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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

.1 These Design Guidelines apply to all plumbing sections and all mechanical sections of Divisions 21 Fire Suppression, 22 Plumbing, 23 Heating, Ventilating and Air Conditioning.

.2 Division 22 includes plumbing systems within the building and up to 1 m (3 feet) from the building foundation for potable water, sanitary sewer, and storm sewer.

.3 Division 22 includes the following plumbing systems:

- .1 Potable cold and hot water distribution
- .2 High purity water systems
- .3 Soil waste and vent systems
- .4 Laboratory waste and vent system, including acid neutralizers
- .5 Storm water systems
- .6 Pressure booster system
- .7 Insulation for potable water, pumps, plumbing fixture connections and any other items requiring once through potable water connections
- .8 Plumbing fixtures and their hangers
- .9 Hot water heaters; potable water connections, and natural gas connections
- .10 Natural gas for potable heating water systems
- .11 Natural and propane gas piping and venting
- .12 Compressed air
- .13 Medical gases, compressed air and vacuum
- .14 Food service plumbing including grease traps
- .15 Fuel oil piping systems
- .16 Hot water temperature maintenance systems

1.2 DESIGN REQUIREMENTS / SITE SERVICES

.1 Where requirements in other Sections provide specific requirements for items covered in this Section, the specific requirements in other sections are considered in addition to requirements herein. Where conflicts exist, the specific requirement in other Sections will govern.

.2 BCIT is committed to LEED Gold Certification. Design and specify Plumbing design, fixtures, and components to enable LEED Water Efficiency credits towards the Gold level.

.3 Avoid the use of storm pumps and sanitary sewer system pumps if possible. Design within reasonable limits to ensure all areas possible are drained by gravity systems.

.4 Ensure necessary storm and sanitary pumps are tied into emergency power, and sump levels are designed to be monitored by the campus-wide Building Automation System (BAS). Provide

duty/standby sump pumps in all cases with automatic duty cycling to even out operating hours, with an alarm to indicate an as-commanded pump failure.

.5 Confirm design and BAS requirements with Superintendent of Mechanical and Electrical, in BCIT Building Operations, for new or additional sump pumps.

.6 Provide backflow prevention on primary water supplies into the buildings. Ensure design includes means of testing equipment on an annual basis without shutting a building down as per American Water Supply Standards. Use a locked bypass along with a secondary backflow preventer.

.7 Install frost proof hose bibs at reasonable intervals around building perimeter to facilitate access for a range of building and maintenance activities. Provide one (1) on each building face, and at not more than 30 m separation complete with indoor accessible isolation valve.

.8 Provide water metering station at each piping connection to major building expansion and/or new building. Ensure design of metering stations does not include any by-pass around the stations.

.9 Review acid waste treatment with BCIT Building Operations. The strong preference is to use large outdoor, accessible acid neutralizer sumps to serve a building with acid waste requirements. Use undercounter acid waste sumps for localized installation where volume and use of acid drainage is limited to small isolated use. Monitor all waste discharge from neutralizer through BAS systems.

.10 Confirm all plumbing equipment requiring frequent maintenance (once a year) is readily accessible. Do not locate at ceiling height, in walls, tunnels, buried, requiring scaffolds, ladders, removal of other equipment, in user space, or in crawl spaces.

.11 Factory-assembled equipment shall incorporate materials and fabrication methods consistent with these standards.

.12 Service Zones: Separate building water services into service zones. Install Isolation valves with drain valves into each zone connection to building distribution systems. Locate drain valves on the connection side of isolation valves.

.13 Access for Maintenance:

.1 Locate equipment for easy maintenance. Ensure a service platform is provided that complies with WorkSafe BC requirements for service and maintainability in mechanical spaces where equipment is located 1.5 m or higher above the ground.

.2 Coordinate plumbing design with other disciplines to provide adequately sized and properly located access panels.

.3 Provide access to roof top equipment by permanent ladders. Ensure equipment within 3 m of roof edge has WorkSafe BC approved railings.

.14 Housekeeping Pads - Equipment Bases:

.1 Provide concrete bases with a 100 mm minimum height under floor-mounted mechanical and plumbing equipment, such as booster pumps, hot water heaters, water tanks and similar equipment.

.2 Coordinate base size and location with equipment specified and show on architectural and structural Drawings. Ensure mechanical equipment (pumps) are installed using vibration isolators and in accordance with equipment manufacturer's recommendations.

.3 Ensure design of concrete bases for equipment requiring isolation pads are reviewed and accepted by the final user of the equipment.

1.3 REFERENCES

.1 Plumbing systems, equipment, and installations shall comply with the following standards:

.1 AWWA C506 Backflow Prevention Devices – Reduced Pressure Principle and Double Check Valve Types.

.2 American Society of Plumbing Engineers (ASPE) Guidelines.

.3 British Columbia Plumbing Code Latest Edition.

.4 BCIT Technical Guidelines.

.5 CSA B64.10-11/B64.10.1-11 (R2016) Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

.6 CSA Standards for Plumbing Fixtures and Potable Water Systems.

1.4 COORDINATION REQUIREMENTS

.1 Coordinate with BCIT Building Operations - Facilities Services.

.2 Coordinate with BCIT Utilities.

.3 Coordinate with other design disciplines; Architectural, Structural, Civil, Mechanical, Electrical and Controls.

.4 Refer to Division 31 Earthwork and Division 32 Exterior Improvements for Site Services Materials and Installation Guidelines.

.5 BCIT Information Technology (IT).

PART 2 - PRODUCTS, MATERIAL AND DESIGN REQUIREMENTS

2.1 PROHIBITED MATERIALS AND PRACTICES

.1 Mechanically joined (Victaulic/GruvLok/ShuJoint/Pressfit) piping is not allowed for the domestic water applications, unless pre-approved in writing by both the Consultant and BCIT.

.2 Stapled or screwed insulation vapour barriers are prohibited.

.3 Ensure compression fittings for water risers to plumbing fixtures matches the pipe manufacturer and is specifically supplied and is installed in accordance with the pipe and fitting supplier’s printed instructions.

.4 Do not use easily removable fixtures with integral traps for cleanouts.

.5 Waterless urinals are not permitted.

.6 Do not use copper tube for pressure pipes or domestic water services.

2.2 BUILDING PLUMBING - GENERAL REQUIREMENTS

.1 Building service backflow preventers:

.1 As per British Columbia Plumbing Code, latest edition.

.2 Provide line size reduced pressure zone assembly, temperature range 1°C - 80°C, maximum working pressure 1,040 kPa, bronze body construction, ball valve test cocks, internal relief valve, single access cover and modular check construction and low pressure drop. Ensure local floor drainage can take backflow capacity without flooding the room.

.2 Drains and Drain Valves:

.1 Floor Drains: Provide in washrooms, and where automatic flushing devices and flushometers are used.

.1 Ensure floor drains connected to sump pumps have backflow prevention valves.

.2 For underground parkade floor drainage, provide catch basins on slab-on-grade locations, and minimum 300 mm diameter floor drains with sediment buckets in elevated slabs.

.2 Ensure isolation valves for critical building systems and equipment are ball valves up to 75 mm pipe size. Use wedge gate valves for all applications 75mm and over. Do not use butterfly valves.

.3 Drain Valves:

.1 Minimum NPS 18 mm unless otherwise specified. Bronze, with hose end male thread and complete with cap and chain.

.2 Design drain valves to be at low points and at section isolating valves unless otherwise specified.

.3 Piping:

.1 Eye Wash Stations: Tempered piped in eye wash stations required as per WorkSafe BC regulations.

.2 Potable Water Piping: Certified polyethylene tubing, certified for potable water. Installation shall take into account grading, expansion, stressing and deformation of the piping. Final installation shall be neat in grouping and appearance. Maintain a minimum of 25 mm space between adjacent valves and fittings. Fittings and connections shall be by same pipe manufacturer and installed in strict accordance to pipe manufactures instructions. Refer to Section 21 10 00 Plumbing Piping for additional specifications.

.3 Acid drain piping and venting connected to lab sinks and fume hoods:

.1 Polypropylene acid resistant piping for lab installations with manufacturer's recommended fittings.

.2 Other drain and vent piping: Copper DWV piping, and/or cast iron piping with fittings as required by British Columbia Plumbing Code.

.4 Sanitary Sumps within Buildings: Provide with gas tight covers and individually vented to outdoors.

.5 Secondary Water Supply: Provide with zone backflow prevention in accordance with BC Plumbing Code, latest edition, and local bylaws. Example: water supplies to refrigerated devices, laboratory classrooms, vending machines, etc.

.6 Sleeves:

.1 Sleeves: Schedule 40 steel pipes.

.2 Provide pipe sleeves at points where pipes pass through masonry, concrete or fire rated assemblies and at Mechanical Room floor penetrations to stories below.

.3 Ensure pipes that penetrate through floor slabs are sleeved with a pipe that protrudes a minimum of 50 mm proud of the floor level to prevent flooding penetrating the floor below.

.4 Sleeves with annular fin continuously welded at midpoint.

.1 Provide sleeves through foundation walls.

.2 Where sleeve extends above finished floor.

.5 Size minimum 6 mm clearance all around, between sleeve and un-insulated pipe or between sleeve and insulation.

.6 Terminate sleeves flush with surface of concrete and masonry walls, concrete floors on grade and 25 mm above other floors.

2.3 EQUIPMENT

.1 General: Provide equipment of a type and manufacturer that has a local representative and a local replacement, where possible, and service outlet to give complete coverage on parts and service at all times.

.2 Mechanical Seals:

.1 Specify mechanical seals on all pump applications.

.2 Ensure seals are compatible with intended service.

.3 Dielectric Couplings:

.1 Provide dielectric couplings where pipes of dissimilar metals are joined.

.2 Ensure couplings are compatible with and suited to pressure rating of piping system.

.3 For pipes NPS 50 mm and under specify isolating unions.

.4 For Pipes NPS 65 mm and over specify isolating flanges.

.4 Escutcheons:

.1 Escutcheons: Chrome or nickel plated brass or Type 302 stainless steel, one (1) piece type with set screws. Outside diameter to cover opening or sleeve. Inside diameter to fit around finished pipe.

.2 Provide escutcheons on pipes passing through walls, partitions, floors and ceilings in finished areas.

2.4 FINISH PAINTING

.1 Refer to Section 09 90 00 Painting and Coating.

.2 Provide a minimum of one (1) coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 State and specify specifically what plumbing equipment and systems are to be tested above and beyond minimum BC Plumbing Code requirements.

.2 Conduct tests in presence of BCIT Facilities Office and the Consultant.

.3 Insulate or conceal work only after testing and approval by BCIT Facilities Office and the Consultant.

.4 Piping Tests:

.1 Maintain test pressure without loss for 48 hours unless otherwise specified.

.2 Test drainage, waste and vent piping to BC Building Code and BCIT Facilities Office requirements.

.3 Test domestic hot, cold and recirculation water piping at 1-1/2 times system operating pressure or minimum 1380 kPa (200 psig), whichever is greater.

.5 Welding Tests:

.1 Provide x-ray testing of 3% of welds for steam and hot water piping exceeding 50 mm size. Where tested weld fails inspection an additional 3% of welds are to be x-rayed.

.2 If further failures are found, x-ray all welds at the Contractor’s expense.

3.2 PREPARATION

.1 Preparation for Fire Stopping:

.1 Un-insulated, unheated pipes not subject to movement shall have no special preparation.

.2 Wrap un-insulated, heated pipes subject to movement with non-combustible smooth material to permit pipe to move without damaging fire stopping material.

.3 Ensure insulated pipes and ducts maintain integrity of insulation and vapor barrier at fire separation.

3.3 PIPE INSTALLATION - GENERAL

.1 Specify fill for voids around pipes:

.1 Caulk between sleeve and pipe in foundation walls and below grade floors with waterproof fire retardant non-hardening mastic.

.2 Where sleeves pass through walls or floors, provide space for fire stopping. Where pipes/ducts pass through fire rated walls, floors and partitions, maintain fire rating integrity.

.3 Ensure there is no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future-use sleeves with lime plaster light weight concrete or other easily removable filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to latest edition of CGSB 1-GP-181M.

.2 Expansion, contraction and building seismic joints:

.1 Support piping to prevent any stress or stain.

.2 Install pressure piping with loop and offset which will permit expansion and contraction without damaging piping.

.3 Building shrinkage and settlement:

.1 Install service flexible connectors before entering into the building.

.2 Support all underground piping from “floating slab” with anti-corrosion materials.

