved by DTIR. DTIR will not grant a deviation from these requirements unless the deviation has been submitted in writing for review and approved prior to proceeding with the design.

2 Water Supplies

- 2.1 Every building shall be provided with a reliable and adequate water supply available to fire department mobile pumping apparatus, building fire protection systems and potable domestic water.
- 2.2 Water Supply Systems:
 - 2.2.1 The minimum water pressure required for plumbing fixtures on the top floor of a building is 172kPa (25 psi)
 - 2.2.2 Conform to Nova Scotia Department of Environment and Labour standards for Canadian Drinking Water.
- 2.3 Refer also to PART 2 Section 2, 21 00 00 for Fire Suppression additional requirements.

3 Plumbing

3.1 Service Water Pipe

- 3.1.1 Cement mortar lining for ductile iron pipe: to AWWA C104/A21.4-16.

3.2 Sewage Pumps

- 3.2.1 General: Only the facilities which cannot drain by gravity to the main sewer, shall be connected to the sump pit.
- 3.2.2 Equipment for Raising Sewage: Use duplex sewage pumps with automatic transfer switch.
- 3.2.3 Provide high water alarms in each sump pit.

3.3 Water Supply System

3.3.1 Service lines must enter the building in an accessible location. They must never enter in fuel rooms, storage rooms, switchgear rooms, or transformer vaults.

3.4 Domestic Hot Water

3.4.1 Generation of domestic hot water shall not be by the main boiler plant but instead by a separate oil fired boiler serving indirect domestic hot water heaters. Alternative strategies for heating of domestic hot water may be considered but will be allowed only with written permission from DTIR.

4 General Design Considerations

4.1 Provide isolating valves for:

4.1.1 For each piece of equipment.

4.1.2 For each group of fixtures or each bathroom and for each riser.

4.1.3 Whenever required by local plumbing code.

4.1.4 For sections of large buildings.

4.1.5 For all branches of water mains.

4.2 Commissioning shall be as per related Facility Services Subgroup- General (FSS-G) requirements.

Section 22 05 00 Common Work Results for Plumbing

1 Roll Grooved Joints

1.1 The more stringent requirements of the 2010 National Plumbing Code of Canada (2015) and these requirements shall be used for the design.

1.1.1 References

1.1.1.1 American Water Works Association (AWWA)

1.1.1.1.1 ANSI/AWWA C111/A21.11-(00) (AWWA C111/A21.11-17),
Rubber Gasket Joints for Ductile-Iron and Fittings.

1.1.1.2 CSA B242-M1980(R1998) (CSA B242-05 (R2016)), Groove and Shoulder
Type Mechanical Pipe Couplings.

1.1.2 Maintenance

1.1.2.1 Extra materials

1.1.2.1.1 Provide the following spare parts:

1.1.2.1.1.1 Gaskets for flanges: one for every ten flanges.

1.2 Products

1.2.1 Pipe Joints

1.2.1.1 Roll grooved: to CSA B242 (CSA B242-05 (R2016)).

1.2.1.2 Roll grooved: Joints to be rigid, except at expansion loops, elbows and pumps where flexible couplings shall be used.

1.2.1.3 Roll grooved products shall be of one manufacturer and have CRNS for Nova Scotia.

1.2.2 Fittings

1.2.2.1 Fittings for roll grooved piping malleable iron to ASTM A47/A47M-99(2018)e1 on ductile iron to ASTM A536-84(2019)e1.

1.2.3 Gaskets

1.2.3.1 Roll grooved couplings gaskets: type EPDM

1.2.3.2 Gaskets shall be good for cold and hot water up to minimum 110deg C (230deg F)

1.2.3.3 Gaskets for other services require approval in writing from DTIR

1.2.4 Valves

1.2.4.1 Connections

1.2.4.1.1 DN 65 (NPS 2 ½) and larger:

1.2.4.1.2 Grooved ends: as specified.

1.2.4.2 Butterfly valves: Application: Isolating equipment:

1.2.4.2.1 DN 65 (NPS 2 ½) and larger:

1.2.4.2.2 Grooved ends: as specified.

1.2.4.3 Swing check Valves: to MSS-SP-71 (MSS SP-71-2018).

1.2.4.3.1 DN 65 (NPS 2 ½) and larger:

1.2.4.3.2 Grooved ends: as specified.

1.2.4.4 Silent check valves;

1.2.4.4.1 DN 65 (NPS 2 ½) and larger:

1.2.4.4.2 Grooved ends: as specified.

2 Pressure/Temperature Relief Valve

2.1 Bronze body, maximum temperature of 93 deg. C (200°F) at 57kg (125 lbs). working pressure. A relief valve or expansion tank is required on domestic hot water systems. If a relief valve is used in lieu of an expansion tank, it shall be rated for no less than 80 psi and be designed for continuous use.

3 Pressure Reducing Cold Water Make-Up Assembly

3.1 Provide, if required, pressure reducing valve (complete with integral strainer and gate valve) on both inlet and outlet connections. Provide two pressure gauges, graduated to a gauge pressure of 862kPa (125 psi), to show inlet and outlet pressure of pressure reducing valve assembly. Provide pressure relief valve on reduced pressure side.

4 Pressure Reducing Valve

4.1 A pressure-reducing valve or valves, relief valve and strainer shall be installed on the domestic water mains wherever a pressure in excess of 552kPa (80 psi) may be expected. A globe valve bypass, the same size as reducing valve shall be provided. Include in the specifications the initial and final pressure and the required flow.

4.2 All valves shall be lead free.

Section 22 05 19 Meters and Gauges for Plumbing Piping

1 Thermometers and Pressure Gauges

1.1 Thermometers

- 1.1.1 Adjustable type 23cm (9") graduated scale, metal casing, calibrated in degrees F and degrees C range to suit the normal operating temperature of the fluid.
- 1.1.2 Locate and install thermometers to facilitate reading.
- 1.1.3 For plumbing systems, install thermometers on the outlet of all DHW tanks and on the inlet and outlet of tempering valves. Also install thermometers on domestic hot water return (recirculation) piping.
- 1.2 Pressure Gauges
 - 1.2.1 Gauges shall be 114mm (4½") diameter, cast aluminum, close type black finished ring and clear glass window, calibrated in both imperial and metric. Dials shall have white finish with jet black embossed figures and graduations.
 - 1.2.2 Permanent legibility shall be ensured by a hot dip stamp process. The pointer shall be adjustable, black finish with red tip.
 - 1.2.3 Movement shall be bronze with bronze bushing. The bourdon tube shall be phosphor bronze soldered to the socket and tip.
 - 1.2.4 Accuracy to be 1% over middle half of scale range and 1½% over balance. All gauges to be complete with snubbers and mini ball valves. Gauges on steam systems shall be complete with mini ball valves and pipe siphon.
 - 1.2.5 Locate and install pressure gauges to facilitate reading.
 - 1.2.6 For plumbing systems, provide calibrated pressure gauges for each pump over 373W (½ hp) (not required on DHW re-circulation pumps), on the water service inside the building, and on the outlets of pressure reducing valve assemblies.
- 2 Meters
 - 2.1 Provide each service connection with a meter, including where the source is other than municipal (e.g. provide meter where well used). Connections shall be provided in accordance with local requirements. Provide a pressure gauge downstream of the meter.
 - 2.2 Meters to be displacement type with pulse output and connected to building automation (controls) system. See Division 25 for additional requirements.
 - 2.3 For all meters provide a strainer upstream. Also provide a valved bypass around the meter and a valve and union on both the inlet and outlet connections. If more than one meter is installed, place a check valve between the meter and shutoff valve on the building side of each meter. A drain valve piped to a floor drain is required on the building side of the meter just beyond the shutoff valve.

