Part 1 General

1.1 Related Sections

.1 Section 22.

1.2 Submittals

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings; submit drawings stamped and signed by professional engineer registered or licensed in Province where the work is taking place.

.3 Shop drawings to show:

- .1 Mounting arrangements.
- .2 Operating and maintenance clearances.

.4 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.

.5 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

.6 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 Operation data to include:
  - .1 Control schematics for systems including environmental controls.
  - .2 Description of systems and their controls.
  - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for systems and component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
  - .7 Colour coding chart.
- .4 Maintenance data to include:
  - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Approvals:

.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Maintain neat records of changes on a set of prints during construction.

.2 Submit to Departmental Representative minimum five (5) working days before Substantial Completion.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.5 Contractor shall certify and check the accuracy of each drawing.

.6 Record additional changes and submit final record drawings at Total Performance.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 Quality Assurance

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 Maintenance

.1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:

.1 One glass for each gauge glass.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.5 Delivery, Storage, And Handling

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 Materials

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

Part 3 Execution

3.1 Painting Repairs And Restoration

.1 Do painting in accordance with Section 09 91 23 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

3.2 Cleaning

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 Field Quality Control

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

.1 Testing to be witness by Authority Having Jurisdiction.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 Demonstration

.1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Departmental Representative will record these demonstrations on video tape for future reference.

3.5 Protection

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

END OF SECTION

Part 1 General

1.1 Summary

.1 Section includes:

.1 Material and installation of pipe work in general.

1.2 References

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B24, Cast Copper Alloy Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B39, Malleable Iron Threaded Pipe Unions.

.3 ANSI/ASME B42, Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.

.2 American Society for Testing and Materials (ASTM)

.3 American Society of Mechanical Engineers (ASME)

.1 ASME B31.9 – Building Services Piping.

.4 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.

Part 2 Products

2.1 General

.1 Installations shall include all devices, attachments, equipment, components and piping necessary to form a complete working system to code requirements.

2.2 Valves

.1 Refer to the specific pipe specification sections for valve types.

.2 All valves of one type (e.g. gate valves) must be of one manufacturer. Ensure that working pressure, size and manufacturer's name are cast or stamped into the body of each valve.

.3 Use O. S. & Y. design on all valves 100 mm and larger unless specifically noted otherwise.

.4 Provide hand wheels on valves 75mm and larger accessible for operation.

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2.3 Strainers

.1 Provide Y-type strainers where, indicated on the drawings and where specified herein, in piping system, full size of the connected piping ahead of each pump, control valve, meter, etc. Install bucket or basket strainers only where indicated on the drawings.

.2 All strainers shall have the same end connections and working pressure as the attached piping is specified.

.3 Use monel screens with a reinforced edge. Perforations shall be 0.8 mm for water and 3.2 mm ahead of pumps.

.4 Provide 20 mm blow-off lines with ball valves, piped directly to drain on all strainers over 50 mm.

2.4 Dielectric Pipe Fittings /Unions

.1 Dielectric fittings factory certified to withstand a minimum of 600 volts on a dry line with no flashover. Unions rated at 1.7 MPa conforming to ANSI B16.39. Flanged fittings rated at 1.2 MPa conforming to ANSI B16.24 (bronze) and B16.42 (iron).

2.5 Pipe Sleeves And Seals

.1 Where piping penetrates below grade walls or floors:

.1 Seal: modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening complete with 316 stainless steel fasteners. Seal elements shall be sized and selected per manufacturer's recommendations and be suitable for the required fire-resistance rating and anticipated environmental conditions.

.2 Sleeve: custom-sized molded HDPE sleeves matched to the mechanical seal dimensions complete with reinforcing ribs, end caps, and integrally formed hollow water stop having a minimum outside diameter 100 mm larger than the diameter of the sleeve itself and allowing 13 mm movement between wall forms to resist pour forces.

.2 Elsewhere: Schedule 40 black steel pipe sleeve.

.3 All sleeves and floor penetrations to be water-tight.

Part 3 Execution

3.1 Connections To Equipment

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Provide valves and either unions, flanges or grooved joint couplings to isolate equipment and allow removal without interrupting operation of other equipment or systems.

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.3 Use double swing joints when equipment mounted on vibration isolation and when piping is subject to movement.

3.2 Clearances

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, and components.

3.3 Drains

.1 Arrange pipe and fittings to ensure complete drainage.

.2 Install drain valve at low points in piping systems, at equipment and at sectional/floor isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Provide air vents as required to assist in draining the piping.