3.4 INSTALLATION - LABELLING

.1 Buried Piping Identification/Markers:

.1 Metallic Pipe: Provide continuously printed 100 mm wide x 4 mil thick “Blaze Orange” plastic tape with printing indicating type of service of buried pipe. Place tape at ±300 mm above buried pipe in backfill.

.2 Non-Metallic Piping: Provide detectable multi-ply tape consisting of aluminum foil core between two (2) layers of 100 mm x 4 mill thick “Blaze Orange” plastic tape with printing indicating type of service of buried pipe. Place tape at ±300 mm above buried pipe in backfill lifts.

.3 Where multiple small pipes are buried in a common trench and do not exceed an overall width of 450 mm, install a single tape line marker.

END OF SECTION

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SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT LABELING

PART 1 - GENERAL

1.1 SUMMARY

.1 Paint labelling on all plumbing equipment.

1.2 RELATED SECTIONS

.1 22 14 00 Facility Storm Drainage.

.2 22 40 00 Plumbing Fixtures.

1.3 REFERENCES

.1 ANSI/ASME A13.1-2015 Scheme for the Identification of Piping Systems.

.2 British Columbia Building Code, 2012 Edition.

1.4 SUBMITTALS

.1 Submit in accordance with requirements of Division 1.

.2 Product Data: Manufacturer’s data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods.

.3 Shop Drawings: Submit list of wording, symbols, letter size, and colour coding for plumbing equipment, piping and valve identification.

.4 Equipment Label Schedule: Provide a schedule of equipment to be labeled with proposed content for each label.

.5 Pipe Label Schedule: Provide a schedule of each piping systems indicating a proposed nomenclature and location of pipe markers.

.6 Valve Tag Schedule: Provide a proposed valve numbering scheme and schedule for each piping system. Tabulate valve number, piping system, system abbreviation as shown on tag, room or space location of valve, normal-operating position (open, closed, or modulating), and variations for identification. Mark valves intended for emergency shut-off and similar special uses.

.7 Closeout Submittals: Record actual as-built locations of valve tags and update schedules accordingly.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum five years documented experience

.2 Installer Qualifications: Company specializing in performing work of this Section with minimum five years documented experience.

.3 ASME Standards: Comply with ANSI/ASME A13.1 for colour scheme, lettering size, length of colour field, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging with labels clearly identifying product name and manufacturer until ready for installation.

.2 Store materials in clean, dry area indoors until ready for installation.

.3 Protect materials and finish from damage during handling and installation.

1.7 PRE-INSTALLATION MEETINGS

.1 Convene pre-installation conference minimum two (2) weeks prior to commencing work of this Section.

.2 Review installation procedures and coordination required with related work.

.3 Inspect and make notes of job conditions prior to installation.

.4 Record minutes of conference and provide copies to all parties present.

.5 Identify outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.

.6 Installation of identification system shall not begin until all outstanding issues are resolved.

1.8 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

.1 Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

.2 Coordinate installation of identifying devices with location of access panels and doors.

.3 Install identifying devices before installing acoustical ceilings and similar concealment.

1.10 EXTRA MATERIALS

.1 Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving banks of assorted sizes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 Acceptable Manufacturer:

.1 Marking Services, Inc. Milwaukee, WI 53224; T: 1- 800-234-0135; Tel: 414-973-1331; Email: sales@markingservices.com; Web:www.markserv.com

.2 Or approved alternative.

.2 Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 MECHANICAL IDENTIFICATION GENERAL

.1 General: Provide manufacturer's standard products of categories and types required for each application specified. For each identification type, provide all products from same manufacturer with same text, style, colour, shape, and other identification features.

.2 Use BCIT standards for all identification standards.

.3 Provide nameplates with unit number on all mechanical equipment.

.4 Provide pipe identification labels including direction-of-flow arrows and with service indicated. Labels shall have background colours matched with specific service designation.

.5 Provide valve tag numbers on plumbing valves.

.6 Include building number for each label as a subtext to each identification, such as SW5 CC-1 for cooling coil CC-1 located in building SW5. Coordinate labelling with the DDC system identification.

2.3 EQUIPMENT LABELS

.1 Plastic Labels for Equipment (Indoor Application):

.1	Material and Thickness:	Multilayer, multicolour, plastic labels for mechanical engraving, 1/16 inch thick.
.2	Letter Colour:	Black
.3	Background Colour:	White
.4	Minimum Label Size:	Length and width vary for required label content, but not less than 1 x 3 inches.
.5	Minimum Letter Size:	1/4 inch.
.6	Adhesive:	Contact-type permanent adhesive, compatible with label and with substrate.

.2 Plastic Labels for Equipment (Outdoor Application):

.1	Material:	MS-215 Max-Tek with printed graphics protected by a chemical and UV resistant MS-3000 top laminate.
.2	Letter Colour:	Black
.3	Background Colour:	White
.4	Minimum Label Size:	Length and width vary for required label content, but not less than 1 x 3 inches.
.5	Minimum Letter Size:	1/4 inch.
.6	Adhesive:	Contact-type permanent adhesive, compatible with label and with substrate.

2.4 PIPE LABELS – INTERIOR

.1 Provide labels for above ground piping located indoors, and not exposed to sunlight or a harsh environment.

.2 Provide pre-printed, colour-coded, with lettering indicating service and flow direction.

.3 Lettering shall be sub-surface printed and protected from direct contact by a layer of plastic. Markers with surface printed lettering will not be accepted.

.4 Pipe Labels for pipe O.D. less than 8 inches: MS-970 Coiled, semi rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive in contact with the pipe surface.

.5 Pipe Labels for pipe O.D. 8 inches and over: MS-970 Strap-on, semi rigid plastic to cover partial circumference of pipe and to attach to pipe with nylon ties

2.5 PIPE LABEL SCHEDULE – INTERIOR

Pipe O.D. (including insulation)	Marker Style	Marker Width	Lettering Height	Marker Type
1/4 inch to 3/8 inch	MS970-TM	3 inches	1/4 inch	Coil-on
1/2 inch to 1 inch	MS970-A	8 inches	1/2 inch	Coil-on
1-1/8 inch to 2-1/4 inch	MS970-B	8 inches	3/4 inch	Coil-on
2-3/8 inch to 3-1/4 inch	MS970-C	12 inches	1-1/4 inch	Coil-on
3-3/8 inch to 4-1/2 inch	MS970-D	12 inches	1-1/4 inch	Coil-on
4-5/8 inch to 5-7/8 inch	MS970-E	12 inches	1-1/4 inch	Coil-on
6 inch to 7-7/8 inch	MS970-FC	12 inches	1-1/4 inch	Coil-on
8 inch to 10 inch	MS970-G	24 inches	2-1/2 inch	Strap-on
Over 10 inch	MS970-H	32 inches	3-1/2 inch	Strap-on

2.6 PIPE COLOUR SCHEDULE

.1 Colours shall be in accordance with BCIT Identification Standards and as follows:

Service	Identification Lettering	Primary Colour (Background)	Secondary Colour (Letter)
Acid Waste	Acid	orange	black
Cold Water Service	C.W.	green	white
Fire Combined Standpipes	SPR/S.P.	red	white
Compressed Air			
0 to 690 kPa	COMP.A.	blue	white
690 kPa and higher	COMP.A. (HP)	blue	white
Distilled Water	Dist.W.	green	white
Domestic Cold Water	D.C.W.	green	white
Domestic Hot Water Recirc.	D.H.W.R.	green	white
Domestic Hot Water Supply 82°C	D.H.W.S. 82°C	green	white
Domestic Hot Water Supply 60°C	D.H.W.S. 60°C	green	white
Non-Potable Cold Water	N.P.W.	green	white
Fire lines W.S.	W.S.	red	white
Fuel oil 2,3,4,5,6	F.O.#	yellow	black
Natural Gas	Gas	yellow	black
Propane	LP GAS	yellow	black
Safety Valve Blowdown	-	green	white
Fire Sprinkler lines	SPR	red	white
Fire Sprinkler lines (Dry)	SPR (DRY)	red	white
Sanitary Drain	SAN	none	none (-)
Plumbing Vent	PVent	none	(-)
Storm Drain	Storm	none	(-)
Non Asbestos Containing Material	NACM	purple	white

2.7 LETTERS WITH DIRECTION OF FLOW ARROWS

.1 12 mm high - 1-1/4 NPS pipe and smaller.

.2 25 mm high - 1-1/2 NPS up to 2-1/2 NPS pipe.

.3 50 mm high - 3 NPS and larger pipe.

.2 Bands:

.1 38 mm wide, except arrow bands 50 mm wide.

.3 Colours:

.1 Horizontally hatched - primary colour.

.2 Vertically hatched - secondary colour.

.3 Black letters and arrows on yellow primary colour.

.4 Background, white letters and arrows or red, blue or green backgrounds.

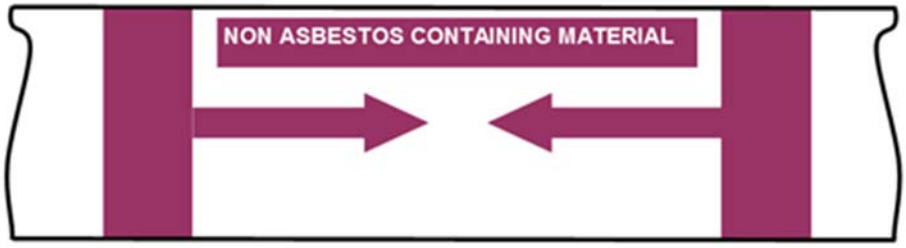
.4 Locate colour banding on maximum 3 m centers. Paint gas piping and fire protection piping in the primary colour for full length of pipe from source to terminal equipment.

2.8 NON ASBESTOS CONTAINING MATERIAL

.1 Where piping has been identified by BCIT as having non-asbestos containing material, apply additional labeling as follows:

.1 Backgrounds and arrows - Purple colour

.2 Letters – White colour



2.9 PIPE LABELS – EXTERIOR

.1 Provide labels for above ground piping located outside, and exposed to sunlight or a harsh environment, the following product is specified.

.2 Provide pre-printed, colour-coded, with lettering indicating service and flow direction.

.3 Pipe markers shall be constructed of MS-995 Maxilar material. Pipe markers shall withstand direct contact with all process chemicals, operating temperatures up to 250 degrees F, and prolonged exposure to direct sunlight.

.4 Pipe markers shall be constructed of printed 5 mil (0.005 inch) polyester and top laminated with MS1000 clear ultra violet and chemical resistant plastic film that is engineered to provide maximum durability of the printed legend. Markers shall be pre-coiled to wrap entirely around the circumference of pipe up to 10 inch outside diameter, and self-sealed with a strip of clear ultra violet and chemical resistant plastic film. Coiled markers shall seal to themselves, and not the pipe surface.

.5 Pipe Labels for pipe O.D. up to 10 inches: Label with a single piece, pre-printed marker that wraps entirely around circumference of pipe, and overlaps and seals to itself rather than adhere to the pipe surface.

.6 Pipe Labels for pipe O.D. 10 inches and greater: Shall be constructed of printed 5 mil (0.005 inch) polyester and top laminated with MS1000 clear ultra violet and chemical resistant plastic film that is pre-applied to an acrylic-faced, co-extruded ABS plastic carrier. Carrier shall have pre-formed legs running the entire length of the part to ensure marker remains straight and aligned with pipe. Flow direction shall be identified by application of a separate arrow label of

same construction. Affix carriers to piping by means of two stainless steel straps that wrap entirely around circumference of pipe.

2.10 PIPE LABEL SCHEDULE – EXTERIOR

Pipe O.D. (including insulation)	Marker Style	Marker Width	Lettering Height	Marker Type
3/4 inch to 1 inch	MS995-A	8 inches	1/2 inch	Wraparound
1-1/8 inch to 2-3/8 inch	MS995-B	8 inches	3/4 inch	Wraparound
2-1/2 inch to 4-3/4 inch	MS995-D	12 inches	1-1/4 inch	Wraparound
5 inch to 7-7/8 inch	MS995-E	12 inches	1-1/4 inch	Wraparound
8 inch to 10 inch	MS995-J	12 inches	1-1/4 inch	Wraparound
Over 10 inch	MS995-MB	32 inches	2-1/2 inch	Carrier

2.11 VALVE TAGS

.1 Valve Tags: Stamped or engraved with 1/4 inch letters for piping abbreviation and 1/2 inch numbers. Provide 5/32-inch hole for fastener.

.2 Material: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

.3 Background Colour: Natural brass.