Section 22 05 29 Hangers and Supports for Plumbing Piping and Equipment

1 Foundations and Bases

- 1.1 All mechanical equipment shall be mounted on 102mm (4 inch high) (minimum) concrete foundations, curbs, or housekeeping pads. In lieu of these concrete bases, steel or cast iron cradles, saddles or stands may be considered for some equipment but will be allowed only with written permission from DTIR.
- 1.2 Concrete bases shall be a minimum of 102mm (4") larger all around than the equipment, and have chamfered edges. Ensure bases are level prior to placement of equipment.

2 Pipe Hangers and Supports

- 2.1 Provide all hangers required for the proper support of piping. Hangers shall be steel adjustable clevis type, epoxy coated or copper plated where in contact with copper piping.
- 2.2 Provide cadmium plated threaded steel rods with nuts and washers. All hanger rod installations to be double nutted (top and bottom).
- 2.3 For plumbing systems, cold pipes less than 32mm (1¼") and all hot pipes shall have line size clevis hangers. Cold pipes 32mm (1¼") and larger shall have insulation protection shields and oversized hangers with calcium silicate, Buckaroos or plastic stand-offs between the pipe and the shield.
- 2.4 Hangers to be within 30cm (12") of at least one end of each elbow. Roller hangers to be provided where expansion dictates.
- 2.5 In concrete construction, use self drilling inserts at proper centers securely anchored in concrete.
- 2.6 Beam clamps shall be used when hanging from any structural steel members. No drilling or welding of these members shall be permitted.
- 2.7 Supporting bolts shall be maximum sizes usable with the specified hanger, with adjustable and locking stop units.
- 2.8 On hot water applications, hanger pipe and structural attachments shall be offset in such a manner that hanger rods are vertical when the piping is hot.
- 2.9 All piping to be hung so that if coils, 3 way valves or pumps were disconnected or removed, pipe would remain in place without sagging or requiring additional hanging.

- 2.10 Vertical pipes shall be supported at each floor by means of iron hooks or clamp hangers placed directly below hub or fittings.
- 2.11 Install piping on spring hangers where vertical movement of the pipe is ½" or more, or the transfer of load to adjacent hangers or connected equipment is not permitted.
- 2.12 When roll grooved piping is used, any piece 122cm (48") or longer shall have a minimum of one support.
- 2.13 Spacing shall be as per the most stringent of the following requirements, code requirements and authorities having jurisdiction.

Nominal Pipe Size	Hanger Rod Diameter	Maximum Spacing: Steel	Maximum Spacing: Copper
Up to 1¼" (32mm)	3/8" (10mm)	7'-0" (2100mm)	6'-0" (1800mm)
1½" (40mm)	3/8" (10mm)	9'-0" (2700mm)	8'-0" (2400mm)
2" (50mm)	3/8" (10mm)	10'-0" (3000mm)	9'-0" (2700mm)
2½" (65mm)	3/8" (10mm)	12'-0" (3700mm)	10'-0" (3000mm)
3" (80mm)	½" (12mm)	12'-0" (3700mm)	10'-0" (3000mm)
3½" (90mm)	½" (12mm)	13'-0" (4000mm)	11'-0" (3300mm)
4" (100mm)	½" (12mm)	14'-0" (4300mm)	12'-0" (3700mm)
6" (150mm)	¾" (20mm)	17'-0" (5200mm)	
8" (200mm)	7/8" (22mm)	19'-0" (5800mm)	
10" (250mm)	7/8" (22mm)	22'-0" (6700mm)	
12" (300mm)	7/8" (22mm)	23'-0" (7000mm)	

Note: Horizontal drainage pipes shall be supported at intervals of not more than 152cm (5'-0") except that where 305cm (ten (10) foot) lengths of cast iron is used, it may be supported at each coupling. Plastic pipe allowed by other sections of this document (PVC, PEX, PEX-AL-PEX) shall be supported as per code.

Section 22 05 48 Vibration and Seismic Controls for Plumbing Piping and Equipment

- 1 Refer also to 13 48 00 Sound Vibration and Seismic Control for general isolation requirements.
- 2 Install piping on spring hangers, inertia bases, RSR pads, etc. as required to maintain low sound and vibration levels.
- 3 Where lateral support of pipe risers is required it shall be accomplished by use of resilient lateral supports.
- 4 Pipes that penetrate the building construction shall be isolated from the building structure by use of unit resilient penetrating sleeve/seals.
- 5 Drain piping connected to vibration isolated equipment shall not contact the building structure or other non isolated system unless it is resiliently mounted as described above.
- 6 Provide flexible pipe connections in piping systems as required by other sections of this document.
- 7 Parallel running pipes may be hung together on a trapeze which is isolated from the building. Do not mix isolated and non-isolated pipes on the same trapeze.

Section 22 05 53 Identification for Plumbing Piping and Equipment

- 1 Manufacturers Nameplates
 - 1.1 Each piece of equipment shall have a metal nameplate mechanically fastened to equipment, with raised or recessed letters. Nameplates to be located so that they are easily read. Do not insulate or paint over plates.
 - 1.2 Include registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval) as required by respective agency and as specified. The supplier shall indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.
- 2 System Nameplates
 - 2.1 Major equipment to be identified with laminated plastic plates with white face and black center (lettering) of minimum size 89mm (3½") x 38mm (1½") x 2.4mm (3/32") nominal thickness, engraved with 12.7mm (½") high lettering.
 - 2.2 Nameplates to be fastened securely with pop rivets or screws in conspicuous place. Where nameplates cannot be mounted, such as on cool surfaces, provide standoffs.