.5 Drain valves: Ball valves unless otherwise approved, NPS 3/4 minimum. Provide hose end male thread, cap and chain where not piped to drain.

3.4 Dielectric Couplings

.1 General: Compatible with system, to suit pressure rating of system.

.2 Locations: Where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: Isolating flanges.

.5 Rated to 150C.

3.5 Pipework Installation

.1 Install exposed piping, equipment, rectangular cleanouts and similar items approximately as shown, parallel or perpendicular to building lines and as close to the structure as possible.

.2 Conceal all piping except where otherwise approved. Install concealed piping to minimize furring space, maximize headroom, and conserve space.

.3 Exposed piping must be carefully installed to be pleasing to the eye and meet the Departmental Representative requirements.

.4 Install all pipe mounted control devices, such as control valves and wells.

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.5 Assemble piping using fittings manufactured to ANSI standards.

.6 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

.7 Use only eccentric reducing fittings at pipe size changes, installed with the piping in line at the top to ensure positive drainage and venting.

.8 Use only long radius welding or soldered fittings in expansion loops, not screwed fittings.

.9 American National Taper pipe thread must be used for all thread connections. Remove burrs and chips and ream or file the pipe ends out to size of bore.

.10 Leave not more than 2 threads exposed on threaded joints when made up.

.11 Screwed fittings jointed with Teflon tape.

.12 Do not use:

.1 close nipples.
.2 threaded protectors as couplings.
.3 direct welded or screwed connections to valves, equipment or other apparatus.

.13 Protect openings against entry of foreign material.

.14 Ream pipes, remove scale and other foreign material before assembly.

.15 Slope piping for positive drainage and venting.

.16 Arrange piping to permit flushing.

.17 Group piping, wherever possible.

.18 Provide anchors and sway braces to Departmental Representative approval.

.19 Provide for thermal expansion.

.20 Provide for movement due to seismic events as required by the NBC.

3.6 Expansion Of Piping

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to the building and equipment. Where pipe runs past building expansion joints, provide expansion compensation.

.2 Only major expansion configurations and fittings have been detailed on the drawings. Provide all required additional compensators, loops and swing connections as specified herein, and in accordance with good trade practice.

.3 Use swing connections with a minimum of 3 elbows (i.e. four fittings including the tee) where required. These swing connections are not always shown on the piping drawings for reasons of clarity; they must however, be installed. Where close tolerances do not permit the installation of a complete swing connection, consult the Engineer prior to the closing of tender.

.4 Install expansion loops cold spring 50 percent of the calculated expansion.

.5 Schedule for Expansion Loops:

.1 Maximum Distance between Anchors:

.1 Domestic Hot Water; copper 30 m, steel 45 m.

.2 Loop Size Required:

Pipe Size NPS	Loop Size (m)
3/4	1.22
1	1.27
1-1/4	1.32
1-1/2	1.37
2	1.42
2-1/2	1.53
3	1.68
4	1.98

.6 If the length between anchors is 50% of the maximum listed above, then the loop can be reduced to 67% of that listed.

.7 Loops shall be located midway between guides.

3.7 Pipe Guides

.1 Provide alignment guides where required for proper operation of the system.

3.8 Pipe Anchors

.1 Provide substantial pipe anchors. Anchors shall be suitably attached to the structure and the pipe to prevent movement.

3.9 Pipe Sleeves And Seals

.1 General: Install where pipes pass through masonry structures, concrete structures, beams, fire rated assemblies, and elsewhere as indicated. Be responsible for maintaining the integrity of the building envelope when making penetrations. Enlist the services of qualified trade(s) to make openings in, and/or repairs to, building envelope.

.2 Sleeve Sizes:

.1 Walls and beams: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.2 Floors: 20 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

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.3 Sleeve Installation:

.1 Concrete walls, masonry walls, beams, and concrete floors on grade: Terminate flush with finished surface.

.2 Other floors:

.1 Terminate 50 mm above finished floor.

.2 Adjust as necessary to accommodate the requirements of through-penetration fire-stopping systems.

.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.4 Sealing:

.1 Foundation walls and below grade floors: Fire retardant, waterproof, modular mechanical seal.

.2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.

.3 Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

.4 Ensure no contact between copper pipe or tube and sleeve.

3.10 Escutcheons

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

.2 Construction: One piece type with set screws. Chrome or nickel plated brass or stainless steel.

.3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.11 Preparation For Firestopping

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Firestopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.12 Flushing Out Of Piping Systems

.1 In accordance as specified in relevant sections of Division 22.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning supplemented as specified in relevant sections of Division 22.