.4 Letter Colour: Black.

.5 Tag Size: 1-1/2 inches, round.

.6 Fasteners:

.1 Exterior: Brass S-Hooks and Jack Chain.

.2 Interior: Beaded chain and S-hook for attachment to the valve stern.

2.12 VALVE TAGS: FOR OUTDOOR LABELING OF PROCESS VALVES.

.1 Material: MS-215 Max-Tek with printed graphics protected by a chemical and UV resistant MS-3000 top laminate, and having stainless steel grommet protected predrilled holes with for attachment hardware.

.2 Background Colour: To match pipe label colour by system.

.3 Letter Colour: Either white or black for best contrast to background colour.

.4 Tag Size: Minimum 1-1/2 inches.

.5 Fasteners: Stainless steel S-Hooks and stainless steel Jack Chain.

2.13 PIPING IDENTIFICATION DEVICES

.1 Manufactured Pipe Markers: Preprinted, colour-coded, with lettering indicating service and direction of flow.

.1 Colours: Comply with ASME A13.1, unless otherwise indicated.

.2 Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

.3 Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.

.4 Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.

.5 Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

.2 Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

.1 Supplemental Fasteners: Attach to pipe with mechanical fasteners that do not penetrate insulation vapour barrier.

.3 Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

.1 Supplemental Fasteners: Over-tape with a clear weather resistant tape designed to withstand operating temperatures of piping.

2.14 STENCILS

.1 Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

.1 Stencil Material: Metal or fiberboard.

.2 Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.

.3 Identification Paint: Exterior, acrylic enamel in colours according to ASME A13.1, unless otherwise indicated.

2.15 VALVE SCHEDULES

.1 Valve Schedules: Provide schedule for each piping system on standard-size paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

.1 Valve-Schedule Frames: Glazed display frame for removable mounting.

.2 Frame: Extruded aluminum.

.3 Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

.4 Printing shall be black on white, water-resistant, fungus-resistant paper.

.5 List valve number, location, size, and use or operating function for each valve.

.6 Coordinate valve numbers with valve tags so that no two valves or scheduled devices have the same number.

2.16 WARNING TAGS

.1 Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

.1 Size: 3 by 5-1/4 inches minimum.

.2 Fasteners: Brass grommet and wire.

.3 Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

.4 Colour: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine substrates for proper preparation and ensure substrate is acceptable for installation. If substrate preparation is the responsibility of another installer, notify Consultant of unsatisfactory preparation before proceeding.

3.2 PREPARATION

.1 Install identifying devices after completion of coverings and painting.

.2 Clean surfaces thoroughly prior to installation.

.3 For labels that are installed using pressure-sensitive adhesives, clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

.4 For pipe markers that are pre-coiled or strap-on type and do not adhere directly to the piping, no surface preparation is necessary.

3.3 LABELLING INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Buried Piping Identification/Markers:

.1 Metallic Pipe: Provide continuously printed 100 mm wide x 4 mil thick “Blaze Orange” plastic tape with printing indicating type of service of buried pipe. Place tape at ±300 mm above buried pipe in backfill.

.2 Non-Metallic Piping: Provide detectable multi-ply tape consisting of aluminum foil core between two (2) layers of 100 mm x 4 mill thick “Blaze Orange” plastic tape with printing indicating type of service of buried pipe. Place tape at ±300 mm above buried pipe in backfill lifts.

.3 Where multiple small pipes are buried in a common trench and do not exceed an overall width of 450 mm, install a single tape line marker.

.3 Equipment Labels:

.1 Install or permanently fasten labels on each major item of mechanical equipment.

.2 Locate equipment labels where accessible and visible.

.4 Pipe Labels: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

.1 Near each valve and control device.

.2 Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

.3 Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.

.4 At access doors, manholes, and similar access points that permit view of concealed piping.

.5 Near major equipment items and other points of origination and termination.

.6 Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

.5 Valve Tags: Install tags on all shut-off valves and control devices in piping systems, except valves within factory-fabricated equipment units.

.6 Mark location of equipment or valves located above ceilings with identifying "buttons" to help in identification for maintenance.

3.4 PROTECTION

.1 Protect installed products until completion of Project.

.2 Touch-up, repair or replace damaged products before Substantial Completion.

3.5 CLEANING

.1 Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

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SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.2 SUMMARY

.1 This Section includes requirements for commissioning plumbing systems, subsystems and equipment.

.2 This Section supplements the requirements specified in Division 01, General Commissioning Requirements.

.3 The requirements of this Section apply to all Plumbing Sections.

.4 The commissioning process is defined in Division 01, General Commissioning Requirements.

.5 A Commissioning Agent (CA) appointed by BCIT and/or the Consultant will manage the commissioning process.

1.3 COORDINATION REQUIRMENTS

.1 Communicate with BCIT Facilities Maintenance personnel and coordinate access at key milestones and periodically through the work for general installation reviews.

.2 BCIT Personnel may visit the project site at their discretion and will make arrangements for site access as required.

1.4 COMMISSIONED SYSTEMS

.1 Commissioning of systems specified in this Section is part of the construction process. Documentation and testing of systems, as well as training of BCIT Operation and Maintenance personnel is required in cooperation with BCIT Facilities Office and the Commissioning Agent.

.2 Commission the following systems:

.1 Plumbing fixtures.

.2 Plumbing equipment including domestic hot water generators, meters, controls, trap primers, pressure reducing valves, interceptors, backflow preventers.

.3 Natural gas pressure regulators and automatic isolation devices.

.4 Sump pumps and controls.

1.5 SUBMITTALS

.1 The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by BCIT Facilities Office and the Consultant prior to forwarding to the Contractor.

.2 The commissioning process requires submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Division 01, General Commissioning Requirements.

.3 Refer to Division 01 General Commissioning Requirements for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

PART 2 - PRODUCTS

2.1 TESTS AND INSPECTION

.1 The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions.

.2 The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and acceptance by the Consultant. Contractor shall review and comment on the tests prior to acceptance.

.3 Replace all batteries for any hands free faucets or flush valves at the time of commissioning.

.4 Provide the labour, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. Sign the test reports to verify tests were performed. See Division 01 General Commissioning Requirements, for additional details.

.5 Arrange for and provide BC Safety Authority and local Plumbing Inspection final inspections and sign-off certificates once the plumbing systems and equipment have been started up and commissioned satisfactorily.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Commissioning of the Building Plumbing Systems will require inspection of individual elements of the plumbing construction throughout the construction period.

.2 Coordinate with Commissioning Agent in accordance with Division 01 and the Commissioning Plan to schedule inspections as required to support the commissioning process.

3.2 INSTALLATION AND PERFORMANCE

.1 Complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.

.2 Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. Complete checklists and submit to BCIT Facilities, Consultant, and to Commissioning Agent for review. Commissioning Agent may spot check a sample of completed checklists.

.3 If Commissioning Agent determines that information provided on the checklist is not accurate, Commissioning Agent will return marked-up checklist for correction and resubmission.

.4 If Commissioning Agent determines a significant number of completed checklists for similar equipment are not accurate, Commissioning Agent will select a broader sample of checklists for review.

.5 If Commissioning Agent determines a significant number of the broader sample of checklists is also inaccurate, all checklists for the type of equipment will be returned for correction and resubmission.

3.3 SITE TESTS AND INSPECTIONS

.1 Tests as required by other Sections of plumbing specifications shall be scheduled and documented in accordance with Division 01 General Requirements.

.2 Testing shall be incorporated into project schedule. Provide no less than seven (7) calendar days' notice of testing. Commissioning Agent will witness selected tests at the sole discretion of the Commissioning Agent.

.3 Tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 FIELD QUALITY CONTROL

.1 Training of the BCIT Operation and Maintenance Personnel is required in cooperation with the Consultant and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to Operation and Maintenance Personnel concerning the location, operation, and troubleshooting of installed systems.

.2 Submit training agendas and trainer resumes in accordance with requirements of Division 01. Schedule instruction in coordination with the BCIT Facilities Office and Consultant after submission and acceptance of formal training plans.

.3 Submit signed confirmation from BCIT Facilities Maintenance personnel, Commissioning Agent and Consultant verifying training has been accepted and completed

END OF SECTION

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SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide plumbing piping and accessories for a complete system.

1.2 REFERENCES

.1 American Society of Plumbing Engineers Design Guides.

.2 ANSI/NSF Standard 14 “Plastics Piping System Components and Related Materials”

.3 ANSI/NSF Standard 61 “Drinking Water System Components - Health Effects”

.4 ASSE (Plumbing) 1061-2015 Performance Requirements for Push-Fit Fittings.

.5 ASTM F877-11a Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.

.6 ASTM F1807-15 Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing.

.7 ASTM F1960-15 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing.

.8 ASTM F2080-15a Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe.

.9 ASTM F2098-15 Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings.

.10 ASTM F2159-14 Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-Linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing.

.11 ASTM F2434-14 Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 PEX Tubing and SDR9 PEX-AL-PEX Tubing.

.12 British Columbia Building Code, 2012 Edition (BCBC).

.13 British Columbia Plumbing Code, 2012 Edition.

.14 Burnaby Plumbing Bylaw, 2000.

.15 CAN/CSA B137 SERIES-13 Thermoplastic pressure piping compendium, Includes Update No. 1 (2015), Update No. 2 (2015), Update No. 3 (2015).

.16 CSA and ULC Standards.

.17 ULC 102.2 Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies (CAN/ULC S102.2-10).

.18 ULC 115 Standard Method of Fire Tests of Firestop Systems (CAN/ULC S115-11).

1.3 DESIGN REQUIREMENTS

.1 Where solar collectors are planned or contemplated, consult with BCIT Technical Services for approval of concept.

.2 Do not use glass acid waste piping under laboratory sinks that have storage shelf below or are intended for storage.

.3 Review proposed acid waste treatment and locations for access to acid neutralizers with BCIT Facilities Office.

.4 Where renovations or additions are being made to an existing building with copper tube potable water piping, confirm with BCIT facilities whether to extend all new plastic potable water piping for the addition/renovated areas, or continue with copper tube.

.5 Domestic Hot Water Recirculation: Size system recirculation pumps as per American Society of Plumbing Engineers Design Guides. Maximum piping flow velocity shall not exceed 1 m/s.

.6 Domestic Hot Water Heating: Install non slam check valves in all cold water connections to domestic water heaters.

1.4 COORDINATION REQUIREMENTS

.1 Coordinate work of this Section with BCIT Building Facilities.

1.5 SUBMITTALS

.1 Submit in accordance with Division 1 Requirements.

.2 Product Data: Submit manufacturer's product data sheets.

1.6 QUALITY ASSURANCE

.1 Perform work to Province of British Columbia Plumbing Code, latest edition, and City of Burnaby standards. Maintain one (1) copy on site.

.2 Valves: Manufacturer's name and pressure rating marked on valve body.

.3 Welding Materials and Procedures: Conform to ASME SEC IX and applicable provincial labour regulations.

.4 Welders Certification: To ASME SEC IX, NCPWB Standard Procedure Specifications and Province of BC Boiler and Pressure Vessel Act.

.5 Conform to applicable latest local Code for installation of backflow prevention devices. Provide certification to satisfy Authorities Having Jurisdiction.

.6 Provide Certificate of Compliance from Authority Having Jurisdiction indicating approval of installation of backflow prevention devices.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

.1 Do not use plastic drainage piping in the following locations:

.1 Inside buildings or under buildings except for acid waste systems.

.2 For underground sanitary, storm drainage if steam or condensate is drained to these systems, or can be drained into them in the future. (i.e Commercial kitchen dishwasher discharge drainage).

.2 Do not use cellular ABS or PVC pipe under traffic areas with less than 750 mm cover.

.3 Do not use Precision Plumbing Products or similar trap primers that contain fine screens.

.4 Do not use flexible (similar to Big O type) drainage piping.

2.2 GENERAL

.1 Backflow/Cross Connection Controls: In accordance with British Columbia Plumbing Code, including adequately sized local floor drains or catch basins required for the rated flow from the backflow prevention device.

.2 Water Hammer Arrestors: To AWWA and manufacturer's standards. Do not use air gap pipe risers.

.3 Mount equipment requiring periodic maintenance in locations where access using ladders and "confined space entry" are not required.

.4 Specify floor drains for public washrooms, and where flushometers are used, and as required by the Plumbing Code.

.5 Provide bypass piping isolation and check valves on water booster systems.

.6 Provide air dryers on compressed air systems. Specify auto-drain valves.

.7 Specify dual PRV's for services larger than 50 mm diameter, complete with a low flow PRV on a bypass pipe.