- 2.3 Unique mechanical identification tag shall follow naming system laid out on drawings and in specifications. Equipment type, number and service or areas or zone of building it serves to be identified.

3 Equipment Concealed by Ceiling

- 3.1 At valves, balancing dampers air vents and drains, and other similar pieces of mechanical equipment located above T-bar ceilings or access doors, install circular 19mm (¾") diameter self-adhesive identification discs on the underside of the ceiling, as close as possible to the location of the equipment.
- 3.2 Discs shall be coloured as scheduled in this section (see pipe primary and secondary colours table).
- 3.3 Where the item has a primary and secondary colour, provide a 19mm (¾") diameter primary colour disc with a 9.5mm (3/8") diameter secondary colour disc centered on the primary disc.
- 3.4 Equipment located above T-bar ceilings or access doors, provide laminated plastic plates as noted for System nameplates above (with plates for fire dampers to have red face and white lettering). A second identical plate shall be installed on the underside of the ceiling grid or access door opening frame, as close as possible to the location of the equipment. System nameplates are required for backflow preventers, mixing valves and other similar pieces of equipment.

4 Pipe Identification

- 4.1 Medium in piping to be identified as indicated below showing name and service, including temperature and pressure as indicated below, and directional flow arrows where relevant.
- 4.1.1 Material shall be vinyl/plastic coated cloth with protective over coating and waterproof contact adhesive undercoating, suitable for continuous operating temperature of 149 deg. C (300 deg. F) and intermittent temperature of 204 deg. C (400 deg. F).
- 4.1.2 Tape shall be 51mm (2") wide single wrap around pipe or pipe covering with ends overlapping not less than 25mm (1"). Tape is to be cut, not torn.
- 4.1.3 Block capital letters 51mm (2") high for pipes of 76mm (3") nominal and larger o.d. including insulation and not less than 19mm (¾") high for smaller diameters shall be used.
- 4.1.4 Direction arrows 15cm (6") long by 51mm (2") wide for piping of 76mm (3") nominal or large o.d. including insulation and 102mm (4") long by 19mm (¾") wide for smaller diameters to be used. Double headed arrows to be used where direction of flow is reversible.

- 4.1.5 Waterproof and heat resistant plastic marker tags to be used for pipes and tubing of 19mm (¾") nominal and smaller o.d.
 - 4.1.6 Use black pipe marker letters and direction arrows. Use white on red background for fire protection pipe markers.
 - 4.1.7 Stenciled identification if used shall be from a first quality low VOC paint, with letters a minimum of 51mm (2"). Use stenciling on all purpose or canvas insulation jackets only.
 - 4.1.8 A high quality pre-manufactured identification system may be used in lieu of the identification noted above. Submit proposed product(s) to DTIR and do not proceed until written approval received.
- 4.2 Location of Identification
- 4.2.1 Markers and classifying colours on piping systems to be located so they can be seen from floor or platform.
 - 4.2.2 Piping runs to be identified at least once in each room, regardless of whether concealed or in open areas.
 - 4.2.3 Do not exceed 15m (50'-0") between identification, regardless of whether concealed or in open areas.
 - 4.2.4 In addition, where piping is concealed in pipe chase or other confined space, point of entry and leaving, and each access opening to be identified.
 - 4.2.5 Both sides where piping passes through walls, partitions and floors to be identified.
 - 4.2.6 Piping to be identified at starting and ending points of runs and at each piece of equipment.
 - 4.2.7 Identify branch, equipment or building served after each valve. (i.e. heating zones are to be identified in boiler rooms)
 - 4.2.8 Provide primary and secondary colour banding.
 - 4.2.9 Identification and colour coding shall be as per the following:

Pipe Marker	Valve Tag	Primary Colour	Second Colour
Domestic (Potable) Cold Water	DC	Gree	Non
Non-Potable Cold Water (paint entire line purple)	NP W	Purple	Non e
Domestic Hot Water Supp.	D.H.W .S.	Gree	Non
Domestic Hot Water Recirc.	D.H.W .R.	Green	Non
Storm Sewer	S.S.	Gree	Non
San. Sewer	San. S.	Gree	Non
Fuel Oil (Show Type No.)	F.O.(No.)	Yellow	Orange
Vent (Plumbing)	V.P	Gree	Non
Propane /Natural Gas (paint entire line yellow)	P.G./N.G.	Yellow	Orange
Raw Water	RAW W	Gree	Non
City Water	CI.	Gree	Non
Distilled Water	DI.	Gree	Non
Demineralized Water	DE.W	Gree	Non
Chilled Drinking Water Supply	D.W .S	Gree	Non
Drinking Water Return	D.W .R	Gree	Non

Pipe Marker	Valve Tag	Primary Colour	Second Colour
Treated Water	T.W	Green	None
Waste Water	W	Green	None
Acid Drain (Add Source)	A.D	Yellow	Black
Isotope Drain	I.D.	Yellow	Purple
Instrument Air	I.A	Green	None
Gasoline	G	Yellow	Orange
Nitrogen	NIT	Blue	Yellow
Oxygen	OX	Yellow	Orange
Vacuum	VA	Green	None
Compressed Air Gauge Pressure 689kPa (100 PSI) and Lower	C.A (PSI)	Green	None
Compressed Air Gauge Pressure Over 689kPa (100 PSI)	C.A (PSI)	Yellow	Black

5 Valves

5.1 38mm (1½") laminated plastic plates (tags) with corner hole shall be provided for all valves and installed with nonferrous chains, "S" hooks or heavy duty plastic tie wraps. Tags shall have horizontal 12.7mm (½") letters accurately aligned and machine engraved into the core. Required for all valves and operating controllers.

5.1.1 Provide one valve chart for each Operations and Maintenance manual and one chart framed and wall mounted.

5.1.2 Valves in systems to be numbered consecutively.

6 Buried Pipe Identification

6.1 Use detectable Identoline underground warning tape colour coded to pipe service for full length of pipe.

6.2 Bury to manufacturers recommendations.

- 6.3 Identify all systems, equipment, components, controls and sensors. Inscription to identify function.

Section 22 05 76 Facility Drainage Piping Cleanouts

1 Cleanouts

- 1.1 In addition to those required by code, an easily accessible cleanout shall be provided at each 135 degree change in direction in soil or waste pipe and at the base of each stack. All cleanouts shall be of the same nominal size as the pipes up to 102mm (4") and not less than 102mm (4") for larger pipes.
- 1.2 Provide cleanouts in vertical waste stacks below all double waste fittings used to interconnect two waste trap arms.
- 1.3 Provide cleanouts to allow for complete cleaning or clearing of building plumbing system. Cleanouts shall be spaced as per the latest National Plumbing Code of Canada requirements.
- 1.4 Provide P-traps with removable dips below all sinks or drainage Y's with copper end cleanouts in trap arm piping between trap and wall or in vertical waste piping prior to the floor penetration.
- 1.5 Cleanouts are to comply to the most stringent of either code requirements or the criteria described above.
- 1.6 Cleanouts shall be complete with gas-tight expansion plug.