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.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.13 Pressure Testing Of Equipment And Pipework

.1 Advise Departmental Representative 48-hours minimum prior to performance of pressure tests.

.2 Pipework: Test as specified in relevant sections of Division 22 where specified, otherwise test to requirements of ASME B31.9.

.3 Test all piping, with the exception of atmospheric vents and sanitary piping, hydraulically to 1½ times the operating pressure but not less than 860 kPag.

.4 Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

.2 Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

.3 Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10 ft WC). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.4 Prepare reports for tests and required corrective action.

.5 Prove piping with less than 14 kPa pressure drop and no visible leakages for a period of 24 hours with a hydraulic test.

.6 Test all sanitary piping in accordance with the applicable Plumbing code.

.7 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or test media.

.8 Conduct tests in presence of Departmental Representative.

.9 Pay costs for testing, repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.10 Insulate or conceal work only after approval and certification of tests by Departmental Representative. Test underground piping prior to backfilling.

END OF SECTION

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Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plumbing pumps.

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Coordinate submittal requirements and provide submittals required by Section 01 47 15 - Sustainable Requirements: Construction.

.3 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.

.2 Submit WHMIS MSDS in accordance with Section 01 47 15 - Sustainable Requirements: Construction and Section 02 81 01 - Hazardous Materials. Indicate VOC's for adhesive and solvents during application and curing.

.4 Shop Drawings.

.1 Submit shop drawings to indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.

.2 Wiring and schematic diagrams.

.3 Dimensions and recommended installation.

.4 Pump performance and efficiency curves.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturers' Field Reports: manufacturers' field reports specified.

.8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:

.1 Manufacturers name, type, model year, capacity and serial number.

.2 Details of operation, servicing and maintenance.

.3 Recommended spare parts list with names and addresses.

1.4 QUALITY ASSURANCE

.1 Pre-Installation Meeting:.

.1 Convene pre-installation meeting one week prior to beginning work of this Section on-site installations in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM) Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart.

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Construction requirements: in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.4 Verification: contractor's verification in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Store and manage hazardous materials in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

.2 Waste Management and Disposal:

.1 Separate waste materials for reuse recycling in accordance with Section01 47 19 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.5 Unused sealant materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.6 Fold up metal, plastic, banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

.1 Materials and resources in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 DRAIN PUMP

.1 Refer to Plumbing Fixture Schedules for type and capacity.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Make piping and electrical connections to pump and motor assembly and controls as indicated.

.2 Ensure pump and motor assembly do not support piping.

3.3 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Check power supply.

.2 Check starter protective devices.

.2 Start-up, check for proper and safe operation.

.3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

.4 Adjust flow from water-cooled bearings.

.5 Adjust impeller shaft stuffing boxes, packing glands.

.6 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification, include:

.1 Materials and resources.

.2 Storage and collection of recyclables.

.3 Construction waste management.

.4 Resource reuse.

.5 Recycled content.

.6 Local/regional materials.

.7 Certified wood.

.8 Low-emitting materials.

3.4 START-UP

.1 General:

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: General Requirements, supplemented as specified herein.

.2 Procedures:

.1 Check power supply.

.2 Check starter O/L heater sizes.

.3 Start pumps, check impeller rotation.

.4 Check for safe and proper operation.

.5 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.

.6 Test operation of hands-on-auto switch.

.7 Test operation of alternator.

.8 Adjust leakage through water-cooled bearings.

.9 Adjust shaft stuffing boxes.

.10 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.

.11 Check base for free-floating, no obstructions under base.

.12 Run-in pumps for 12 continuous hours.

.13 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.

.14 Adjust alignment of piping and conduit to ensure full flexibility.

.15 Eliminate causes of cavitation, flashing, air entrainment.

.16 Measure pressure drop across strainer when clean and with flow rates as finally set.

.17 Replace seals if pump used to degrease system or if pump used for temporary heat.

.18 Verify lubricating oil levels.

3.5 PV – SANITARY PUMP

.1 Application tolerances:

.1 Flow: plus 10%; minus 0%.

.2 Pressure: plus 10%; Minus 5%.

.2 PV Procedures:

.1 Fill sump at rate slower than capacity of pump.

.2 Record levels of starts and stops. Determine flow rate by observing time taken to down water level.

.3 Fill sump at rate faster than capacity of pump.

.4 Record levels of start and stop - water level rising and water level falling.

.5 Verify operation of alternator.

