

Part 1 General**1.01 SUBMITTALS**

- .1 Submittals: in accordance with Division 01 – General Requirements.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Points of operation on performance curves.
 - .3 Manufacturer to certify current model production.
 - .4 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Division 01 – General Requirements.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:
 - .1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems.
 - .2 Transfer information daily to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Departmental Representative for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.02 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Division 01 – General Requirements.

1.03 MAINTENANCE

- .1 Furnish spare parts in accordance with Division 01 – General Requirements as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Division 01 – General Requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials in accordance with Division 01 – General Requirements.

Part 2 Products**2.01 MATERIALS**

- .1 Section not used.

Part 3 Execution**3.01 PAINTING REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.02 CLEANING

- .1 Clean interior and exterior of all systems including strainers and screens.

3.03 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.04 DEMONSTRATION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.

3.05 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

Part 1 General**1.01 DEFINITIONS**

- .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - will mean "not concealed" as defined herein.

1.02 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Division 01 – General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

1.03 SAMPLES

- .1 Submit samples in accordance with Division 01 – General Requirements.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

1.04 MANUFACTURERS' INSTRUCTIONS

- .1 Submit manufacturers' installation instructions in accordance with Division 01 – General Requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

1.05 QUALIFICATIONS

- .1 Installer to be specialist in performing work of this Section.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

1.07 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – General Requirements.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

- .3 Collect and separate for disposal paper, plastic corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Place excess or unused insulation and insulation accessory materials in designated containers.

Part 2 Products

2.01 FIRE AND SMOKE RATING

- .1 In accordance with CAN/ULC-S102.
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.02 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: Rigid moulded mineral fiber without factory applied vapour retarder jacket (as scheduled in Part 3 of this section).
 - .1 Maximum 'k' value at 38°C mean temperature of 0.035 (SI).
 - .2 White kraft paper bonded to glass fiber reinforced aluminum foil.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket to CGSB 51-GP-52M (as scheduled in Part 3 of this section).
 - .1 Maximum 'k' value at 38°C mean temperature of 0.035 (SI).
 - .2 White kraft paper bonded to glass fiber reinforced aluminum foil.
- .5 TIAC Code A-6: Flexible unicellular tubular elastomer.
 - .1 Insulation: to ASTM C534.
 - .2 Maximum "k" factor: 0.27.
- .6 Acceptable Material: Knauf, Owens Corning, Johns Manville, Certain Teed, Armstrong.

2.03 INSULATION SECUREMENT

- .1 Tape: Self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

2.04 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Hydraulic setting on mineral wool, to ASTM C449/C449M.

2.05 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.

2.06 INDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.

2.07 OUTDOOR VAPOUR RETARDER FINISH

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

2.08 JACKETS

- .1 Polyvinyl Chloride (PVC):
 - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
 - .2 Colour: white.
 - .3 Minimum service temperatures: -20°C.
 - .4 Maximum service temperature: 65°C.
 - .5 Moisture vapour transmission: 0.02 perm.
 - .6 Thickness: 0.5 mm.
 - .7 Fastenings:
 - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
 - .2 Tacks.
- .2 Canvas:
 - .1 220 gm/m² cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
 - .2 Lagging adhesive: Compatible with insulation.
- .3 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Stucco embossed.
 - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
 - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
 - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.

2.09 WEATHERPROOF CAULKING FOR JACKETS INSTALLED OUTDOORS

- .1 Caulking to: Section 07 92 10 - Joint Sealers.

Part 3 Execution**3.01 PRE- INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces to be clean, dry, free from foreign material.

3.02 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.03 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.04 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: SS Wire Bands Tape at 300 mm oc.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS Wire at 300 mm oc.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: A-6.