.8 Strainers:

.1 Provide fine stainless steel mesh strainers for domestic water systems in piping upstream of pressure reducing valves, backflow preventers and meters.

.2 Provide two (2) strainers in parallel for water services larger than 50 mm diameter.

.9 Above Ground Storm and Sewer Piping: Provide cast iron or DWV copper pipe.

.10 Housekeeping Pads and Curbs: Provide 100 mm high curbs and 100 mm high pads under equipment and around pipe penetrations in mechanical rooms.

.11 Sanitary sumps within buildings must have gas tight covers and be individually vented to outdoors.

2.3 PLUMBING PIPING

.1 Potable Water Plastic Piping: Provide plastic piping for all domestic cold, hot water, and recirculated hot water systems, conforming to referenced standards. Acceptable products:

.1 IPEX AquaRise.

.2 Uponor AquaPEX.

.3 HeatLink PureLink PEXa.

.4 Viega PureFlo.

.5 Rehau RauPex Everloc.

.6 Aquatherm GreenPipe.

.2 Where practical, acid waste piping material such as polypropylene (Fuseal), Pegas or Zurn brand polypropylene corrosive waste piping is acceptable.

.3 Plastic Pipe Products: Conforming to ULC 102.2 Flame and Smoke Spread ratings.

PART 3 - EXECUTION

3.1 WATER METERS

.1 Install make-up water connections to mechanical systems complete with water metering stations.

.2 Install water metering station into each piping connection to major building expansion and/or new building. Design of metering stations shall not include any by-pass around the stations.

3.2 DELIVERY, STORAGE AND HANDLING

.1 Do not store PEX pipes outdoors.

.2 Keep PEX pipes in original packaging until time of installation.

.3 Ensure exposure to sunlight during installation does not exceed maximum recommended UV exposure time as recommended by manufacturer.

.4 Mechanical Fitting System: Install PEX Piping connections in accordance with manufacturer's recommendations and instructions. Ensure fittings are marked by a certified third-party agency such as NSF, IAPMO, CSA, ICC, UL or other third-party testing and listing agency.

3.3 FIELD QUALITY CONTROL AND TESTING

.1 Tests, correction of deficiencies, and retests are responsibility of Contractor. Perform after system installation has been completed and prior to system being put into continuous operation.

.2 Provide 48 hours' notice to BCIT Facilities Office and Consultant in advance of each set of tests, indicating in writing: testing agency, schedule of tests, testing procedure, and type of measuring equipment. Obtain written approval prior to conducting tests, submitting detailed test reports to Consultant within seven (7) days of completion of test.

.3 Provide instruments, meters, equipment and personnel required to conduct tests.

.4 Test equipment, device or material for a reasonable length of time required to make a complete and thorough test to verify performance requirements before final acceptance and completion of the work.

.5 Testing shall consist of hydraulic pressure at 1400 KPa (200 psi) for 8 hours.

.6 Domestic water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C-601. Submit completion certificate from the testing firm to the Consultant.

.7 Such tests shall not be construed as evidence of acceptance of any part of the work.

END OF SECTION

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SECTION 22 13 00
FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide sanitary sewer and vent systems, including piping, equipment and necessary accessories for complete system.

1.2 REFERENCES

.1 ASME A13.1-2015 Scheme for the Identification of Piping Systems.

.2 ASME A112.36.2M-1991(R 2012) Cleanouts.

.3 ASME A112.6.3-2016 Floor and Trench Drains.

.4 ASME B1.20.1-2013 Pipe Threads, General Purpose (Inch).

.5 ASME B16.1-2015 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

.6 ASME B16.4-2011 Gray Iron Threaded Fittings: Classes 125 and 250.

.7 ASME B16.15-2013 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

.8 ASME B16.18-2012 Cast Copper Alloy Solder Joint Pressure Fittings.

.9 ASME B16.21-2011 Nonmetallic Flat Gaskets for Pipe Flanges.

.10 ASME B16.22-2013 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.11 ASME B16.23-2011 Cast Copper Alloy Solder Joint Drainage Fittings: DWV.

.12 ASME B16.24-2011 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500.

.13 ASME B16.29-2012 Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings: DWV.

.14 ASME B16.39-2014 Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300.

.15 ASME B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series), Includes Errata (2013).

.16 ASSE 1001-2008 Performance Requirements for Atmospheric Type Vacuum Breakers.

.17 ASSE 1018-2001 Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied.

.18 ASSE 1044-2015 Performance Requirements for Trap Seal Primer Devices - Drainage Types and Electronic Design Types.

.19 ASSE 1079-2012 Performance Requirements for Dielectric Pipe Unions.

.20 ASTM A53/A53M-12 Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless.

.21 ASTM A74-16 Standard Specification for Cast Iron Soil Pipe and Fittings.

.22 ASTM A888-15 Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.23 ASTM B32-08(2014) Standard Specification for Solder Metal.

.24 ASTM B43-15 Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

.25 ASTM B75/B75M-11 Standard Specification for Seamless Copper Tube.

.26 ASTM B88-14 Standard Specification for Seamless Copper Water Tube.

.27 ASTM B306-13 Standard Specification for Copper Drainage Tube (DWV).

.28 ASTM B584-14 Standard Specification for Copper Alloy Sand Castings for General Applications.

.29 ASTM B687-99(2016) Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples.

.30 ASTM B813-16 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

.31 ASTM B828-16 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

.32 ASTM C564-14 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.33 ASTM D1785-15 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

.34 ASTM D2321-14e1: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

.35 ASTM D2564-12 Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

.36 ASTM D2665-14 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

.37 ASTM D2855-15 Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

.38 ASTM D5926-15 Standard Specification for Poly(Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.

.39 ASTM F402-05(2012) Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

.40 ASTM F477-14 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.41 ASTM F1545-15a Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.

.42 British Columbia Building Code, 2012 Edition (BCBC).

.43 Cast Iron Soil Pipe Institute (CISPI): Cast Iron Soil Pipe and Fittings Handbook, 2006.

.44 CISPI 301-12 Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.45 CISPI 310-12 Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.46 Copper Development Association, Inc. (CDA): A4015: Copper Tube Handbook.

.47 MSS SP 123-2013 Manufacturers Standardization Society (MSS) Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube.

.48 PDI WH 201-10 Plumbing and Drainage Institute (PDI) Water Hammer Arrestors Standard

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data: Include manufacturer's literature and data with full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Provide data for the following:

- .1 Piping
- .2 Floor Drains
- .3 Grease Interceptors and Grease Traps
- .4 Cleanouts
- .5 Trap Seal Protection
- .6 Penetration Sleeves
- .7 Pipe Fittings
- .8 Traps
- .9 Exposed Piping and Fittings
- .10 Oil interceptors
- .11 Acid waste neutralizers

.3 Shop Drawings: Provide detailed Shop Drawings where clamping devices and extensions are required in connection with waterproofing membrane or floor drain. Identify percentage of recycled content of cast iron piping on Shop Drawings.

.4 Record Documents: Maintain as-built Drawings of each completed phase for verification, and provide the complete set at time of final systems certification testing. Provide a copy of Record Documents on Auto-Cad and/or Revit on compact disk or DVD. Where testing company is hired to provide as-builts or any portion thereof, it shall not be deemed a conflict of interest or breach of the ‘third party testing company’ requirement.

.5 Certification Documents: Prior to submitting the request for final inspection, provide Certification documentation to include the following:

- .1 Test results.
- .2 Names of individuals performing work for the testing agency on this project.
- .3 Detailed procedures followed for all tests.
- .4 Certification that all results of tests were within limits specified.

1.4 QUALITY ASSURANCE

.1 Perform work to Province of British Columbia Plumbing Code, latest edition standards. Maintain one (1) copy on site.

.2 Valves: Manufacturer's name and pressure rating marked on valve body.

.3 Welding Materials and Procedures: Conform to ASME SEC IX and applicable provincial labour regulations.

.4 Welders Certification: To ASME SEC IX, NCPWB Standard Procedure Specifications and Province of BC Boiler and Pressure Vessel Act.

1.5 COMMISSIONING

.1 Provide commissioning documentation in accordance with the requirements of Section 22 08 00, Commissioning of Plumbing Systems.

.2 Components provided under this Section of the specification will be tested as part of a larger system.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS

.1 PVC piping and fittings shall not be used for the following applications:

.1 Waste collected from steam condensate drains.

.2 Spaces such as mechanical equipment rooms, kitchens, sterile processing services, sterilizer areas, and areas designated for sleep.

.3 Vertical waste and soil stacks serving more than two (2) floors.

.4 Exposed in mechanical equipment rooms.

.5 Exposed inside of ceiling return plenums.

2.2 SANITARY WASTE, DRAIN, AND VENT PIPING

.1 Cast iron waste, drain, and vent pipe and fittings.

.2 Provide cast iron waste, drain, and vent pipe and fittings for the following applications:

.1 Pipe buried in or in contact with earth. (May be PVC/ABS to within 100 mm of top side of slab).

.2 Interior waste and vent piping above grade.

.3 Cast iron pipe hubless (plain end or no-hub or hubless) with stainless steel mechanical joints.

.4 Soil Pipe and Fittings: Conforming to the requirements of CISPI 301, ASTM A888, or ASTM A74.

.5 Cast iron pipe and fittings shall be made from a minimum of 95% post-consumer recycled material.

.6 Joints for Hubless Pipe and Fittings: Conforming to manufacturer's installation instructions and to CISPI 310. Install joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

.3 Copper Tube (DWV):

.1 Copper DWV Tube Sanitary Waste, Drain and Vent Pipe: May be used for piping above ground, except for urinal drains.

.2 Copper DWV Tube: Drainage type, drawn temper conforming to ASTM B306.

.3 Copper Drainage Fittings: Cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.

.4 Joints: Lead free, using a water flushable flux, and conforming to ASTM B32.

.4 Polyvinyl Chloride (PVC):

.1 Polyvinyl chloride (PVC) pipe and fittings are permitted where the waste temperature is below 60°C (140°F).

.2 Polyvinyl Chloride Sanitary Waste, Drain, and Vent Pipe and Fittings: Solid core sewer piping conforming to ASTM D2665, sewer and drain series with ends for solvent cemented joints.

.3 PVC Fittings: Solvent welded socket type using solvent cement conforming to ASTM D2564.

.4 Acid Waste and Vent Pipe from Laboratories or Other Corrosive Waste Streams: Acid resistant polypropylene DWV pipe. Acceptable products: Pegas, Orion, IPEX Enfield and IPEX Labline, and IPEX PlenumLine flame retardant PVDF mechanical joint acid waste pipe system for return air plenums/high temperature corrosive chemical waste applications.

2.3 PUMP DISCHARGE PIPING

.1 Pump discharge pipe and fittings:

.1 Copper Tube: Hard drawn Type “L” conforming to ASTM B88 DWV.

.2 Fittings: Cast copper alloy conforming to ASME B16.18 or wrought copper conforming to ASME B16.22 with solder joint ends.

.3 Unions: Copper alloy, hexagonal stock body with ball and socket, metal to metal seating surface conforming to MSS SP-123 with female solder-joint or threaded ends.

.4 Flanges: Class 150, cast copper conforming to ASME B16.24 with solder-joint end.

.1 Flange gaskets: full face, flat nonmetallic, asbestos-free conforming to ASME B16.21.

.2 Flange nuts and bolts: Carbon steel conforming to ASME B18.2.1.

.5 Solder: Lead free, water flushable flux conforming to ASTM B32 and ASTM B813.

2.4 EXPOSED WASTE PIPING

.1 Exposed Waste Piping: Chrome plated brass piping of full iron pipe size in finished rooms, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Owner or specified in other sections.

.1 Pipe: Conforming to ASTM B43, regular weight.

.2 Fittings: Conforming to ASME B16.15 and ASTM D2665.

.3 Nipples: Conforming to ASTM B687, Chromium-plated.

.4 Unions: Brass or bronze with chrome finish. Unions 65 mm (2½ inches) and larger shall be flange type with approved gaskets.

.2 In unfinished rooms such as Mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. Pipe materials specified under the paragraph “Sanitary Waste, Drain, and Vent Piping” can be used. Paint sanitary pipe in unfinished rooms as specified in Division 09, Painting.

2.5 SPECIALTY PIPE FITTINGS

.1 Ensure transition pipe couplings join piping with small differences in outside diameters or different materials. Use end connections of same size and compatible with pipes being joined. Use elastomeric transition coupling, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. For transition sleeve coupling, use the following material:

.1 For cast iron soil pipes: Use rubber sleeve material conforming to ASTM C564.