Section 22 07 00 Plumbing Insulation

1 Wire, Mesh and Straps

1.1 Materials

- 1.1.1 Stainless Steel Wire: 18 ga., Type 304, dead soft annealed.
- 1.1.2 Galvanized Wire: 15 ga., annealed.
- 1.1.3 Stainless Steel Mesh: Hexagonal mesh, 20 ga., Type 304.
- 1.1.4 Galvanized mesh: Hexagonal mesh, 15 ga., galvanized annealed.
- 1.1.5 Aluminum straps: 12.7mm (½") x 26 ga.

- 1.1.6 Stainless Steel Straps: 12.7mm (½") x 26 ga., Type 304, dead soft.
- 1.2 Where vapour barriers are used, wire, wire mesh and straps shall be stainless steel.
- 1.3 Where no vapour barrier is required, wire and wire mesh shall be galvanized steel. Straps may be galvanized steel or aluminum.
- 2 Pins; welded 4 mm diameter with 38mm (1½") diameter head for installation through insulation. Length to suit thickness of insulation.
- 3 Canvas: ULC listed plain weave, cotton fabric, 227g (8 oz). Finish all exposed insulation with canvas and two coats of lagging adhesive.

Section 22 07 16 Plumbing Equipment Insulation

- 1 Insulate all equipment that operates at less than 15 °C (60°F) and more than 40 °C (104°F)
- 2 Equipment Insulation (above ambient temperature)
 - 2.1 Insulate domestic hot water tanks with 51mm (2") thick sectional semi-rigid mineral fibre, 4.5 lbs./cu. ft. See also Divisions 21 and 23).
 - 2.2 Insulation for curved surfaces shall be 51mm (2") flexible mineral fiber blanket to CAN/CGSB 51.11 (CAN/CGSB 51.11-92), or 51mm (2") thick sectional semi-rigid, as noted above.
 - 2.3 Hydrous calcium silicate insulation shall be 51mm (2 inches) thick, have a density of 208kg/m³ (13 lbs./cu.ft.), and a maximum linear shrinkage of 2.2% after a 24 hour period at 649deg. C (1200 deg. F).
- 3 Equipment Insulation (below ambient temperature)
 - 3.1 Insulate water storage tanks and other similar pieces of equipment with 51mm (2") thick sectional semi-rigid mineral fibre, 72kg/m³ (4.5 lbs./cu. ft), complete with vapour barrier jacket. See also Divisions 21 and 23.
 - 3.2 Insulation for curved surfaces shall be 51mm (2") flexible mineral fiber blanket to CAN/CGSB 51.11 (CAN/CGSB 51.11-92), or 51mm (2") thick sectional semi-rigid, as noted above, complete with vapour barrier jacket.

- 4 On flat surfaces, mineral fibre insulation shall be applied by impaling the insulation on 9 ga. pins, spot welded, on maximum 30cm (12") centers, and placed no closer than 4" from the edge of the board. Secure with 12.7mm (½") O.D. speed washers. Provide appropriate finish and canvas jacket.
- 5 On curved surfaces secure the mineral fibre insulation where indicated with galvanized steel wire or aluminum straps. Finish the insulation by applying 25mm (1") galvanized hexagonal mesh and 15 gauge galvanized annealed wire, with metal corner beads applied after the blocks are wired in place. Wire mesh shall be tightly stretched in place and secured with galvanized wire. Overlap mesh points and bind with galvanized wire. Apply one coat, not less than 6.4mm (¼") thick of hydraulic setting cement and trowel to a smooth finish. Cover with canvas neatly fitted and secured with lagging adhesive. Lap seams at least 51mm (2").
- 6 Calcium silicate insulation blocks shall be carefully fitted and applied with all blocks staggered. The blocks shall be secured with galvanized wire or aluminum straps.
- 7 Finish all exposed insulation with canvas jacket that is ULC listed, fire retardant treated, applied with an approved lagging adhesive and painted with a fire retardant paint with a flame spread rating not greater than 25.

Section 22 07 19 Plumbing Piping Insulation

1 Pipe Insulation

- 1.1 Insulate all piping that operates at less than 16 deg. C (60 deg. F) or more than 40deg. C (104 deg. F) (in floor radiant feeds less than 40deg. C (104 deg. F) do not require insulation). All piping insulation shall be jacketted and piping/fittings/components operate at less than 16 deg. C (60 deg. F) shall have insulation with a vapour barrier jacket. Insulation and jacket material shall be suitable for the operating temperature of the pipe, for example PVC jacket on fittings would not be suitable for steam service.

1.2 Pipe Insulation

- 1.2.1 Pipe insulation shall be preformed mineral fiber having a density of 64kg/m³ (4 lbs./cu.ft) to CAN/CGSB 51.9-92.

- 1.2.2 Insulation for concealed storm drainage piping may be flexible mineral fiber blanket to CAN/CGSB 51.11-92.

1.3 Jacketing on Pipe Insulation

- 1.3.1 Glass fiber reinforced kraft foil laminate, all service jacket is acceptable for concealed spaces.

- 1.3.2 Where not in concealed spaces, pipe insulation shall be canvas jacketed. Canvas jackets shall be ULC listed and labeled, fire retardant treated, applied with an approved lagging adhesive (two coats) and painted with a fire retardant paint with a flame spread rating not greater than 25 and a smoke developed classification of not higher than 50. Minimum canvas weight shall be 0.22kg/m² (6.5 oz/sq. yd).
- 1.3.3 PVC jacket on exposed pipe straights will be considered in locations where the insulation is not subject to physical contact, for example, where the pipe runs at high level in a non service room that has no finished ceiling, e.g. a gymnasium (obtain specific written permission from DTIR).
- 1.3.4 Vapour barrier jackets shall be factory applied and to CGSB 51-GP-52MA.
- 1.3.5 Provide 51mm (2") longitudinal overlap and butt joints.
- 1.3.6 For fittings, provide flexible or premoulded insulation with canvas or PVC jacket.
- 1.3.7 Provide removable pre-fabricated insulation pads c/w jacket for valves over 51mm (2"), 3-way control valves, strainers, suction diffusers, triple duty valves, heads of domestic water heater tube bundles, backflow preventers, water meters, domestic water PRVs, domestic cold water pumps.
- 1.3.8 Jacketing on piping installed outdoors shall be aluminum.
- 1.4 Pipe Insulation Thickness
 - 1.4.1 For heating and cooling systems piping, refer to Part 5 and Table 5.2.4.3 of the Model National Energy Code for Buildings (NEBC 2015). Note that the Table includes refrigerant piping with the lines to have minimum 25 mm (1") insulation.
 - 1.4.2 For domestic hot water systems, refer to Part 6 and Table 6.2.3.1 of the Model National Energy Code for Buildings (NEBC 2015). DTIR's additional requirements are as follows:
 - 1.4.3 All domestic hot water piping (Note 1 of this Table shall not apply) shall be insulated as per the Table,
 - 1.4.4 Piping systems not covered by the Model National Energy Code but requiring insulation are as follows:
 - 1.4.4.1 Domestic cold water systems shall be provided with minimum 13 mm (½") insulation on 13 mm (½") pipe and minimum 25 mm (1") insulation on pipe 19mm (¾") and over.
 - 1.4.4.2 Storm drainage (rainwater) piping shall be provided with minimum 25 mm (1") insulation on above grade portions, including the underside of roof drain bodies.