.6 Adjust water level controls as necessary.

.7 Check operation of alternator.

.8 Adjust level controls as necessary.

.9 Check level at which high water level alarm starts and stops. Adjust as necessary.

.3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.

.4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

3.6 REPORTS

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: reports, supplemented as specified.

.2 Include:

.1 PV results on approved PV Report Forms.

.2 Product Information report forms.

.3 Pump performance curves (family of curves) with final point of actual performance.

3.7 TRAINING

.1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O M Personnel, supplemented as specified.

END OF SECTION

Part 1 General

1.1 Summary

.1 Section Includes:

.1 Materials and installation of metallic drainage waste and vent piping.

1.2 References

.1 American Society for Testing and Materials International, (ASTM).

.1 ASTM B32, Specification for Solder Metal.
.2 ASTM B306, Specification for Copper Drainage Tube (DWV).
.3 ASTM/ASME B16.29, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings – DWV.
.4 ASTM B 813, Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
.5 ASTM B 828, Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

.2 American Society of Mechanical Engineers (ASME)

.1 ASME B16.23, Cast Copper Alloy Solder Joint Drainage Fittings: DWV

.3 Canadian Standards Association (CSA International).

.1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
.2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
.3 CAN/CSA-B125, Plumbing Fittings.
.4 CAN/CSA-B602, Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer.

1.3 Shop Drawings And Product Data

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 Copper Tube And Fittings

.1 Above ground sanitary, and vent: Type DWV to ASTM B306.

.1 Fittings.
.1 Cast brass: to ASME B16.23.

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.2 Wrought copper: to ASTM/ASME B16.29.

.2 Solder and flux: to ASTM B32, ASTM B 813, ASTM B 828.

2.2 Cast Iron Piping And Fittings

.1 Above ground sanitary and vent: to CAN/CSA-B70.

.1 Joints.

.1 Mechanical joints to: CAN/CSA-B602.

.2 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.

.3 Stainless steel clamps.

2.3 Polyvinyl Chloride (Pvc) Sdr Series

.1 Manufactured from Type I, Grade I PVC compound with a Cell Classification of 12454 per ASTM D1784. Pipe shall be manufactured in strict compliance to ASTM D2241.

.2 Buried sanitary and vent to: CSA-B181.1, CSA-B181.2, CSA-B182.1.

.1 Joints

.1 Solvent weld for PVC: to ASTM D2564.

Part 3 Execution

3.1 Buried Pipe

.1 Install as follows, unless otherwise recommended by the manufacturer or directed by Departmental Representative:

.1 Provide 150 mm sand bedding below pipe and 150mm of sand over pipe for initial backfill.

.2 Balance of fill and amount of compaction to be the same as specified for the slab above.

.3 For sizes under 150 mm minimum grade to be 2%.

3.2 Testing

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

.3 Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

.2 Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

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.3 Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 30 kPa (10-ft WC). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

.4 Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 250 Pa (1-in wg). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

.5 Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.6 Prepare reports for tests and required corrective action.

.4 Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

.1 Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

.2 Cap and subject piping to static-water pressure of 345 kPa (50 psig) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

.3 Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

.4 Prepare reports for tests and required corrective action.

END OF SECTION

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Part 1 General

1.1 Related Requirements

.1 Section 22.

1.2 References

.1 ASTM International Inc.

.1 ASTM D2235, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

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

.2 Canadian Standards Association (CSA International) CAN/CSA-Series B1800, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.

.3 Green Seal Environmental Standards (GSES)

.1 Standard GS-36, Commercial Adhesives.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 South Coast Air Quality Management District (SCAQMD), California State

.1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

1.3 Action And Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for piping and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements

1.4 Delivery, Storage And Handling

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Store at temperatures and conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 Material

.1 Sustainable Requirements: materials and products in accordance with Section 01 47 15 Sustainable Requirements: Construction.

.2 Adhesives and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

2.2 Piping And Fittings

.1 For buried and/or above ground DWV piping to:

.1 CAN/CSA B1800.

2.3 Joints

.1 Solvent weld for PVC: to ASTM D2564.

.2 Solvent weld for ABS: to ASTM D2235.

Part 3 Execution

3.1 Application

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Installation

.1 In accordance with Section 23 05 05 - Installation of Pipework.

.2 Install in accordance with National Plumbing Code, and authority having jurisdiction.

3.3 Testing

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades/slopes and freedom from obstructions.

3.4 Performance Verification

.1 Cleanouts:

.1 Ensure accessible and that access doors are correctly located.