- .1 Insulation securements: as listed by Manufacturer..
- .2 Seals: lap seal adhesive, lagging adhesive.
- .5 Thickness of insulation to be as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Domestic HW and HWR (see Note 4)		A-1	25	25	25	38	38	38
Domestic CW (see Note 4)		A-3	25	25	25	25	25	25
Domestic TW & TWR (see Note 4)		A-1	25	25	25	25	25	25
Sanitary Sewer Vent (See Note 2)		A-3				25	25	
Note 1	Insulate interior rain water piping systems for a distance of 3 m along piping from each roof drain location. Insulation shall run along all connected pipe regardless of flow direction. Insulate roof drain body and all mounting hardware to full thickness coverage, seal to underside of roofdeck.							
Note 2	Insulate sanitary sewer vent piping from cold air terminus continuously through cold interior building areas and to 2 m into warm building area.							
Note 3	Coat all natural gas piping penetrating exterior wall or roof for 2 m into building with 2 heavy coats of brush on vapour retardent mastic. Permeance value less than 0.05, flame spread less than 20.							
Note 4	Where piping serves shower fixtures and is located within adjacent block wall, revise insulation code to A-6 (unicellular elastomer) of same thickness specified.							

- .6 Finishes:
 - .1 Exposed indoors: Canvas, Aluminum or PVC jacket.
 - .2 Exposed in mechanical rooms or crawlspaces: Canvas, Aluminum or PVC jacket.
 - .3 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
 - .4 Outdoors: Water-proof Aluminum jacket.
 - .5 Finish attachments: SS bands, at 150 mm oc. Seals: wing.
 - .6 Installation: To appropriate TIAC code CRF/1 through CPF/5.

END OF SECTION 22 07 00

Part 1 General**1.01 REFERENCE STANDARDS**

- .1 American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15, Cast Copper Alloy Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM B88M, Standard Specification for Seamless Copper Water Tube.
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-71, Grey Iron Swing Check Valves, Flanged and Threaded Ends.
 - .2 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .5 National Research Council (NRC)
 - .1 National Plumbing Code of Canada (NPC).

1.02 PRODUCT DATA

- .1 Submit product data in accordance with Division 01 – General Requirements.
- .2 Submit data for following: valves.

1.03 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Division 01 – General Requirements.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – General Requirements.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

Part 2 Products**2.01 PIPING**

- .1 Domestic hot, cold, tempered and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type K: to ASTM B88.

2.02 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS2.5 and larger: roll grooved to CSA B242.

2.03 JOINTS

- .1 Rubber gaskets, 1.6 mm 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.
- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket (acceptable for sizes 80 mm and larger).
 - .1 Acceptable material: Victaulic, Gruvlok, CCTF ShurJoint.
- .6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.04 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 Acceptable material: Crane, Toyo, MAS.
- .2 NPS2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.
 - .2 Acceptable material: Crane, Toyo, MAS.
- .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 Acceptable material: Crane, Toyo, MAS.

2.05 BALL VALVES

- .1 NPS2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE Teflon adjustable packing, brass gland and PTFE Teflon seat, steel lever handle.
 - .3 Acceptable material: Crane, Toyo, MAS.
- .2 NPS2 and under, soldered:
 - .1 To ANSI/ASME 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.
 - .3 Acceptable material: Crane, Toyo, MAS.

2.06 BUTTERFLY VALVES

- .1 NPS2 1/2 and over, grooved ends:
 - .1 Class 300, bubble tight shut-off, bronze body.
 - .2 Operator:
 - .1 NPS4 and under: lever handle.
 - .2 NPS6 and over: gear operated.
 - .3 Acceptable material: Victaulic, Gruvlok, CCTF ShurJoint.

2.07 CIRCUIT BALANCE VALVES

- .1 Supply and install where shown, calibrated, testable, y-pattern circuit balance valves. Each valve shall be equipped with test ports for field connection of a portable differential pressure test meter.
- .2 Valves shall have micrometer adjustable flow setting scale with positive position memory. Valves shall be capable of use for positive shut off.
- .3 Valves shall be constructed of copper alloy suitable for use in potable water systems.
- .4 Acceptable material: Victaulic T&A, Armstrong, Taco.