- 1.4.4.3 Humidifier piping to manifolds shall be provided with minimum 25 mm (1") insulation.
- 1.4.4.4 Air conditioning unit drain lines shall be provided with minimum 13 mm (½") insulation.

1.5 Installation

- 1.5.1 Pipe insulation must be kept clean and dry.
- 1.5.2 Unless specifically noted otherwise insulation shall not stop at walls and floors.
- 1.5.3 Both longitudinal and butt joints may be made with factory applied pressure sensitive vapour proof adhesive.
- 1.5.4 Gouge out insulation for proper fit where there is interference between weld bead and insulation. Insulation shall be beveled away from studs and nuts to permit their removal without damage to insulation, and shall be closely and neatly trimmed around extending parts of pipe saddles, supports, hangers and clamp guides, and sealed with insulating cement.
- 1.5.5 The exposed surface, and any surface that may be exposed of any insulation assembly by cutting through material in any direction, shall have a flame spread rating not greater than 25 without evidence of continued combustion, and the insulation materials shall also have a smoke developed classification of not higher than 50 when tested in accordance with ASTM E84 (ASTM E84-19a).
- 1.5.6 If the coverings and linings are to be applied with adhesives, they shall be tested as assembled with such adhesives; or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50.

Section 22 10 00 Plumbing Piping

- 1 All solder for drainage, vent and domestic water piping to be lead free.
- 2 Drainage and Vent Systems
 - 2.1 Sanitary, storm and vent pipe above grade shall be DWV copper for sizes under 51mm (2"), cast iron or DWV copper for sizes 51mm (2") and over. Cast iron shall conform to CAN B70 (CSA B70-12 (R2016)). Fittings to be same material as pipe. Mechanical joints may be used above grade. Seal between cast iron and copper shall be made with an appropriate fitting. Right angle connections in drain pipes shall be made with Y branches and 1/8 bends, the use of 90 deg. tees and elbows shall be avoided.

- 2.2 PVC-DWV for above grade piping is also acceptable where permitted by code. PVC-DWV for above grade shall have less than 25 flame spread and not more than 50 smoke rating (example IPEX XFR-15-40). Note that PVC-DWV shall be insulated as per Facility Services Subgroup - General, Pipe Insulation.
- 2.3 Minimum pipe size used below grade shall be 51mm (2").
- 2.4 Sanitary pipe below grade shall be PVC-DWV or cast iron.
- 2.5 Storm pipe below grade shall be PVC-SDR 35, PVC-DWV or cast iron.
- 2.6 Sanitary pipe and fittings running under kitchen areas and boiler rooms shall be cast iron as described above.
- 2.7 Joints for below grade cast iron pipe shall be hub and spigot with self locking rubber compression gaskets (Bibby Bi-Seal or equal products which require approval in writing from DTIR). Mechanical joints may also be used below grade.
- 2.8 Each fixture shall be provided with individual trap. Stacks less than 76mm (3") where carried through the roof, shall be increased to at least 76mm (3") before passing through the roof.
- 2.9 Stacks 76mm (3") and larger shall be increased at least one size before passing through the roof.
- 2.10 Pipe all equipment drains to floor drains so that no drainage/condensate runs across floors to floor drain locations.
- 2.11 When connecting PVC to other types of pipe, joints shall be solvent weld or mechanical coupling.
- 2.12 Laboratory Acid Drainage
 - 2.12.1 Above ground sanitary and vent
 - 2.12.1.1 Fittings and piping
 - 2.12.1.1.1 Polypropylene with flame retardant
 - 2.12.1.1.2 Borosilicate glass
 - 2.12.1.1.2.1 Compression type stainless steel coupling with inner seal ring
 - 2.12.1.1.2.2 Padded pipe hangers.

2.12.1.1.2.3 High silicon iron.

2.12.2 Below grade sanitary

2.12.2.1 Fittings and piping

2.12.2.1.1 Polypropylene

2.12.2.1.2 Borosilicate glass

2.12.2.1.2.1 Compression type stainless steel coupling with inner seal ring.

2.12.2.1.2.2 Padded pipe hangers

2.12.2.1.3 High silicon iron

2.12.3 Neutralization tank and sediment interceptor

2.12.3.1 High density polyethylene tank, complete with vent connection. Locate tank close to wall and arrange piping to minimize the length of horizontal vent pipe run.

2.12.3.2 1" thick bolted cover with neoprene gasket.

2.12.3.3 Flush with floor top complete with frame ring, truss head bolts and hot sunk securing nuts.

2.12.3.4 2.4mm (3/32") non skid prime coated steel top.

2.12.3.5 Neutralization tank

2.12.3.5.1 Initial charge plus one additional charge of limestone neutralizing chips.

2.12.3.5.2 Gasketed inspection port shall be 20cm (8").

2.12.3.5.3 Capacity shall be 250L (55 Imperial gallons) empty, 114L (25 Imperial gallons) actual.

2.12.3.5.4 Provide electronic PH monitoring system complete with wall mounted indicator adjacent to the tank.

2.12.3.6 Sediment interceptor

2.12.3.6.1 Perforated solids basket.

2.12.3.6.2 Basket size shall be 36cm (14") diameter by 61cm (24") high.

2.12.4 Provide separate venting system (extending independently to outside) for acid drainage system.

2.12.5 When connecting PVC to other types of pipe, joints shall be solvent weld or mechanical coupling.

3 Domestic Water Systems

3.1 Water piping to be Type "L" copper for domestic hot, cold and recirculation systems above ground. Buried piping to be soft copper Type "K" with no buried joints. Cross linked polyethylene (PEX) pipe may be considered for run outs to individual plumbing fixtures where permitted by code (obtain specific written permission from DTIR).