.2 Open, cover with linseed oil and re-seal.

.3 Verify cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (sanitary, vent, pump discharge) c/w directional arrows every floor or 4.5 m (whichever is less).

3.5 Cleaning

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.

END OF SECTION

Part 1 General

1.1 References

.1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)

.1 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.

.2 Canadian Standards Association (CSA International)

.1 CSA B51-03(R2007), Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CAN/CSA C22.2 No.110-94(R2004), Construction and Test of Electric Storage Tank Water Heaters.

1.2 Action And Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for domestic water heater, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Provide drawings stamped and signed by professional engineer registered or licensed in Territory where work is taking place.

.2 Indicate:

.1 Equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

1.3 Closeout Submittals

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 1 78 00 - Closeout Submittals.

1.4 Delivery, Storage And Handling

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 Warranty

.1 For the Work of this Section 22 30 05 - Domestic Water Heaters, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

.2 Contractor hereby warrants domestic water heaters in accordance with CCDC2, but for number of years specified for each product.

Part 2 Products

2.1 Components

.1 Sustainable Requirements:

.1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 Electric Water Heater

.1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 with screw-in type elements, 3000W, and surface mounted type adjustable thermostats.

.2 Tank: 22.7 L, polymerized fluorocarbon lined steel, 400mm diameter x 387mm high, 50mm mineral wool or rigid polyurethane insulation, enamelled steel jacket, 3 year warranty certificate.

2.3 Trim And Instrumentation

.1 Drain valve: NPS 1 with hose end.

.2 Thermometer: 100 mm dial type with red pointer and thermowell filled with conductive paste.

.3 Pressure gauge: 75 mm dial type with red pointer, syphon, and shut-off cock.

.4 Thermowell filled with conductive paste for control valve temperature sensor.

.5 ASME rated temperature and pressure relief valve sized for full capacity of heater control valve, having discharge terminating over floor drain or drain pan and visible to operators.

.6 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

2.4 Anchor Bolts And Templates

.1 Supply anchor bolts and templates for installation in structural steel support in accordance with Section 05 50 00 - Metal fabrications.

Part 3 Execution

3.1 Application

.1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Installation

.1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.

.2 Provide structural steel and drain pan for under-counter mounted tanks.

.3 Provide insulation between tank and supports.

3.3 Field Quality Control

.1 Manufacturer's factory trained, certified Engineer to start up and commission DHW heaters.

3.4 Cleaning

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 Summary

.1 Section Includes:

.1 The supply and installation of plumbing fixtures and trim.

1.2 References

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series, Plumbing Fixtures.
.2 CAN/CSA-B125 Series, Plumbing Fittings.
.3 CAN/CSA-B651, Barrier-Free Design.

1.3 Shop Drawings And Product Data

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to the Departmental Representative a complete brochure of all the new fixtures and accessories for review before placing a firm order.

.3 Confirm styles, space, and quantities with Architectural drawings before submission.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 Manufactured Units

.1 Fixtures:

.1 Manufacture in accordance with CAN/CSA-B45 series.
.2 Confirm colour with Departmental Representative.
.3 Free of discoloration and flaws.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 All exposed plumbing brass, metal supplies, traps, escutcheons, pipes, valves, fittings, etc. shall be chrome plated.

.4 Number, types, locations: architectural drawings to govern.

.5 Fixtures in any one location to be product of one manufacturer and of same type.

.6 Trim in any one location to be product of one manufacturer and of same type.

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.7 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Chrome plated rigid supply pipes each with screwdriver stop, reducers, and escutcheon.

.2 Waste:

.1 Brass P-trap with clean out on each fixture not having integral trap.

.8 Sealant: Colour- white, confirm with Departmental Representative.

2.2 Accessibility

.1 Refer to 22 05 02 Common Work Results for Plumbing.

Part 3 Execution

3.1 General

.1 Coordinate wall and floor construction to suit fixture layout.

.2 Provide all hangers, supports, brackets reinforcement, 1.9 mm steel backup plates, etc., for the proper installation and support of fixtures and their respective supply fittings.

.3 All connections shall be watertight, including supplies, traps, etc.

3.2 Installation

.1 The fixtures shall be set level and square with relation to interior finish, floor, and wall lines. Locate with equal spacing on both sides, unless specifically shown otherwise.

.2 Mounting heights:

.1 Standard: to comply with the manufacturer's recommendations unless otherwise indicated or specified.

.2 Physically handicapped: to comply with the most stringent of either NBCC or CAN/CSA B651.