.2 For PVC soil pipes: Use elastomeric seal or PVC, conforming to ASTM F477 or ASTM D5926.

.3 For dissimilar pipes: Use PVC sleeve material conforming to ASTM D5926, or other material compatible with pipe materials being joined.

.2 Dielectric Fittings: Conforming to ASSE 1079 with a pressure rating of 861 kPa at a minimum temperature of 82°C. End connections: Solder joint copper alloy and threaded ferrous.

.1 Dielectric Flange Insulating Kits: Non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa.

.1 Gaskets: Neoprene or phenolic.

.2 Bolt Sleeves: Phenolic or polyethylene.

.3 Washers: Phenolic with steel backing washers.

.2 Di-electric Nipples: Electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa at 107°C.

.1 End Connections: Male threaded.

.2 Linings: Inert and noncorrosive propylene.

2.6 CLEANOUTS

.1 Cleanouts: Same size as the pipe, up to 100 mm; and not less than 100 mm for larger pipe.

.1 Ensure cleanouts are easily accessible, gastight and watertight. Provide minimum clearance of 600 mm for clearing a clogged sanitary line.

.2 Floor Cleanouts: Gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. Include a gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug. Frame, cover material and finish shall be nickel-bronze copper alloy with a square shape.

.1 Ensure cleanout is vertically adjustable for a minimum of 50 mm. When a waterproof membrane is used in the floor system, provide clamping collars on the cleanouts.

.2 Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs.

.3 Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors: Provide with square top covers recessed for tile insertion. Provide carpet cleanout markers in carpeted areas. Provide two-way cleanouts where indicated on drawings and at every building exit.

.4 Use heavy duty type loading classification for cleanouts in sidewalk areas or areas subject to vehicular traffic.

.3 Provide cleanouts at or near the base of vertical stacks with cleanout plug approximately 600 mm above the floor. Where no fixtures are installed on the lowest floor, install cleanout at base of stack. Extend cleanouts to the wall access cover. Cleanout shall consist of sanitary tees. Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 x 150 mm at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

.4 Horizontal Runs Above Grade: Use cleanouts of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.7 FLOOR DRAINS

.1 General Data: Floor drains shall comply with ASME A112.6.3. Provide a caulking flange, inside gasket, or hubless connection for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe.

.1 Drain connection shall be bottom outlet.

.2 Provide a membrane clamp and extensions if required, where installed in connection with waterproof membrane.

.3 Puncturing membrane other than for drain opening will not be permitted.

.4 Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe.

.5 Membrane Flashing: For drains not installed in connection with a waterproof membrane, provide a 1.1 to 1.8 Kg (2.5 to 4 lbs.) flashing membrane, 600 mm square or approved alternative.

.2 Floor Drain (FD-1): J.R. Smith Model 2005 or approved alternative.

.1 ANSI A112.21.1; lacquered cast iron two (2) piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

.3 Floor Drain (FD-2): J.R. Smith Model 2005 or approved alternative.

.1 ANSI A112.21.1; lacquered cast iron two (2) piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with removable perforated sediment bucket.

.4 Floor Drain (FD-3): J.R. Smith Model 2310 or approved alternative.

.1 ANSI A112.21.1; lacquered cast iron two (2) piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer with polished bronze funnel or anti- splash rim.

.5 Floor Drain (FD-4): J.R. Smith Model 2120 or approved alternative.

.1 ANSI A112.21.1; lacquered cast iron two (2) piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer.

.6 Floor Drain (FD-5): J.R. Smith Model 2142 or approved alternative.

.1 ANSI A112.21.1; lacquered cast iron two (2) piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze extra heavy duty strainer with hinged grate and sediment bucket.

.7 Floor Drain (Trench Drain) (FD-6): Cast iron: Zurn Model Flo-Thru

.1 Lacquered cast iron two (2) piece body with drainage flange, heavy duty grate [150 mm (6 inches)], length as required for location and duty, dome strainer, end plates with gaskets. Load range H-20.

.8 Floor Drain (Acid waste) (FD-7): Corrosion resistant floor drains shall be as manufactured by Pegas from fire-retardant polypropylene (FRPP) material conforming to ASTM D 4101. Grate, plug, funnels and covers are to be made from fiber-filled polypropylene for strength and durability.

2.8 FLOOR SINKS

.1 Floor Sink (FS-1): J.R. Smith Model 3003 or approved alternative.

.1 Galvanized cast iron body with stainless steel dome strainer and seepage flange.

.2 Floor Sink (FS-2): J.R. Smith Model 3121C or approved alternative.

.1 Square lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, clamp collar, epoxy coated sediment bucket, nickel bronze frame and full grate.

2.9 TRAPS

.1 Provide traps on all sanitary branch waste connections from fixtures or equipment not provided with traps.

.2 Traps General: Correspond to fittings on cast iron soil pipe or steel pipe respectively, and size as required by connected service or fixture.

.3 Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons.

.4 Concealed traps may be rough cast brass or same material as the piping to which they are connected to.

.5 Slip joints are not permitted on sewer side of trap.

2.10 PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

.1 Trap Primer: The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 861 kPa (125 psig) and conforming to standard ASSE 1018.

.1 The inlet and outlet connections shall be 15 mm or DN15.

.2 The trap seal primer valve shall be fully automatic with an all brass or bronze body.

.3 The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.

.4 The trap seal primer valve shall include a manifold when serving two (2), three (3), or four (4) traps.

.5 The manifold shall be omitted when serving only one (1) trap.

2.11 PENETRATION SLEEVES

.1 Sleeve Flashing Devices - General: Provided at points where pipes pass through membrane waterproofed floors or walls.

.2 Sleeve Flashing Devices: Manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane.

.3 Include a galvanized steel pipe extension in the top of the fitting that will extend 50 mm above finished floor, and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab.

.4 Provide a waterproof caulked joint at the top hub.

2.12 ACCESSORIES

.1 Provide miscellaneous materials for proper installation of hangers, supports and accessories as specified, required, directed or as noted on the drawings. If the vertical distance exceeds 6.1 m (20 ft.) for cast iron pipe provide additional support in the center of that span. Provide all necessary auxiliary steel to ensure that support.

.2 Cast Escutcheon with Set Screw: Provide at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

.1 Install pipe in accordance with requirements of the British Columbia Plumbing Code, latest edition, and standards referenced in this Section, including pipe identification complete with legible lettering and flow arrows.

.2 Install branch piping for waste from respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by BCIT or specified in other Sections.

.3 Install pipe round and straight. Perform cutting with proper tools. Ream pipe to full size after cutting.

.4 Lay pipe runs to avoid interference with other work.

.5 Install piping:

.1 Above accessible ceilings where possible.

.2 To permit valve servicing or operation.

.3 Free of sags and bends.

.6 Install seismic restraint where required by Code.

.7 Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.

.8 Use long turn double wye branch and eighth bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90°. Proper size of standard increaser and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

.9 Correct unsatisfactory installation at no cost to BCIT Facilities Office.

3.2 UNDERGROUND PIPING

.1 Underground PVC piping shall be installed according to ASTM D2321.

.2 Lay buried soil and waste drainage and vent piping beginning at the low point of each system. Install piping true to grades and alignment indicated with unbroken continuity of invert. Place hub ends upstream. Install required gaskets according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

.3 Install cast iron piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings".

.4 Install aboveground copper tubing according to Copper Development Association's (CDA) "Copper Tube Handbook".

3.3 ABOVEGROUND PIPING

.1 Install aboveground PVC piping according to ASTM D2665.

3.4 JOINT CONSTRUCTION

.1 Join hub and spigot, cast iron piping with gasket joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

.2 Install hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

.3 Hubless or no-hub, cast iron piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

.4 Install threaded joints, and thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp disc cutters. Ream and remove butts of threaded pipe ends and restore to full pipe inside diameter. Join pipe fittings and valves as follows:

.1 Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.

.2 Replace pipe sections with damaged threads with new sections of pipe.

.5 Join copper tube and fittings with soldered joints according to ASTM B828. Use a water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32.

.6 For joints in PVC piping, use solvent cement joints for joints. Clean and dry surfaces prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendixes.

3.5 SPECIALTY PIPE FITTINGS

.1 Install transition coupling at pipe joints with small differences in pipe outside diameters.

.2 Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.6 PIPE HANGERS, SUPPORTS AND ACCESSORIES

.1 Support piping according to the British Columbia Plumbing Code, latest edition and the standards referenced in this Section. Where conflicts arise between the Code and the standards, the most restrictive or the requirement that specifies supports with highest loading or shortest spacing will apply.

.2 Paint hangers, supports, rods, inserts and accessories used for pipe supports according to Division 09, Painting. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

.3 Support horizontal piping and tubing within 300 mm of each fitting or coupling.

.4 Support horizontal cast iron piping with the following maximum horizontal spacing and minimum hanger rod diameters:

.1 40 mm or DN40 to 50 mm or DN50 1500 mm (60 inches) with 10 mm rod.

.2 75 mm or DN75 1500 mm with 15 mm rod.

.3 100 mm or DN100 to 125 mm or DN125 1500 mm with 18 mm rod.

.4 150 mm or DN150 to 200 mm or DN200 1500 mm with 20 mm rod.

.5 250 mm or DN250 to 300 mm or DN300 1500 mm with 23 mm rod.

.5 Maximum spacing for plastic pipe shall be 1.22 m.

.6 Support vertical piping and tubing at base, at each floor, and at intervals no greater than 4.6 m.

.7 Floor, wall and ceiling plates, supports, hangers shall have the following characteristics:

.1 Solid or split unplated cast iron.

.2 Provide plates shall be with set screws.

.3 Height adjustable clevis type pipe hangers.

.4 Use steel adjustable floor rests and base flanges.

.5 Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two (2) removable nuts at each end for positioning rod and hanger and locking each in place.

.6 Riser clamps shall be malleable iron or steel.

.7 Rollers shall be cast iron.

3.7 INSTALLATION AT WATERPROOFING AND FIRESTOPPING

.1 Penetrations:

.1 Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Division 07, Firestopping. Completely fill and seal clearances between raceways and openings with fire stopping materials.

.2 Water proofing: At floor penetrations, completely seal clearances around pipe with sealant, to make water-tight.

3.8 INSTALLATION

.1 Exhaust vents: Extend separately through roof. Ensure sanitary vents are not connected to exhaust vents.

3.9 FIELD QUALITY CONTROL - TESTS

.1 Test sanitary waste and drain systems either in their entirety or in sections.

.2 Conduct Waste System tests before trenches are backfilled or fixtures are connected. Conduct a water test or air test as directed by Consultant.

.3 Water Test:

.1 Where entire system is tested, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow.

.2 Where the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m head of water.

.3 In testing successive sections, test at least upper 3 m of next preceding section so that each joint or pipe except upper most 3 m of system has been submitted to a test of at least a 3 m head of water. Prior to starting inspection, keep water in the system, or in portion under test, for at least 15 minutes. System shall then be tight at all joints.

.4 Air Test:

.1 Maintain air pressure of 34 kPa gauge for at least 15 minutes without leakage.

.2 Use a force pump and mercury column gage for the air test.

.5 After installing all fixtures and equipment, open water supply so that all p-traps can be observed. Inspect P-traps for at least 15 minutes for leaks and correct any leaks found.

END OF SECTION

This document contains standards that are the minimum requirements for BCIT construction projects. The information in the document is organized using the MasterFormat® and SectionFormat® systems. It is not a specification; it is intended to supplement the Consultant's own documents. Do not use this information as a standalone specification.

SECTION 22 14 00
FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

.1 Provide storm drainage systems, including piping and all necessary accessories as designated in this Section.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).

.2 ASME A112.21.2M-1983 [Withdrawn] Roof Drains.

.3 ASME A13.1-2015 Scheme for Identification of Piping Systems.

.4 ASME B16.3-2011 Malleable Iron Threaded Fittings: Classes 150 and 300.

.5 ASME B16.9-2012 Factory-Made Wrought Steel Buttwelding Fittings.

.6 ASME B16.11-2011 Forged Steel Fittings, Socket-Welding and Threaded.

.7 ASME B16.12-2009 (R2014) Cast Iron Threaded Drainage Fittings.

.8 ASME B16.15-2013 Cast Bronze Threaded Fittings, Class 125 and 250.

.9 ASME B16.18-2012 Cast Copper Alloy Solder-Joint Pressure Fittings.

.10 ASME B16.22-2013 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.11 ASTM A47/A47M-99(2014) Standard Specification for Ferritic Malleable Iron Castings.