3.1.1 If PEX is used it shall follow the building lines and bend supports in lieu of 90 degree fittings shall be used.

3.1.2 Only use everloc or cold flare expansion type connections.

3.2 Trap primer lines below grade (with no buried joints) are permitted to be PEX These materials may also be considered for above grade trap primer lines where permitted by code (obtain specific written permission from DTIR).

3.3 Note that PEX shall be insulated as per requirements of Facility Services Subgroup - General.

3.4 Silfos solder shall be used for pipe 64mm (2½") and larger.

3.5 Copper pipe 64mm (2½") and larger may be roll grooved. Grooved couplings shall be designed with angle bolt pads to provide a rigid joint, complete with EPDM flush seal gaskets. Provide unions at tanks, fixtures and other equipment.

3.6 If roll groove piping system is used, all couplings and fittings shall be of the same manufacturer.

3.7 Ball valves shall be used for shut-off applications 51mm (2") and smaller.

3.8 Circuit balancing valves shall be used where balancing is required (e.g. on domestic water recirculation lines).

3.9 Provide hose end drain with cap and chain at low points of all services piping. No water from any drain or relief valve shall discharge on floor. Pipe drains from air receivers, hot water tanks, etc., to hub drains. Where this is impractical lengths of hoses with fittings and adaptors may be used.

- 3.10 Provide drains on all isolated domestic water branch lines serving fixtures on the second level or higher that cannot be drained through fixtures on the lowest level.
- 3.11 Only lead free bronze or brass valves, strainers, etc. shall be used on the complete water system (starting at the first valve of the incoming water).
- 3.12 Valves shall be installed at all mains and at all branches.

4 Piping Installation

- 4.1 Install pipe straight, parallel to building lines, and close to walls and ceilings, with specified pitch. Use standard fittings for direction changes. The water supply mains shall generally run near the ceiling of the lowest story.
- 4.2 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.
- 4.3 Prohibited Locations: No water piping shall be placed in floor fills, structural slabs over ornamental suspended ceilings, in transformer vaults, electrical or server rooms, or over switch boards or electrical panels.
- 4.4 Where pipe sizes differ from connection sizes of equipment, install reducing couplings close to equipment. Reducing bushings are not permitted.
- 4.5 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.
- 4.6 Ream ends of pipes and tubes before being made up.
- 4.7 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.
- 4.8 Use non-corrosive lubricant or Teflon tape applied to male thread.
- 4.9 Cut grooved pipe ends square, with seating surface clean and free from indent and score marks.
- 4.10 Install di-electric couplings wherever piping of dissimilar metals are joined.
- 4.11 Install swing or swivel joints to connect risers to mains.
- 4.12 All piping shall be run concealed in pipe spaces, chases and ceiling spaces where practical. Piping that is run exposed in finished areas shall be located in corners and furred in under work of the appropriate section for indicated furring.

- 4.13 Transition from plastic to copper or cast iron to take place not further than 76mm (3") above slab.
 - 4.14 Wipe all pipes of soldering flux as the joint is completed.
 - 4.15 A circuit balancing valve and check valve shall be installed in each recirculation branch or riser before joining the main.
 - 4.16 Return circulating pipes: Required where domestic hot water supply pipe or pipes exceeds 15m (50 feet). Include balancing valves and check valves to ensure that flow is one way only.
 - 4.17 All drainage mains below grade shall be run at minimum 2% slope.
 - 4.18 See Refer to Facility Services Subgroup - General (FSS-G) for testing requirements.
- 5 Expansion Compensators
- 5.1 Install in accordance with manufacturer's recommendations.
 - 5.2 Provide anchors to control the direction and extent of pipe movement.
 - 5.3 Provide guides in accordance with manufacturer's recommendations.
 - 5.4 Where space permits, provide expansion loops in lieu of compensators.
- 6 Mechanically Formed Tee Connections
- 6.1 Mechanically formed tee connections shall be permitted for use on copper tube water systems in type L copper.
 - 6.2 Mechanically extracted collar shall be formed in continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of a tube wall. The collaring device shall be fully adjustable to ensure proper tolerance and complete uniformity of the joint.
 - 6.3 The branch shall be notched to conform with the inner curve of the run tube, dimpled to ensure penetration of the branch tube into the collar is of sufficient depth for brazing and that the branch tube does not obstruct the flow in the main line tube.
 - 6.4 All joints shall be soldered.
 - 6.5 All mechanically formed branch collars shall be listed or approved by the appropriate National, Provincial or Municipal codes in addition to the Underwriters Laboratory.

- 6.6 Tee connections can be used on one (1) inch and above water pipe and where the branch line connection to the branch main is at least one (1) pipe size smaller than the branch main.

Section 22 11 00 Facility Water Distribution

1 General

- 1.1 Unless otherwise required by the program, the domestic hot water service shall be nominal 50°C (120°F) (except as noted in .2 below) and available at all fixtures in the building at all times. Water shall be maintained at a minimum of 60 deg. C (140 deg. F) in the storage device and mixed down to 49 deg. C (120 deg. F).
- 1.2 Water supplied to kitchens (dishwashers and pot sinks only), laundries and other designated areas shall be nominal 60°C (140°F).
- 1.3 Provide domestic hot water recirculation where hot water supply pipe or pipes exceeds 15m (50 feet). Use of electric domestic hot water heaters located at remote spaces in lieu of the central domestic hot water system with recirculation shall not be allowed, unless permission is obtained in writing from DTIR.

2 Water Hammer

- 2.1 Air chambers sized in accordance with branch pipe size and length, water velocity and flow pressure may be provided if provision is made for recharging by including an isolation valve, hose bibb and pet cock. Otherwise water hammer arresters shall be used. Install one or more per each group of fixtures as recommended.
- 2.2 Water hammer prevention devices shall be sized and shown on the plumbing drawings.

3 Plumbing Specialties

- 3.1 All plumbing specialties (other than gaskets) shall be metallic. Exposed metal parts in finished areas shall be chrome plated or stainless steel. Exposed non-metal parts shall be sprayed painted silver/aluminum.

4 Vacuum Breakers

- 4.1 Provide on domestic cold water supply to domestic hot water tanks.

5 Backflow Preventers

- 5.1 Protect the entire water distribution system against contamination due to backflow from non-potable sources. Provide a single reduced pressure type backflow preventer for

services up to 51mm (2") and two reduced pressure type backflow preventers for services larger.

- 5.2 Provide each connection to fixtures or equipment for which approved air gap or vacuum breaker is not shown, or specified elsewhere with the fixture or equipment itself, with a reduced pressure type backflow preventer (and dump valve). Discharge shall be piped to a drain.
- 5.3 All reduced pressure backflow preventers installed in a location where the line pressure is alternately decreasing and increasing (e.g. deep well with storage tanks) shall be complete with a check valve in the supply piping to the backflow preventer. The backflow preventer shall be designed to dump when reverse flow occurs.
- 5.4 Refer to AWWA manual for cross connection control.