.3 Chrome plated piping: use only strap wrenches on chrome plating piping and fittings. Replace any damaged by wrench marks. Joints to be threaded or slip union type.

.4 Fixtures shall be piped complete in a first class manner.

.5 Apply sealant to all joints where fixtures come in contact with floors, walls and/or counters. Joints shall be made watertight with a smooth bead of sealant applied in a neat, workmanlike manner.

.6 After installation, fixtures shall be protected from damage, dirt and paint. Replace damaged materials. Clean only with manufacturer approved non-abrasive cleansers.

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3.3 Adjusting

.1 Adjustments:

.1 Adjust water flow rate to design flow rates.
.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
.3 Adjust temperature limit and safety controls.
.4 Adjust brass for easy, drip-free operation.

.2 Checks:

.1 Aerators: operation, cleanliness.
.2 Strainers: cleanliness.
.3 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 Demonstration

.1 Demonstrate all special fixtures to the Owner, including operation and maintenance.

END OF SECTION

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Part 1 General

1.1 Summary

.1 Section Includes:

.1 Materials and installation for plumbing specialties and accessories.

1.2 References

.1 American Society for Testing and Materials International (ASTM).

.1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM A536, Specification for Ductile Iron Castings.

.3 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.2 American Water Works Association (AWWA).

.1 AWWA C116/A21.16, American National Standard for Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service.

.2 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.

.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.

.2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 Plumbing and Drainage Institute (PDI).

.1 PDI-WH 201, Water Hammer Arresters.

1.3 Submittals

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit following additional information:

.1 Submit a single set of shop drawing for all backflow prevention devices.

.2 Indicate the location and type of each backflow preventer.

1.4 Closeout Submittals

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

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Part 2 Products

2.1 Drain Pump

.1 Refer to plumbing fixture schedule.

2.2 Cleanouts

.1 Cleanouts:

.1 Walls: heavy lacquered cast iron body.

.2 Floors: heavy lacquered cast iron body with adjustable head suitable for recessed access cover, and neoprene gasket or inside caulk connection. Provide anchor flange with clamping collar for units located in waterproof floors.

.3 Plugs: tapered threaded bronze with raised head, gas- and water-tight seal.

.2 Access Covers:

.1 Walls: flush mounted, square, prime-coated, 1.9 mm thick steel construction with concealed hinge, door with rounded corners, and screwdriver-operated cam lock.

.2 Floors:

.1 Unfinished concrete: nickel bronze, heavy duty, round scoriated top with retaining screws.

.2 Tile: nickel bronze, square scoriated top with retaining screws.

.3 Sheet goods: nickel bronze, round scoriated top with retaining screws.

.4 Carpet: nickel bronze, round scoriated top with carpet marker and retaining screws.

2.3 Water Hammer Arresters

.1 Stainless steel construction, bellows type: tested and certified to PDI-WH 201.

2.4 Strainers

.1 860 kPa (125 psi) maximum working pressure, Y-type with 20 mesh, removable stainless steel screen.

.2 NPS 2 and under, bronze body, screwed ends, with brass cap.

.3 NPS 2-1/2 and over, cast iron body, flanged ends, with bolted cap.

Part 3 Execution

3.1 Cleanouts

.1 Size: line size up to NPS 4. Not less than NPS 4 on larger pipes.

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.2 Install cleanouts where easily utilized, at the base of soil and waste stacks, and rainwater leaders, at locations required by local code and authority having jurisdiction, and as indicated.

.3 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.4 In finished areas, ensure a neat installation level within the surrounding floor or wall. Beneath vanities located as high as permissible for good access and minimum visibility.

3.2 Water Hammer Arresters

.1 Provide water hammer arresters.

.1 On branch supplies to fixtures or group of fixtures.

.2 Where recommended by Plumbing and Drainage Institute Standard PDI-WH 201 "Water Hammer Arresters".

.3 Where indicated on the drawings.

.2 Size in conformance with Plumbing and Drainage Institute Standard PDI-WH 201 "Water Hammer Arresters".

3.3 Strainers

.1 Install with sufficient room to remove screen.

.2 Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

3.4 Testing And Adjusting

.1 Access doors:

.1 Verify size and location relative to items to be accessed.

.2 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.3 Water hammer arresters:

.1 Verify proper installation of correct type and size of water hammer arrester.

.4 Strainers:

.1 Clean out repeatedly until clear.

.2 Verify accessibility of cleanout plug and basket.

.3 Verify that cleanout plug does not leak.

END OF SECTION

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