.12 ASTM A53/A53M-12 Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc- coated Welded and Seamless.

.13 ASTM A74-16 Standard Specification for Cast Iron Soil Pipe and Fittings.

.14 ASTM A183-14 Standard Specification for Carbon Steel Track Bolts and Nuts.

.15 ASTM A312/A312M-16 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

.16 ASTM A536-84(2014) Standard Specification for Ductile Iron Castings.

.17 ASTM A733-15 Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.

.18 ASTM B32-18(2014) Standard Specification for Solder Metal.

.19 ASTM B61-15 Standard Specification for Steam or Valve Bronze Castings.

.20 ASTM B62-15 Standard Specification for Composition Bronze or Ounce Metal Castings.

.21 ASTM B75/B75M-11 Standard Specification for Seamless Copper Tube.

.22 ASTM B88-14 Standard Specification for Seamless Copper Water Tube.

.23 ASTM B306-13 Standard Specification for Copper Drainage Tube (DWV).

.24 ASTM B584-14 Standard Specification for Copper Alloy Sand Castings for General Applications.

.25 ASTM B687-99(2016) Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples.

.26 ASTM C564-14 Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.27 ASTM D2000-12 Standard Classification System for Rubber Products in Automotive Applications.

.28 ASTM D2447-03[Withdrawn] Standard Specification for Polyethylene (PE) Plastic Pipe, Schedule 40 and 80, Based on Outside Diameter (Withdrawn 2010).

.29 ASTM D2564-12 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

.30 ASTM D2665-14 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

.31 ASTM D4101-14E1 Standard Specification for Propylene Plastic Injection and Extrusion Materials.

.32 American Welding Society (AWS): A5.8M/A5.8:2011-AMD 1 Specification for Filler Metals for Brazing and Braze Welding (Includes Amendment 1, 2012).

.33 British Columbia Building Code, 2012 Edition (BCBC).

.34 Cast Iron Soil Pipe Institute (CISPI):

.1 CISPI 301-04 Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.2 CISPI 310-04 Couplings for Use in Connection with Hubless Cast Iron Soil and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

.35 International Code Council (ICC): ICC IPC-2015 International Plumbing Code.

.36 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

.1 MSS SP-72-2010A Ball Valves with Flanged or Butt-Welding Ends for General Service.

.2 MSS SP-110-2010 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends, Includes Errata (8-23-2010).

1.3 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Manufacturer's Literature and Data:

.1 Piping.

.2 Roof Drains.

.3 Cleanouts.

.4 All items listed in Part 2 - Products.

.3 Shop Drawings: Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

.1 Cast Iron Storm Pipe and Fittings:

.1 Use cast iron storm pipe and fittings for the following applications:

.1 Pipe buried in or in contact with earth may be PVC/ABS to within 100 mm of the top of the slab on grade.

.2 Interior storm piping above grade.

.3 All mechanical equipment rooms or other areas containing mechanical air handling equipment.

.2 Cast Iron Storm Pipe: Hubless (plain end or no-hub) as required by selected jointing method.

.3 Pipe and Fittings Material: Cast iron soil pipe and fittings conforming to the requirements of CISPI Standard 301, ASTM A-888, or ASTM A-74.

.4 Joints for Hubless Pipe and Fittings: Conforming to the manufacturer's installation instructions. Couplings for hubless joints: Conforming to CISPI 310.

.2 Copper Tube, (DWV): May be used for storm drainage piping above ground.

.1 Copper DWV tube: Drainage type, drawn temper conforming to ASTM B306.

.2 Copper drainage fittings: Cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.

.3 Use lead free joints, with a water flushable flux, conforming to ASTM B32.

.3 Polyvinyl Chloride (PVC):

.1 Polyvinyl chloride storm sewer pipe and fittings are permitted for single storey structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.

.2 Polyvinyl chloride storm sewer pipe and fittings shall be schedule 40 solid core sewer piping conforming to ASTM D1785 and D 2665, Sewer and Drain Series, with ends for solvent cemented joints.

.3 Polyvinyl chloride joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

.4 Insulate roof drain piping in locations where the outdoor conditions are subject to freezing. Unless otherwise noted, insulate fully the roof drain body, including all of the drain piping right to the slab on grade penetration to underground pipe connection.

2.2 PUMPED DRAIN PIPING

.1 Pumped drain piping under 100 mm: Copper tube conforming to ASTM B88, type "K" or "L", or Schedule 40 PVC.

.2 Pumped drain piping 100 mm and above: Galvanized steel conforming to A 53, seamless, Schedule 40.

.3 Pumped drain pipe fittings shall comply with the following:

.1 Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22.

.2 Unions shall be bronze, MSS SP-72, SP-110. Solder or braze joints.

.3 Grooved fittings, 65 mm to 100 mm wrought copper ASTM A75 C12200, 125 to 150 mm bronze castings ASTM B584, CDA 844.

.4 Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with coloured alkyd enamel.

.4 Provide adapters for joining screwed pipe to copper tubing.

.5 Solder: Use a non-corrosive flux conforming to ASTM B32.

2.3 SPECIALTY PIPE FITTINGS

.1 Ensure that transition pipe couplings join piping with small differences in outside diameters or be of different materials.

.1 End connections: Same size and compatible with pipes being joined.

.2 Transition coupling: Elastomeric, sleeve type reducing or transition pattern and includes shear erring and corrosion resistant metal tension band and tightening mechanism on each end.

.3 The transition coupling sleeve coupling shall be of the following material:

.1 For cast iron soil pipes: Rubber sleeve material conforming to ASTM C564.

.2 For PVC soil pipes sleeve material: Elastomeric seal or PVC, conforming to ASTM F 477 or ASTM D5926.

.3 For dissimilar pipes: PVC sleeve material conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

.2 Dielectric fittings:

.1 Conforming to ASSE 1079 with a pressure rating of 860 kPa at a minimum temperature of 82°C.

.2 End connection: Solder joint copper alloy and threaded ferrous.

.3 Dielectric flange insulating kits:

.1 Non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa.

.2 Gasket: Neoprene or phenolic.

.3 Bolt sleeves: Phenolic or polyethylene.

.4 Washers: Phenolic with steel backing washers.

.4 Dielectric nipples:

.1 Electroplated steel nipple conforming to ASTM F1545 with pressure rating of 2070 kPa at 107°C.

.2 End connection: Male threaded.

.3 Lining: Inert and noncorrosive propylene.

2.4 CLEANOUTS

.1 Cleanouts: Same size as pipe, up to 100 mm; and not less than 100 mm for larger pipe.

.1 Ensure cleanouts are easily accessible, gastight and watertight. Provide minimum clearance of 600 mm for clearing clogged sanitary lines.

.2 Floor Cleanouts:

.1 Gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M.

.1 Include a gray iron ferrule with hubless, socket, inside caulk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug.

.2 Frame, cover material and finish: Nickel-bronze copper alloy with a square shape.

.2 Ensure cleanout is vertically adjustable for a minimum of 50 mm. When waterproof membrane is used in floor system, provide clamping collars on the cleanouts.

.3 Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs.

.4 Cleanouts in resilient tile floors, quarry tile and ceramic tile floors:

.1 Provide with square top covers recessed for tile insertion.

.2 Provide carpet cleanout markers in carpeted areas.

.3 Provide two-way cleanouts where indicated on drawings and at every building exit.

.5 Cleanouts in sidewalk areas or areas subject to vehicular traffic: Heavy duty type loading classification.

.3 Provide cleanouts at or near the base of vertical stacks with cleanout plug approximately 600 mm above the floor.

.1 Where no fixtures are installed on the lowest floor, install cleanout at base of stack. Extend cleanouts to the wall access cover. Cleanout shall consist of sanitary tees.

.2 Furnish nickel-bronze square frame and stainless steel cover with minimum opening of 150 x 150 mm at each wall cleanout.

.3 Where piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, is acceptable as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

.4 Horizontal Runs Above Grade: Use cleanouts of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.5 ROOF DRAINS AND CONNECTIONS

.1 Roof Drains (RD): Cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, provide a soft copper membrane 300 mm in diameter greater than outside diameter of drain collar. Where drains installed on roofs have built up roofing covered with gravel or slag, provide an integral gravel stop. Provide integral no-hub, soil pipe gasket or threaded outlet connection.

.1 Flat Roofs: Roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm in diameter.

.1 For insulated roof, provide a roof drain with adjustable drainage collar, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp.

.2 Prior to insulation installation, bottom section shall serve as roof drain during construction.

.2 Canopy Roofs: Roof drain shall have a beehive or dome shaped strainer with the integral flange not larger than 200 mm in diameter.

.1 For insulated roof, provide the roof drain with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp.

.2 Prior to insulation installation, bottom section shall serve as roof drain during construction.

.3 Promenade Decks: Roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.

.4 Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.

.5 Protective Roof Membrane Insulation Assembly: Roof drain shall have a perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp.

.1 Non Pedestrian Roofs: Roof drain shall have large polypropylene or aluminum locking dome.

.2 Pedestrian Roof: Roof drain shall have a bronze promenade top 350 mm square, set in square secured frame support collar.

.6 Roof Drains, Overflow: Roof Drains identified as overflow drains shall have a 50 mm water dam integral to the drain body.

.7 Insulate roof drains in areas subject to freezing and provide heat tape.

.2 Expansion Joints: Heavy cast iron with cast brass or copper expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

.3 Interior Downspouts: Provide expansion joint, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 ft.) long or more.

.4 Downspout Nozzle: Brass, unfinished downspout nozzle fitting, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

.1 Sleeve Flashing Device:

.1 Provide at points where pipes pass through membrane waterproofed floors or walls.

.2 Manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane.

.3 Provide a galvanized steel pipe extension in the top of the fitting that will extend 50 mm (2 inches) above finished floor.

.4 Provide galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab.

.5 Provide a waterproofed caulked joint at the top hub.

2.7 CATCHBASINS AND MANHOLES

.1 Catch basins and storm manholes: Pre-cast concrete with a solid concrete base where adequate depth is available for using standard pre-cast sections.

.1 Where necessary, use concrete manhole blocks with cement mortared joints with solid concrete base.

.2 Barrel: 48 in. (1200 mm) in diameter with minimum personnel access of 30 in. (750 mm) in diameter if the invert elevation is more than 4 ft. (1200 mm) below the surface.

.3 Castings: Bar inlet designed to accommodate the surface conditions at the location.

.2 Use curb-inlet grates in parking or driving areas whenever possible.

.3 Ensure castings in areas exposed to vehicle traffic are of traffic-bearing design.

.4 Install a minimum of two, 2 in. (50 mm) thick concrete adjusting rings on manholes and catch basins wherever depth permits.

.5 Ensure that catch basin covers in parking lots or pedestrian areas do not have inlet holes large enough for canes and crutches to get caught.

.6 Ensure catch basin covers in roads, parking lots and pedestrian areas are bicycle-safe.

2.8 BACK WATER VALVES

.1 Cast Iron: ANSI A112.21.2; galvanized cast iron body and cover, brass valve, 150 mm (6 in.) extension sleeve as required, and access cover.

.2 Plastic: ABS or PVC body and valve, 150 mm (6 in.) extension sleeve, and access cover.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

.1 Ensure pipe installation is in accordance with requirements of the BC Plumbing Code and referenced standards in this Section.

.2 Piping shall conform to the following:

.1 Storm Water Drain and Vent Drain to main stacks:

PIPE SIZE	MINIMUM PITCH
80 mm and smaller	2%
100 mm and larger	1%

.3 Ensure piping is round and straight, cut with proper tools and reamed to full size after cutting.

.4 Ensure piping is free of sags and bends.

.5 Lay pipe runs to avoid interference with other work.

.6 Install seismic restraint where required by Code.

.7 Install branch piping from the piping system and connect to all drains and outlets.

.8 Install piping above accessible ceilings to allow for ceiling panel removal.

.9 Minimum horizontal slope shall be one inch for every 1.22 m (2%) of pipe length, unless otherwise stated in documentation.

.10 Make changes in direction of storm drainage piping using appropriate branches, bends and long sweep bends.

.1 Where change in direction of flow is from horizontal to vertical, sanitary tees and short sweep 1/4 bends may be used on vertical stacks.

.2 Where two fixtures are installed back to back or side by side with common drain pipe, use long turn double wye branch and 1/8 bend fittings.

.3 Do not change direction of flow more than 90°.

.4 Where pipes of different sizes are connected, use proper size of standard increaser and reducers.