6 Backwater Valves

- 6.1 Fixtures shall be protected with an accessible backwater valve or shutoff valve where required (only those below the level of the street service shall be protected). Backwater valves shall comply with the latest National Plumbing Code of Canada.

7 Wall Hydrants and Hose Bibbs

- 7.1 Shall have thread spout, replaceable composition disc, bronze construction, chrome plating and be complete with backflow protection.
- 7.2 Wall hydrants shall be installed so that any part of the exterior of the building may be reached with 30m (100 feet) of hose without having the hose across the entrance to the building. Wall hydrants shall be of the non-freeze, self-draining type (except for gymnasium areas where the non-freeze portion would protrude into the gym space) and shall be vandal proof.
- 7.3 Provide hose bibs in machine rooms, boiler rooms and vehicle sally ports.

Section 22 11 23 Domestic Water Pumps

1 General

- 1.1 Pumps shall be centrifugal type with quiet operating characteristics and maximum speed of 1750 rpm. Pumps shall have mechanical seals and sleeve bearings.
- 1.2 A flat curve pump selected slightly to left of midpoint of pump capacity curve is recommended. A steep curve pump can be considered if the system has high head loss terminal unit sub-circuits and no modulating valves.

- 1.3 Pump motors shall be non-overloading over published rating curve.
- 1.4 Pump construction shall permit complete servicing without disassembly of piping or motor connections. Pump connections shall be flanged.
- 1.5 All base mounted and vertical in-line centrifugal pumps shall be mounted on housekeeping pads as per Section 13 48 00.
- 1.6 Where lift is required of pumps, variable frequency drives and booster pumps shall not be used.

2 Base Mounted Pumps

- 2.1 Base mounted pumps to be equipped with water-tight, long-life, self-lubricating mechanical seals. The pumps shall be of the end-suction, radially-split casing type of center-line discharge design with back pull-out feature permitting removal of the complete rotating assembly without disturbing pipe connections. Pump construction shall be bronze-fitted suitable for a maximum working pressure of 1308kPa (175 psig). The pump shafts shall be supported by two heavy duty ball bearings. Casing gasket shall be confined within pump casing. Pumps shall be complete with bronze impeller and stainless steel shaft.
- 2.2 The driving motor shall be of the squirrel-cage induction type with ODP enclosure. Pump and motor to be mounted on a rigidly constructed fabricated steel base plate and directly connected through a flexible coupling protected by a guard.
- 2.3 With each pump, provide a suction guide with cast iron body, outlet guide vanes, removable stainless steel strainer with c" diameter holes and a fine mesh brass start-up strainer. Each suction guide size to be selected to match each pump suction flange size and rating. Where guide flange on pipe side does not meet pipe size, provide necessary increaser. Strainers to be periodically inspected during start-up of the system and the fine mesh brass strainer removed after the system is fully operational. Space shall be provided for the removal of the strainer and connection of a blow-down valve.
- 2.4 Each pump shall be provided with a triple duty control valve (smaller pumps can be provided with a check valve and circuit balancing valve). Bodies shall be arranged with right angle inlet connections to permit mounting in horizontal or vertical position to suit piping arrangement (straight type permitted where manufacturer doesn't approve angle type for horizontal stem mounting). Bodies shall be drilled both ends for ASA 57kg (125 lb).
- 2.5 Provide three (3) roll grooved joints or flexible connectors at each pump connection. These joints or connectors shall be within 183cm (six (6) feet) of the pump on both the inlet and outlet sides.
- 2.6 Drip ledge bases shall be piped to the nearest floor drain.

- 2.7 Upon satisfactory pump alignment, base shall be filled with grout and, after hardening, anchor bolts shall be tightened and alignment rechecked and, if necessary, corrected by the use of shims.

3 Vertical Pumps

- 3.1 Pumps shall be vertical in-line centrifugal pumping units with back pull-out feature. Pumps shall have cast iron casing with equal size suction and discharge flanges, separate tapped flush line and pressure gauge connections, bronze dynamically balanced impeller, stainless steel shaft, lower carbon throttle bushing, outside type balanced mechanical seal with rotating face, stationary seat and Viton secondary seal.
- 3.2 The pump is to be fitted with a factory installed flush line.
- 3.3 Supply in the flush line to the mechanical seal, a 50 micron cartridge filter (alternatively, a cyclone separator when pump differential pressure exceeds 308kPa (30 psig)) and floating ball type sight flow indicator suitable for the working pressure encountered.
- 3.4 The driving motor shall be an industry standard, vertical solid shaft, squirrel cage induction type, P-base, with open drip-proof enclosure and shall be connected to the pump through a high tensile aluminum, split type spacer coupling to permit servicing of the mechanical seal without disturbing pump, motor or electrical wiring. The coupling shall be protected by a guard.

4 In-Line Circulator Pumps

- 4.1 Horizontal mount, centrifugal, close coupled, mounted in-line. Casing shall be cast iron except bronze casing for domestic hot and cold water services. Impeller shall be bronze or cadmium plated steel. Shaft shall be carbon steel alloy with integral thrust collar. Bearings shall be bronze with spiral grooves to convey lubricant the entire length of the bushing. Seals shall be spring loaded carbon rotating washer complete with rubber bellow held against a stationary floating stellite seat and seat ring.

Section 22 13 00 Facility Sanitary Sewer

1 Grease Interceptors

- 1.1 For kitchens, provide grease interceptors complying with the latest National Plumbing Code of Canada. Where feasible, locate outside of kitchens. Interceptors to be of metal construction and complete with non-skid secure cover and gasket, white exterior and acid resistant interior enamel finish for mounting flush with floor. Each interceptor shall have flow control fitting suitably vented; metal thickness shall be not less than 5mm (3/16"). Provide a vent on the downstream side of the interceptor. Interceptors shall be the enzymatic type.