Part 3 Execution**3.01 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.02 VALVES

- .1 Isolate equipment, fixtures and branches with butterfly or ball valves.
- .2 Balance recirculation system using circuit balance valves. Mark settings and record on as-built drawings on completion.

3.03 PRESSURE TESTS

- .1 Test pressure: greater of 1 1/2 times maximum system operating pressure or 860 kPa.

3.04 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean.

3.05 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 air chambers, expansion compensators are installed properly.

3.06 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction.
- .2 Upon completion, provide laboratory test reports on water quality to Departmental Representative for approval.

3.07 START-UP

- .1 Timing: Start up after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
 - .1 Establish circulation and ensure that air is eliminated.
 - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
 - .3 Bring HWS storage tank up to design temperature slowly.
 - .4 Monitor piping HWS and HWR piping systems for freedom of movement, pipe expansion as designed.
 - .5 Check control, limit, safety devices for normal and safe operation.
- .4 Rectify start-up deficiencies.

3.08 PERFORMANCE VERIFICATION (PV)

- .1 Timing:
 - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
 - .1 Verify that flow rate and pressure meet Design Criteria.
 - .2 TAB HWC in accordance with Section 23 05 93 HVAC - Testing Adjusting and Balancing (TAB).
 - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .4 Verify performance of temperature controls.
 - .5 Verify compliance with safety and health requirements.
 - .6 Check for proper operation of water hammer arrestors. Run each outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor. Repeat for outlets and flush valves.
 - .7 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
 - .1 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION 22 11 18

Part 1 General**1.01 REFERENCE STANDARDS**

- .1 ASTM International Inc.
 - .1 ASTM B32, Standard Specification for Solder Metal.
 - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3, Plumbing Fittings.
- .3 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada [2015] (NPC).

1.02 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – General Requirements.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products**2.01 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary and vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.
 - .2 Wrought copper: to CAN/CSA-B125.
 - .2 Solder: tin-lead, 50:50, to ASTM B32.

2.02 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm and vent minimum NPS2, to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.

- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
 - .1 Joints.
 - .1 Mechanical joints.
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.01 INSTALLATION

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Copper piping shall not be used on any urinal drainage.

3.02 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.
- .3 Perform all testing as required by authority having jurisdiction.

3.03 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION 22 13 17

Part 1 General**1.01 REFERENCE STANDARDS**

- .1 ASTM International Inc.
 - .1 ASTM D2564, Standard Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada [2015] (NPC).

1.02 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – General Requirements.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products**2.01 PIPING AND FITTINGS**

- .1 For buried and above ground DWV piping to:
 - .1 CSA-B181.2.
- .2 Do not use PVC-DWV for sections of piping where hot water may be discharge such as boiler or humidifier blowdown and drain. Provide cast iron or copper piping to connection with main.
- .3 Do not use standard PVC-DWB for sections of piping located in a space used for movement of return air. Pipe and fittings shall be formulated for flame spread of 0 and Smoke Developed of 35. No field applied coatings will be acceptable except where used to recoat piping joints.
 - .1 Acceptable product: IPEX XFR

2.02 JOINTS

- .1 Solvent weld for PVC: to ASTM D2564.

Part 3 Execution**3.01 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code an local authority having jurisdiction.
- .2 Where pipe or fittings are located within a space to be used for transport of return air, provide treated system to meet Flame Spread of 0 and Smoke Developed of 35 when tested to CAN/ULC S102.2. Only field joints may be coated in field. Provide all pipe and fittings of factory treated material. Install according to Manufacturers certified procedures, using compatible solvent cement and primer.

3.02 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.03 PERFORMANCE VERIFICATION (PV)

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Verify provisions for movement of roof system.
- .4 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END OF SECTION 22 13 18

Part 1 General**1.01 REFERENCE STANDARDS**

- .1 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada [2015] (NPC)

1.02 SHOP DRAWINGS

- .1 Submit shop drawings and product data in accordance with Division 01 – General Requirements.
- .2 Indicate, for all fixtures and trim:
 - .1 Dimensions, construction details and materials, roughing-in dimensions, performance.