.5 Reducing size of drainage piping in direction of flow is prohibited.

.11 Buried storm drainage piping:

.1 Lay beginning at low point of system.

.2 Install piping true to grades and alignment indicated with unbroken continuity of invert. Place hub ends upstream.

.3 Gaskets: Install required gaskets according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

.12 Cast iron piping: Install according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

.13 Aboveground copper tubing: Install according to CDA's "Copper Tube Handbook".

.14 Aboveground PVC piping: Install according to ASTM D2665.

.15 Underground PVC piping: Install according to ASTM D2321.

3.2 JOINT CONSTRUCTION

.1 Hub and spigot, cast iron piping with gasket joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

.2 Hubless, cast iron piping: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

.3 Threaded joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp disc cutters. Ream threaded pipe ends to remove burrs and restore to full pipe inside diameter. Join pipe fittings and valves as follows:

.1 Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.

.2 Where pipe sections have damaged threads, replace with new sections of pipe.

.4 Copper tube and fittings with soldered joints: Join according to requirements of ASTM B828. Use water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32.

.5 PVC piping: Install in accordance with requirements of ASTM F402. Ensure joints conform to ASTM D2855 and ASTM D2665 appendices. Use solvent cement joints for joints. Clean surfaces and dry prior to applying primer and solvent cement.

3.3 SPECIALTY PIPE FITTINGS

.1 Transition coupling: Install at pipe joints with small differences in pipe outside diameters.

.2 Install dielectric fittings at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

.1 Ensure piping is in accordance with the British Columbia Plumbing Code, latest edition, Section 22 05 00, Common Work Results for Plumbing, and requirements of standards of this Section.

.2 Shop coat all hangers, supports, rods, inserts and accessories used for pipe supports with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

.3 Support horizontal piping and tubing within 300 mm of each fitting or coupling.

.4 Support horizontal cast iron piping with the following maximum horizontal spacing and minimum hanger rod diameters:

.1 NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm with 10 mm rod.

.2 NPS 3 (DN 80): 1500 mm with 13 mm rod.

.3 NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm with 16 mm rod.

.4 NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm with 19 mm rod.

.5 NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm with 22 mm rod.

.5 The maximum support spacing for horizontal plastic shall be 1.22 m.

.6 Support vertical piping and tubing at the base, at each floor, and at intervals no greater than 4.57 m.

.7 Floor, Wall and Ceiling Plates shall have the following characteristics:

.1 Solid or split unplated cast iron.

.2 Provide plates with set screws.

.3 Height adjustable clevis type pipe hangers.

.4 Adjustable Floor Rests and Base Flanges: Steel.

.5 Hanger Rods: Low carbon steel, fully threaded or threaded at each end with two (2) removable nuts at each end for positioning rod and hanger and locking each in place.

.6 Riser Clamps: Malleable iron or steel.

.7 Roller: Cast iron.

.8 Hangers and supports utilized with insulated pipe and tubing shall have 180° (min.) metal protection shield centered on and welded to the hanger and support. Shield shall be 100 mm in length and be 16 gauge steel and sized for the insulation.

.8 Installation of hangers, supports and accessories: Provide miscellaneous materials as specified, required, directed or as noted on the Drawings. If vertical distance exceeds 6 m for cast iron pipe, provide auxiliary steel for additional support in the center of that span.

.9 Cast escutcheon with set screw: Install at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

.10 Penetrations:

.1 Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop providing an effective barrier against the spread of fire, smoke and gases. Completely fill and seal clearances between raceways and openings with the fire stopping materials.

.2 Water proofing: At floor penetrations, seal and make watertight with sealant all clearances around the pipe.

3.5 FIELD QUALITY CONTROL

.1 Test storm sewer system in its entirety or in sections.

.2 Storm Water Drain Tests: Conduct before trenches are backfilled or fixtures are connected. Conduct water test or air test as directed.

.1 Water test for entire system: Tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow.

.2 Water test for sections: Tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m head of water.

.3 Water test for successive sections: Test at least upper 3 m of next preceding section so that each joint or pipe except upper most 3 m of system has been submitted to a test of at least a 3 m head of water. Keep water in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.

.4 Air test: Maintain air pressure of 35 kPa gauge for at least 15 minutes without leakage. Use a force pump and mercury column gauge for the test.

END OF SECTION

This document contains standards that are the minimum requirements for BCIT construction projects. The information in the document is organized using the MasterFormat® and SectionFormat® systems. It is not a specification; it is intended to supplement the Consultant's own documents. Do not use this information as a standalone specification.

SECTION 22 34 00
FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

.1 Water Heaters.

.2 Packaged water heating systems.

.3 Domestic water heat exchangers.

.4 Water storage tanks.

1.2 REFERENCES

.1 American Gas Association (AGA) and Canadian Gas Association (CGA).

.2 American Society of Mechanical Engineers (ASME).

.3 ASHRAE 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI Approved; IES Co-sponsored).

.4 ASME Section 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.

.5 British Columbia Building Code, 2012 Edition (BCBC).

.6 Canadian Standards Association (CSA).

.7 National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).

.8 National Electrical Manufacturers' Association (NEMA).

.9 National Sanitation Foundation (NSF).

.10 NFPA (Fire) 30 Flammable and Combustible Liquids Code, 2015 Edition.

.11 NFPA (Fire) 54 / ANSI Z223.1 National Fuel Gas Code, 2015 Edition (AGA Z223115), 2nd Printing (Includes Errata).

.12 NFPA (Fire) 58 Liquefied Petroleum Gas Code, 2014 Edition NFPA (Fire) 70 National Electrical Code (NEC), 2014 Edition.

.13 NFPA (Fire) 70 National Electrical Code (NEC), 2014 Edition.

.14 UL 1453-2016 Electric Booster and Commercial Storage Tank Water Heaters.

.15 UL 174-2004 Household Electric Storage Tank Water Heaters.

.16 Underwriters Laboratories (ULC).

1.3 DESIGN REQUIREMENTS

.1 Water heaters with storage capacity of 180 L or less and heating capacities of 4.5 kW or less may be electric and shall have a drain pan piped to drain.

.2 For larger tanks and heating capacity natural gas or other service over electric is preferred. The maximum required domestic hot water temperature shall be 60°C. Where hotter domestic water is required it shall be boosted from 60°C. Temporary hot water source for low occupancy periods (i.e. summer break) should be installed for maintenance service.

.3 For tanks heated by campus heating mains and where interruption of domestic hot water service is particularly problematic (e.g. food services, laboratories), provide two (2) brazed plate, double-wall heat exchangers in parallel with isolating valves so one can be removed for cleaning while the other remains in service. Otherwise provide a single brazed-plate, double-wall heat exchanger. Multiple 450 L glass-lined, insulated storage tanks or single stainless steel tank may be considered as an option

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data:

.1 Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

.2 Indicate pump type, capacity, and power requirements.

.3 Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve and motor efficiency.

.4 Provide electrical characteristics and connection requirements.

.3 Shop Drawings:

.1 Indicate heat exchanger dimensions, size of tappings, and performance data.

.2 Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

.4 Project Record Documents: Record actual locations of components and equipment with maintenance points.

.5 Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

.6 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

.1 Ensure products and installation of specified products are to recommendations and requirements of referenced standards in this Section.

.2 Conform to AGA, NSF, NBBPVI, NFPA 54, NFPA 58, NFPA 70, UL 174, UL 1453 requirements for water heaters.

.3 Conform to ASME Section 8D for manufacture of pressure vessels for heat exchangers.

.4 Conform to ASME Section 8D, NFPA 30, NFPA 31 for tanks.

.5 Products Requiring Electrical Connection: Listed and classified by ULC and CSA or testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated. Note the requirement for “intrinsically safe” installation of parkade sump pumps as per City of Vancouver Bulletin 92-2 as adopted by other Lower Mainland Municipalities.

.6 Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum five (5) years documented experience.

.7 Provide pumps with manufacturer's name, model number, and rating/capacity identified.

.8 Ensure pumps operate at specified system fluid temperatures without vapour binding and cavitation, are non-overloading in parallel or individual operation, operate within 25% of midpoint of published maximum efficiency curve.

PART 2 - PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

.1 Type: Automatic, natural gas-fired, high efficiency condensing vertical storage.

.2 Performance: Maximum working pressure: 1000 kPa (150 psig).

.3 Tank: Glass lined to ASHRAE 90.1, welded steel, ASME labelled; multiple flue passages, 100 mm diameter inspection port, thermally insulated with minimum 50 mm mineral wool material, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

.4 Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

.5 Approval: By AGA and CGA as automatic storage water heater and automatic circulating tank water heater for operation at 82°C operation on combustible floors.

.6 Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 97°C differential, automatic reset high temperature limiting thermostat factory set at 90°C gas pressure regulator, multi-ribbon or tubular burner, 100% safety shut-off pilot and thermocouple, [intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shut down of pilot and main burner in 2-4 seconds after loss of flame and power venter.

2.2 COMMERCIAL ELECTRIC WATER HEATERS

.1 Type: Factory-assembled and wired, electric, vertical storage type.

.2 Performance: Maximum working pressure; 1000 kPa.

.3 Tank: Glass lined to ASHRAE 90.1, welded steel, ASME labelled; 100 mm diameter inspection port, thermally insulated with minimum 50 mm mineral wool material encased in corrosion-resistant steel jacket; baked-on enamel finish.

.4 Controls: Automatic immersion water thermostat; externally adjustable temperature range from 16 to 82°C flanged or screw-in nichrome elements, high temperature limit thermostat.

.5 Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

.6 Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gauges.

.7 Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 480 W/cm^2.

2.3 PACKAGED WATER HEATING SYSTEMS

.1 System: High Efficiency condensing gas-fired indirect water heating boiler, circulating pump, controls, piping and valving as indicated, storage tank.

.2 Boiler:

.1 Type: High Efficiency condensing gas-fired water tube boiler.

.2 Boiler Trim: Gas burner, thermometer and pressure gauge, immersion thermostats for operating and high limit protection, 100% safety shut-off electric gas valve with transformer, electronic safety pilot and pilot burner, gas pressure regulator, manual gas shut-off, low water cut off, ASME rated temperature and pressure relief valve, coil relief valve, automatic boiler fill and expansion tank.

.3 Storage Tank (may be vertical or horizontal as required):

.1 Working pressure: 1000 kPa ASME labelled.

.2 Lining: 0.38 mm (15 mils) thick epoxy lining extended through flanges and couplings.

.3 Support: Two (2) welded tank saddles not less than 100 mm wide by 6 mm thick, mounted on 50 mm pipe stand with minimum four cross braced legs; sheet teflon isolation strip between tank and saddle; dielectric unions between tank and piping system.

.4 Insulation: 75 mm mineral wool insulation with exterior aluminum jacket to ASHRAE 90.1.

.4 Pump:

.1 Type: All bronze, in-line circulation pump controlled by tank mounted immersion thermostat set at 60°C.

.5 Thermostatic Valve: Three-way, self-contained, full line size, bronze body 13 to 50 mm size, iron body 60 mm and over, set at 60°C.

2.4 DOMESTIC WATER HEAT EXCHANGERS

.1 Tubes: U-tube double wall type with 19 mm diameter seamless copper tubes suitable for 860 kPa working pressure, complete with leak detection and drain provisions.

.2 Heads: Brass, with brass tube sheets, threaded or flanged for piping connections. Provide tube leak detection drain plugs at head for double walled tubes.

.3 Water Chamber and Tube Bundle: Removable for inspection and cleaning.

.4 Coating: Prime coat exterior.

.5 Code: ASME Code for pressure vessels for service pressures, ASME "U" symbol stamped on heat exchanger.

.6 Shell and Tube Type: Steel shell, with threaded or flanged piping connections and necessary tappings, steel saddle and attaching U-bolts, designed for heating fluid in shell and heated fluid in tubes.

.7 Immersion Type: Steel collar for welding to tank.

.8 Accessories:

.1 Wells for temperature regulator sensor at heated water outlet.

.2 ASME rated pressure and temperature relief valve on heated water discharge.

.3 ASME rated pressure relief valves from tapping on heated water side, set at 820 kPa (120 psig).

.4 ASME rated pressure relief valve on water inlet on downstream side of control valve.

.5 Thermometers and pressure gauge tappings on water inlets and outlets.

2.5 DOMESTIC HOT WATER STORAGE TANKS

.1 Tank: Welded steel, ASME labelled for working pressure of 870 kPa steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.

.2 Lining: Glass lining continued into flanged connections to ASHRAE 90.1.