- 1.2 Install necessary extension pieces on grease interceptors recessed in the floor to bring the cover flush with the floor.
 - 1.3 Where interceptors are installed below counters or equipment, locate so that top is removable for cleaning purposes.
 - 1.4 Dishwashers shall not discharge into grease interceptors.
- 2 Garage Oil Interceptors
 - 2.1 For vehicle garages, use an oil and sludge interceptor with removable but secure locked covers.
- 3 Drains
 - 3.1 Floor Drains - Minimum outlet and drain line size from floor drains shall be 76mm (3"). Trap primers are required on all floor drains. Trap primers are also required for other drains where loss of trap seal will occur through evaporation. Use deep-seal traps and flashing clamps where required.
 - 3.2 Hub Drains - Minimum outlet and drain line size from hub drains shall be 76mm (3"). Preference shall be given to combination funnel floor drains. Use screwed-in-hub to at least 51mm (2") above floor level with bodies and traps as for floor drains in equipment areas.
 - 3.3 Floor drains located in boiler rooms may be ganged together into a running trap at the exit from the room.
 - 3.4 Finished areas - Cast iron body complete with adjustable strainer, nickel bronze top, integral seepage flange, 13mm (½") seal primer tapping.
 - 3.5 Unfinished areas - Cast iron, Dura coated complete with dome strainer, cast iron top, integral seepage flange, 13mm (½") seal primer tapping.
 - 3.6 Holding cells shall incorporate a flushing floor drain with a hose bibb installed outside the cell. All floor drains located in areas occupied and/or attended by the inmates shall have secured type grates.
- 4 Pipe Line Strainer
 - 4.1 Screwed iron body with adaptor for soldered copper tubing, brass screws and standard perforation 0.8mm (1/32") holes.
- 5 Trap Seal Primers
 - 5.1 All trap seal primers shall be electronic complete with manual test button. Trap primers shall have 13mm (½") manifold connections, 24 hour timer vacuum breaker, galvanized

steel box with prime coated access door, 120 volt single point power connection, and water hammer arrestor.

6 Cleanouts

- 6.1 Refer to Section 22 05 76 Facility Drainage Piping Cleanouts.

Section 22 14 00 Facility Storm Drainage

1 Roof Drains

- 1.1 Where municipality requires controlled run-off, coordinate ponding and weir type roof drains with architect.
- 1.2 Make provision for rain water leader thermal expansion. Pay particular attention when the piping is PVC-DWV.
- 1.3 Roof drain domes to be aluminum or cast iron.

Section 22 40 00 Plumbing Fixtures

1 General

- 1.1 Vitreous china plumbing fixtures shall be white and the product of one manufacturer.
- 1.2 Stainless steel plumbing fixtures shall be the product of one manufacturer
- 1.3 Trim shall be of one manufacturer and heavy duty pattern for institutional use (Delta Commercial - Teck Institutional or equal products which require approval in writing from DTIR).
- 1.4 Provide concealed chair carriers for wall mounted fixtures. Heavy duty mounting brackets fastened from the back side of the wall are acceptable for urinals where they are mounted on concrete block walls.
- 1.5 Exposed plumbing brass and metal work shall be heavy triple chromium plated.
- 1.6 Provide union connections at all faucets.
- 1.7 Note that other project requirements may mean modification of the items listed below with additional features and/or limitations. For example, barrier free and energy related (MNECB, LEED, Climate Change Action Plan etc.) requirements may necessitate the use of certain fixtures and/or trim. Mechanical design engineer to consult with DTIR.

2 Water Closets

- 2.1 Water closets shall be vitreous china, wall mounted in all areas.
- 2.2 All water closets shall have siphon jet bowl and elongated rim except for educational facility primary classroom washrooms where water closets to have regular rim.
- 2.3 All water closets shall have white, solid plastic, open front seats with antibacterial properties. Barrier free water closets shall have covers for seats.
- 2.4 Flush valves for water closets shall be manual, exposed, with oscillating handle.
- 2.5 For educational facilities, tanks may be used in staff washrooms and, if necessary, in public (student) washrooms where the available water service is unsuitable for flush valves. Where tanks are used rather than flush valves, tanks shall be lined to prevent sweating. Provide bolt down covers on tanks in all areas except in staff washrooms.
- 2.6 Water closets shall be low flow type (4.8 litres/flush).

3 Urinals

- 3.1 Urinals shall be vitreous china, washout, wall mounted type, flushing rim, integral extended shields, removable SS strainer. Trap water level shall not be above strainer.
- 3.2 Urinal wastes to be cast iron from 30cm (12") above overflow to main branch waste, with hard type K copper outlet connection through wall. Urinal wastes may also be PVC-DWV plastic.
- 3.3 Flush valves for urinals shall be electronic and wired to building electrical system (not battery powered).

4 Flush Valves

- 4.1 Water pressure at flush valves shall be 172 to 414 kPa (25 to 60 psi) (the water system shall maintain a minimum pressure of 172 kPa (25 psi) at all flush valves in the building, including during times of peak usage)
- 4.2 Where concealed valves are used, provide access for service.

5 Lavatories

- 5.1 Vitreous China - Wall mounted type, rectangular, splash lip and overflow (overflow must not be exposed such that it could be vandalized)

- 5.2 Countertop - Self rimming, stainless steel, overflow, seal to be putty, caulking or concealed vinyl gasket (undercounter mount also acceptable). For educational facilities, provide protective skirts under lavatories to prevent vandalism to overflow pipes and other components.
 - 5.3 Provide faucet with aerator and two indexed metal handles. Waste stoppers are generally not required; use surface grid strainers.
- 6 Fixture Carriers
- 6.1 Select carriers to support fixtures without strain on piping. Supports shall be such that 91 kg (200 lb). weight will not loosen or distort mounting.
- 7 Service and Mop Sinks
- 7.1 Floor mounted molded stone mop service basin c/w stainless steel back and suitable trim.
- 8 Stainless Steel Sinks
- 8.1 Type 302 SS, self-rimming, single or double compartment with undercoating, crumb cups, holes drilled in ledgeback.
 - 8.2 Chrome plated supply with swing spout, aerator, two indexed metal handles. Provide retractable spray in staff rooms.
- 9 Emergency Fixtures
- 9.1 All emergency fixtures (eye/face wash and combination shower eye/face wash stations etc.) shall be supplied with tempered water via an adjustable temperature mixing valve.
- 10 Fixture Installation
- 10.1 Connect fixtures complete with supplies and drains, separately trapped, supported level and square. Each fixture shall have shut-off valve and union connections on supplies. Threaded IPS connections on inlet to fixture shut off shall be used. 5/8" compression valves are not to be used as isolation valves for fixtures. Soldered connections are also not permitted.
 - 10.2 Hot water faucets shall be on left. Mixing faucets shall have opposite action and pressure balanced mixing valves shall have check valves on supplies. Fixtures on outside walls shall have supplies from floor; other fixtures shall be serviced from wall.
 - 10.3 Exposed piping, valves and metal to vitreous china fixtures shall be chrome plated with plated escutcheons. Exposed piping, valves and metal to stainless steel fixtures shall be spray painted chrome, if not chrome plated.
 - 10.4 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

10.5 All joints between plumbing fixtures and walls or floors are to be caulked.

10.6 Braided and plastic supplies shall not be used.

END