1.03 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Division 01 – General Requirements.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 List of recommended spare parts.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products**2.01 MANUFACTURED UNITS**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: Architectural drawings to govern. Quantities shown on Mechanical drawings may not be reduced.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

- .7 Sinks
 - .1 S-1: Single Compartment wall mounted hand wash, barrier free
 - .1 Fixture: Single compartment, wall mounted with rectangular bowl, front access, 14 gauge, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Cabinet bottom shall be removable and secured with tamper resistant screws. Cabinet interior shall be sound deadened with fire resistant material. Unit c/w deck mounted spout and 38mm drain and grid strainer. Controls by other manufacturer. Bowl size – 350 wide x 300 f/b x115mm deep.
 - .2 Push button controls: Push button controls, solid state, digital circuitry c/w transformer (provided by mechanical).
 - .1 Acceptable product: Bradley S45-1941, S83-131A, 4 second cycle c/w transformer and 24V solenoid valve.
 - .2 S-2 Single Compartment stainless steel sink, counter mounted
 - .1 Fixture: Self rimming drop in sink with faucet ledge, 18 gauge, type 304 stainless steel. Exposed surfaces are #4 satin finished. Undercoated to reduce condensation. Center back waste location, 89mm crumb cup strainer with 38mm brass tailpiece.
 - .2 Faucet: Heavy duty, chrome plated, cast brass, two handle deck mount sink faucet with 200mm centers. Cermaic quarter turn cartridges. 203mm tubular swing spout, vandal resistant aerator outlet, 5.7l/m flow control aerator, 75mm lever blade handles.
- .8 Lavatory Basins
 - .1 L-1: Single Compartment wall mounted sink, barrier free
 - .1 Fixture: Single compartment, wall mounted with rectangular bowl, front access, 16 gauge, type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Unit c/w deck mounted spout and 38mm drain and grid strainer. Provide wall carrier. Controls by other manufacturer.
 - .2 Push button controls: Push button controls, solid state, digital circuitry c/w transformer (provided by mechanical).
 - .1 Acceptable product: Bradley S45-1941, S83-131A, 4 second cycle c/w transformer and 24V solenoid valve.
- .9 Water Closets
 - .1 WC-1: Floor mounted, back outlet, barrier free
 - .1 Fixture: Floor mounted, back outlet, 16 gauge, type 304 stainless steel, seamless welded stainless steel. Exterior has a satin finish with integral contoured seat, 450mm high. Inside of the toilet bowl c/w satin finish. Reinforced wall flange. Siphon jet, elongated bowl, 1.6 gpf, 90mm trap, 38mm flushing inlet connection. Controls by other manufacturer.
 - .2 Push button controls: Push button controls, solid state, digital circuitry c/w transformer (provided by mechanical).
 - .1 Acceptable product: Bradley S45-1941, S83-131B, 15 second cycle c/w transformer and 24V solenoid valve.
 - .2 WC-2: Sink/Toilet Comby – Barrier Free, Angled Toilet Bowl, Angled Lavy