.3 Openings: Up to 75 mm copper-silicone threaded; over 100 mm flanged; flanged collar for heat exchanger; manway fitting.

.4 Accessories: Tank drain, water inlet and outlet, thermometer range of 4 to 93°C ASME pressure relief valve suitable for maximum working pressure.

2.6 DIAPHRAGM-TYPE COMPRESSION TANKS

.1 Construction: Welded steel, tested and stamped to Section 8D of ASME Code; supplied with National Board Form U-1, rated for working pressure of 860 kPa with flexible EPDM diaphragm sealed into tank, and steel legs or saddles, complete with IAPMO certification for potable water use.

.2 Accessories: Pressure gauge and air-charging fitting, tank drain; pre-charge to 80 kPa provide floor stand with clamps for vertical tanks or saddle and rack for horizontal tanks.

2.7 DHW RECIRC AUTOMATIC FLOW VALVES

.1 Domestic hot water recirculation valves shall be pressure independent constant flow, factory set, stainless steel. Standard of acceptance: Griswold standard flow cartridge.

.2 Select valves flow settings for minimum flow required to maintain warm water throughout the system and size the recirculation piping and pump accordingly.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install water heaters to manufacturer's instructions and to AGA/CGA, NSF, NFPA 54, ULC requirements, including seismic restraints.

.2 Coordinate with plumbing piping and related fuel piping, gas venting, and electrical work to achieve operating system. Note all pumps to be complete with “quick-connect” electrical connection for maintenance purposes.

.3 Domestic Water Heat Exchangers:

.1 Install shell and tube type domestic water heat exchangers with clearance for tube bundle removal without disturbing other installed equipment or piping.

.2 Support unit on secured floor stand posts with seismic restraint straps/braces.

.3 Pipe relief valves and drains to nearest floor drain.

.4 Pitch shell for condensate drain to traps.

.5 Brazed plate type heat exchangers may be used, along with easily removable pipe fittings and isolation for servicing and replacement.

.4 Domestic Hot Water Storage Tanks:

.1 Provide steel pipe support, independent of building structural framing members.

.2 Clean and flush after installation. Seal until pipe connections are made.

3.2 DHW RECIRCULATION

.1 Provide sufficient balancing valves to ensure adequate flow through each domestic hot water recirculation branch to maintain hot water. Design the DHW Recirculation system such that there is a maximum 10 second wait time for hot water at any/all faucets and fixtures.

.2 DHW recirculation pump controls on the DDC with return water temperature sensor point. Consider occupancy based or demand-based recirculation pump control so pump runs only from demand and/or from end of line temperature sensor.

END OF SECTION

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

.1 Coordinate with BCIT Building Operations for appropriate fixture applications.

.2 Consultants must propose fixture types very early in the design process to enable them to be tested on campus.

.3 BCIT requires all projects to comply with and achieve LEED Gold level of certification. All plumbing fixtures and trim shall be selected for highest performance with lowest practical water flow.

1.2 REFERENCES

.1 ANSI Z358.1-2014 Emergency Eye Wash and Shower Equipment.

.2 ARI 1010-94 [Withdrawn] Self-Contained Mechanically Refrigerated Drinking Water Coolers. [Delete this standard : See 2.1.2]

.3 ASME A112.6.1M-1997 (R2012) Supports for Off-the-Floor Plumbing Fixtures for Public Use.

.4 ASME A112.18.1-2012/CSA B125.1-12 Plumbing Supply Fittings.

.5 ASME A112.19.1-2013/CSA B45.2-13 Enameled Cast Iron and Enameled Steel Plumbing Fixtures.

.6 ASME A112.19.2-2013/CSA B45.1-13 Ceramic Plumbing Fixtures, Includes Update No. 1 (2013).

.7 ASME A112.19.3-2008/CSA B45.4.08(R2013) Stainless steel plumbing fixtures, Includes Updates No. 1 and No. 2.

.8 ASME A112.19.4M-1994(R2009) Porcelain Enameled Formed Steel Plumbing Fixtures.

.9 ASME A112.19.5-2011/CSA B45.15-11 Flush Valves and Spuds for Water Closets, Urinals, and Tanks, Includes Update No. 1.

.10 British Columbia Building Code, 2012 Edition (BCBC).

.11 British Columbia Plumbing Code, [Add this standard]

.12 CSA and ULC Standards.

.13 NFPA (Fire) 70 National Electrical Code (NEC), 2014 Edition.

1.3 DESIGN REQUIREMENTS

.1 Supply two (2) sets of faucet washers, two (2) aerators for kitchen sinks, one (1) flush valve service kit, two (2) lavatory aerators, one (1) spare shower head for each different type of fixture.

.2 All water closets in public areas shall be floor-mounted and have open front seats. All urinals shall be wall-hung.

.3 Confirm water closet selection with Consultant and BCIT at Schematic Design Stage to establish wall or floor mounted, to determine wall thickness and access.

.4 Hard-wired, 'No-touch' motion detector-activated plumbing fixtures and accessories are preferred for faucets, urinals, water closets and are to be considered for paper towel, hand dryer and soap dispensers.

.5 Specify water conserving type of fixtures and trim.

.6 Depending on water supply pipe size, design and hot water temperature, consider low flow faucets with anti-scald devices.

.7 Drinking Water Fountains:

.1 All buildings over 600 gross square meters shall have at least one (1) accessible drinking water fountain, located in a public area. Drinking fountain must include an appropriate fixture for filling water bottles.

.2 New buildings: Locate drinking water fountains inside buildings at Level 1 entrance lobbies visible from the exterior. On multi-floor buildings, locate a drinking fountain/water bottle filling station at the same location on each floor, generally just outside a main public washroom group.

.1 Install drinking water fountains on the shortest dead leg possible off of a line that is flowing regularly. This line would preferably be serving a washroom.

.8 Plumbing Fixtures:

.1 All plumbing fixtures and trim used in handicapped accessible locations shall comply with British Columbia Building Code, latest edition.

.2 Selection of Flush toilets: Flushing efficiency to a Maximum Performance (MaP) rating of ≥ 1000 g/flush is recommended. Refer to MaP searchable database for further instruction: http://www.map-testing.com/.

.3 Installation of low-flush/high efficiency toilets with extremely long drainage distances may require evaluation on a site-by site basis, especially if no supplemental flows (e.g., from showers or baths) are available.

.4 All fixtures within the building shall be generally and where possible be of the same manufacturer.

.5 Specify make of fixtures with manufacturers' local representation.

.9 Controls:

.1 Use building power for hands free controls, where provided use standby power for the building.

.2 Where automatic recharging is included in the fixture, battery-powered units are acceptable. Acceptable product: Toto Ecoflush or approved alternative.

1.4 SUBMITTALS

.1 Submit in accordance with Section 01 33 00 Submittal Procedures.

.2 Product Data: Provide catalogue illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

.3 Shop Drawings: Provide clear water consumption data and LEED Water Efficiency Credit compliance on Shop Drawings.

.4 Maintenance Data: Include fixture trim exploded view and replacement parts lists.

.5 Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three (3) years documented experience.

.2 All fixtures and trim shall be CSA approved.

.3 All plumbing fixtures and trim used in handicapped accessible locations shall comply with the British Columbia Building Code, Latest Edition.

.4 Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. ULC and CSA, or a testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated.

.5 Emergency showers and eye wash stations shall meet ANSI Z358.1 Standards, latest Edition.

PART 2 - PRODUCTS

2.1 PROHIBITED MATERIALS AND PRACTICES

.1 Waterless Urinals and Dual Flush Toilets:

.1 Do not use waterless urinals.

.2 Dual flush toilets may be used for private Staff washroom installations only, where there is no student or public access. Do not use for public washrooms.

.2 Do not mechanically cool drinking water fountains (no refrigerated units).

.3 Do not provide filters for drinking water fountains (no backflow preventers required).

2.2 PLUMBING FIXTURES

.1 Emergency Showers and Eye Wash Stations:

.1 Provide eyewash and emergency showers in accordance with WorkSafe BC requirements.

.2 Water: Tempered, not to exceed 25°C, or be lower than 20°C.

.3 Hand controlled valves: Type: ‘stay open’.

.4 Provide a plumbed in floor drain complete with trap primers for each shower and station.

.5 Floor surfaces shall slope to drain.

.6 Where an eye-wash station is adjacent to a sink, the sink drain may be used for the eye-wash drain.

.7 Specify eye wash stations as eye wash only, not face and eye wash combination.

.8 Ensure isolating valves are not readily accessible to user.

.2 Drinking Water Fountains and Bottle Filling Stations:

.1 Acceptable Manufacturers:

.1 Franke.

.2 Bobrick.

.3 Or approved alternative.

2.3 LABORATORY PLUMBING FIXTURES

.1 Laboratory Plumbing Fixtures:

.1 Renovations: Where only a few fixtures are required, check for possible matching trim in BCIT Plumbing Shop’s stock.

.1 Where no stock is available, evaluate relative corrosion potential for the installation. Select trim to match the existing with chrome finish.

.2 Where corrosion potential is high, acceptable product is WaterSaver with suitable finish.

.2 Trim for sinks:

.1 Typically hot and cold gooseneck type with type handles.

.2 Where ADA trim: Complete with blade handles, vacuum breaker and tapered, barbed nozzles, or aerator type outlets for wash-up sinks.

.3 Compressed Air Aspiration: Check with BCIT Facilities Management for consideration.

.4 Where sinks require distilled/de-ionised water outlets, provide gooseneck type.

.3 Laboratory sinks:

.1 Typically 316 stainless steel with counter-top flange. Review with BCIT Facilities Management for specific applications.

.2 No ledge-back or cross strainer outlet.

.3 Under counter mount is acceptable in consultation with Consultant.

.4 Acceptable product: Aristaline.

.5 Acceptable manufacturers:

.1 Architectural Metal Industries

.2 Franke

.3 Steel Queen.

2.4 FIXTURE WATER EFFICIENCY REQUIREMENTS

Fixture	Requirement (Maximum Volume or Flow Rate)	Comparative Notes
Toilets	6 litres/flush (non-residential). 4.8 litres/flush average high efficiency or dual flush	▪ Equivalent to existing BC Building Code.
Urinals	0.5 litres/flush	▪ Less than BC Building Code requirement of 1.9 lpf
Shower Head	5.7 litres/minute	▪ BC Building Code is 9.5 litres/minute ▪ Equivalent to LEED 2009 prerequisite ▪ UBC REAP 3.0* credit is 5.6 litres/minute
Kitchen Faucet	5.7 litres/minute	▪ BC Building Code is 8.3 litres/minute ▪ UBC REAP 3.0* prerequisite is 6.8 ▪ Kitchen faucets usually need higher flow than lavatories for good user experience.

Fixture	Requirement (Maximum Volume or Flow Rate)	Comparative Notes
Lavatory Faucet – non sensor/ metering	5.6 litres/minute	▪ BC Building Code is 8.3 litres/minute ▪ UBC REAP 3.0* prerequisite is 3.8 litres/minute ▪ Lavatory faucets do not require flows as high kitchen as faucets for good user experience.
Lavatory Faucet - sensor/metering	1.9 litres/minute or 0.5 litres/cycle	▪ Equivalent to LEED 2009 prerequisite

*Proposed in UBC REAP 3.0 as of February 2014

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that walls and floor finishes are prepared and ready for installation of fixtures.

.2 Verify that electric power is available and of the correct characteristics.

.3 Prior to rough-in and installation, confirm location and size of fixtures and openings.

3.2 PREPARATION

.1 Review millwork Shop Drawings.

.2 Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

.3 Rough-in fixture piping connections to minimum sizes indicated in fixture rough-in schedule.

3.3 INSTALLATION

.1 Install each fixture with trap, easily removable for servicing and cleaning.

.2 Provide chrome plated rigid or flexible supplies to fixtures with Dahl Mini-Ball stops, reducers, and escutcheons.

.3 Install components level and plumb.

.4 Install and secure wall mounted fixtures in place with wall supports, wall carriers and bolts.

.5 Seal fixtures to wall and floor surfaces with silicone sealant, colour to match fixture.

.6 Solidly attach water closets to floor with lag screws or brass anchor bolts. Lead flashing is not intended to hold fixture in place.

.7 Floor mounted plumbing fixtures: Provide cast brass or cast iron floor flanges.

.8 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

.9 Install ADA plumbing fixtures to British Columbia Building Code.

3.4 CLOSEOUT AND CLEANING

.1 Do not permit use of fixtures until BCIT has accepted Occupancy.

.2 Clean plumbing fixtures and equipment.

END OF SECTION