- .1 Fixture: Stainless steel glazed inside and outside, one piece sink/toilet combination unit with integral seat, ADA compliant, floor mounted, anti-ligature, suicide prevention skirt, c/w concealed flush valve located in chase and push button controls (by other manufacturer). 6.l/f. Lavatory section shall have penal deck mounted bubbler, air-control, hot and cold metering. Unit c/w grab bar closure plate, combined waste, toilet waste extension and wall sleeve. Toilet orientation as required.
- .2 Push button controls: Push button controls, solid state, digital circuitry c/w transformer (provided by mechanical).
 - .1 Acceptable product:
 - Toilet Control - Bradley S45-1941, S83-131B, 15 second cycle c/w transformer and 24V solenoid valve.
 - Lavatory Control – Bradley S45-1941, S83-131A, 4 second cycle c/w transformer and 24V solenoid valve.
- .2 WC-3: Sink/Toilet Comby – Angled Toilet Bowl, Oval Lavy
 - .1 Fixture: Stainless steel glazed inside and outside, one piece sink/toilet combination unit with integral seat, floor mounted, anti-ligature, suicide prevention skirt, c/w concealed flush valve located in chase and push button controls (by other manufacturer). 6.l/f. Lavatory section shall have penal deck mounted bubbler and push button controls (by other manufacturer). Unit c/w combined waste, toilet waste extension and wall sleeve. Toilet orientation as required.
 - .2 Push button controls: Push button controls, solid state, digital circuitry c/w transformer (provided by mechanical).
 - .1 Acceptable product:
 - Toilet Control - Bradley S45-1941, S83-131B, 15 second cycle c/w transformer and 24V solenoid valve.
 - Lavatory Control – Bradley S45-1941, S83-131A, 4 second cycle c/w transformer and 24V solenoid valve.
- .10 Shower
 - .1 SH-1: Barrier Free Shower
 - .1 Fixture: Electronic, pressure balanced, concealed in wall, front access, ADA compliant shower system c/w two anti-ligature conical shower heads. One head shall be mounted at regular height, one mounted at height suitable for ADA applications. Unit c/w thermostatic mixing valve.
- .11 Fixture Piping
 - .1 Water supplies
 - .1 Chrome plated flexible copper supply pipes with screw driver ball valve style stops and chrome escutcheons.
 - .2 Waste
 - .1 Chrome plated brass p-trap with cleanout with chrome escutcheon.

Part 3 Execution**3.01 INSTALLATION**

- .1 Mounting heights:
 - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
 - .2 Wall-hung fixtures: as indicated, measured from finished floor.
 - .3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.

3.02 ADJUSTING

- .1 Conform to water use requirements specified in this section.
- .2 Adjustments
 - .1 Adjust water flow rate to design flow rates.
 - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
- .3 Checks
 - .1 Aerators: operation, cleanliness.
 - .2 Vacuum breakers, backflow preventers: operation under all conditions.
 - .3 Wash fountains: operation of flow-actuating devices.
 - .4 Review all secure fixtures to confirm no exposed non-secure fasteners or gaps or open seams.
- .4 Thermostatic controls
 - .1 Verify temperature settings, operation of control, limit and safety controls.

3.03 ELECTRONIC HARD-WIRED

- .1 Provide acceptable transformer to Electrical Division. Transformer shall be rated for connected load requirements.
- .2 Equipment manufacturer shall provide complete wiring diagrams for all installations.
- .3 Wiring shall be full concealed except where intended by manufacturer to be exposed. Where exposed, wiring shall be routed along building lines, close to finishes, away from normal sight lines. Conceal exposed wiring in supplementary flexible conduit.
- .4 Wiring and accessories shall be of quality and execution as specified in electrical divisions.
- .5 Control / mixing enclosures are to be mounted below floor exposed in the Service Space. Provide extensions for the sensor wiring and water supply pipes as required.

END OF SECTION 22 42 00

Part 1 General**1.01 REFERENCE STANDARDS**

- .1 National Research Council Canada (NRC)
 - .1 National Plumbing Code of Canada [2015] (NPC).

1.02 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Division 01 – General Requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for items specified herein.

1.03 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Division 01 – General Requirements.
- .2 Data to include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.04 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Division 01 – General Requirements.
- .2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

Part 2 Products**2.01 FLOOR DRAINS**

- .1 Floor drains and trench drains: to CSA B79.
- .2 Type FD-1: Secure Use
 - .1 Secure duty, cast iron body round, adjustable had, heavy duty nickel bronze stainer with maximum 6mm square openings and secure type fasteners. Plugged trap primer tapping. Fasteners to be stainless steel torx with pin style.

2.02 CLEANOUTS

- .1 Access covers:
 - .1 Floor access: round cast iron body and frame with adjustable secured heavy duty nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for all floor types: nickel bronze heavy duty round 12mm thick scoriated cover, gasket, vandal-proof screws. Fasteners to be stainless steel Torx with pin style.
 - .2 Secure water closet clean-out assemblies.
 - .1 Refer to detail on drawings.
 - .2 Top clean-out access: round cast iron body and frame with adjustable secured heavy duty. 12 mm thick with scoriated cover, gasket, vandal-proof screws. Fasteners to be stainless steel Torx with pin style.
 - .1 Acceptable product: Mifab C1226-XR-1, Zurn, Watts/Ancon
 - .3 Hook Assembly shall be stainless steel connected to fixed anchor with stainless steel braided cable. Cable length to be as shown on drawings.
 - .1 Acceptable product: Bradley (4COH) S29-091.

2.03 WATER HAMMER ARRESTORS

- .1 Stainless steel, heavy duty bellows type, bottom pipe threads with nesting bellows contained in stainless steel casing with sufficient volume to dissipate kinetic energy from water shock. Approved by PDI to Standard WH201.

2.04 TRAP SEAL PRIMERS

- .1 Pressure drop activated brass trap seal primer. Complete with view holes and removable filter screen. Operating pressure range 138 kPa to 861 kPa. Primer to open to water flow on 20 kPa water pressure drop. Connect each primer with ball type isolation valve and air gap discharge fitting on outlet.

2.05 ROOF FLASHINGS

- .1 Spun aluminum (single piece construction) with EPDM triple grommet seal to pipe at top and EPDM base seal at underside. Lined with urethane insulation pre-molded to inside surfaces.
- .2 Sized for exact fit on penetrating pipe.

2.06 THERMOSTATIC MIXING VALVES

- .1 Thermostatic mixing valves shall be of brass construction with stainless steel flow control components. Removable cartridge with strainer, stainless steel piston, liquid filled thermal motor with bellows mounted out of water complete with inlet check stops.
- .2 Control range 29°C to 57°C, minimum temperature differential adjustable to within 5.6°C of inlet temperature. Maximum working pressure of 860 kPa. Size as noted on drawings.
- .3 Valve to fail safe on loss of flow to reduced water supply.

Part 3 Execution**3.01 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.02 CLEANOUTS

- .1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.
- .2 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.03 WATER HAMMER ARRESTORS

- .1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.04 TRAP SEAL PRIMERS

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Departmental Representative.
- .3 Install copper tubing to floor drain. Hard temper with soldered connections where located in accessible locations, soft temper in continuous lengths (no joints) where located in concealed locations.

3.05 START-UP

- .1 Timing: Start-up only after:
 - .1 Pressure tests have been completed.
 - .2 Disinfection procedures have been completed.
 - .3 Certificate of static completion has been issued.
 - .4 Water treatment systems operational.
- .2 Provide continuous supervision during start-up.

3.06 TESTING AND ADJUSTING

- .1 Timing:
 - .1 After start-up deficiencies rectified.
 - .2 After certificate of completion has been issued by authority having jurisdiction.
- .2 Application tolerances:
 - .1 Flow rate at fixtures: +/- 20%.

- .3 Adjustments:
 - .1 Verify that flow rate and pressure meet design criteria.
 - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .4 Floor drains:
 - .1 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
- .5 Vacuum breakers, backflow preventers:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
 - .4
- .6 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .7 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .8 Training:
 - .1 Demonstrate full compliance with Design Criteria.

3.07 ROOF FLASHINGS

- .1 Install as recommended by Manufacturer.
- .2 Coordinate installation with roofing Contractor.
- .3 Provide pre-manufactured flashings for all pipe penetrations through roof including (but not limited to) plumbing vents.
- .4 Provide individual plumbing vents for fixtures located at each utility chase in secure areas (Do not pipe vents horizontally above inmate areas).

END OF SECTION 22 42 01