

**Part 1 General**

**1. INTENT**

1. Provide complete, fully tested and operational mechanical systems to meet requirements described herein and in complete accord with applicable codes and ordinances. Include all costs to obtain all permits and to pay for all fees and charges, including inspection charges by the authorities that issue the permits. Coordinate all related inspections. Permits, fees and inspections including: plumbing and gas, and water treatment.
2. Contract documents of the Specifications and Drawings are generally diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.
3. Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents. Provide adequate access space for maintenance and service.
4. Install material and equipment generally in locations and routes shown, close to building structure with minimum interference with other services or free space. Remove and replace improperly installed equipment as determined by the Contract Administrator.
5. Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the City. Uncrate equipment, assemble, move in place and install complete; start-up and test. Refer to the City supplied equipment and equipment furnished by other divisions.

**2. WARRANTY**

1. Furnish a written guarantee stating that all Work executed in this Contract will be free from defective workmanship and materials for a period of one (1) year from the date of substantial performance of Work. The Contractor shall repair and replace any Work which fails or becomes defective during the term of the guarantee/warranty, providing the operating and maintenance instructions have been complied with. The period of guarantee specified shall not, in any way, supplant any other guarantees of a longer period provided by Manufacturers or as called for in the project documents.

**3. THE CITY REQUIREMENTS DURING WARRANTY**

1. Unless specified otherwise the City shall be responsible for all routine maintenance requirements as required in the manufacturer's instructions.

**4. RELATED REQUIREMENTS**

- |    |                        |                  |
|----|------------------------|------------------|
| 1. | General Requirements   | Division 01      |
| 2. | Submittal Procedures   | Section 01 33 00 |
| 3. | Temporary Utilities    | Section 01 51 00 |
| 4. | Execution Requirements | Section 01 73 00 |

**5. METRIC CONVERSION**

1. All units in this division are expressed in SI units. Soft metric conversions are used throughout.
2. Submit all shop drawings and maintenance manuals in SI units.
3. On all submittals use the same SI units as stated in the specification.
4. Equivalent Nominal Diameters of Pipes - Metric and Imperial
  - .1 Where pipes are specified with metric dimensions and only Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide adapters to ensure compatible connections to all metric sized fittings, equipment and piping.
  - .2 When CSA approved SI Metric pipes are available and are provided, the Contractor shall provide adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.
  - .3 Record accurately on "as-built" drawings the type of pipe (i.e., Metric or Imperial) installed.

**EQUIVALENT NOMINAL DIAMETERS OF PIPES**

mm	Inches	mm	Inches	mm	Inches
3	1/8	64	2-1/2	375	15
6	1/4	75	3	450	18
10	3/8	100	4	500	20
15	1/2	125	5	600	24
19	3/4	150	6	750	30
25	1	200	8		
30	1-1/4	250	10		
40	1-1/2	300	12		
50	2				

5. Metric Duct Sizes
  - .1 The metric duct sizes are expressed as 25 mm = 1 inch.

**6. COORDINATION OF WORK**

1. Cooperate and coordinate with other trades on the project.
2. Make reference to electrical, mechanical, structural and architectural drawings when setting out Work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Provide coordination drawings showing the Work of all trades

and Contractors involved, in areas of potential conflict or congestion, as requested by Contract Administrator at no additional cost.

3. Where dimensional details are required, Work with the applicable architectural and structural drawings.
4. Full size and detailed drawings shall take precedence over scale measurements from drawings.

## **7. CUTTING AND PATCHING**

1. Provide inserts, holes and sleeves, cutting and fitting required for mechanical Work. Relocate improperly located holes and sleeves.
2. Provide inserts or drill for expansion bolts, hanger rods, brackets, and supports.
3. Obtain written approval from Contract Administrator before drilling, coring, cutting or burning structural members. Ensure post tensioned or pre-stressed strands are located accurately and avoid with an adequate margin of safety.
4. Provide openings and holes required in precast concrete members for mechanical Work. Cast holes larger than 100 mm (4") in diameter. Field-cut holes smaller than 100 mm (4") if location is approved.
5. Patch and make good building where damaged from equipment installation, improperly located holes etc. Work to be performed by the trade or Contractor responsible for that type of Work.

## **8. ACCESS DOORS**

1. Provide access doors for maintenance or adjustment purposes for all mechanical system components including:
  - .1 Valves
  - .2 Volume and splitter dampers
  - .3 Fire dampers
  - .4 Cleanouts and traps
  - .5 Controls, coils and terminal units
  - .6 Expansion joints
  - .7 Filters
  - .8 Strainers
2. Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling

or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be UL-listed.

3. Sizes to be 200 mm x 200 mm for cleanout, 300 mm x 300 mm for hand 600 mm x 600 mm for body access minimum.
4. Provide ULC-listed fire rated access doors installed in rated wall and ceilings.

## **9. FIRE-STOPPING AND SEALING**

1. Fire-stop all pipe, duct, conduit and wire penetrations through floors and walls, designated as fire and/or smoke separations. The Contractor is required to coordinate with the architectural drawings to contractual rated wall types and installation details.

## **10. PIPE SLEEVES**

1. Pipe sleeves through exterior walls shall be of SCH 40 316L stainless steel pipe and shall be, unless detailed otherwise, one size larger than the penetrating pipe for 100 mm and larger pipe, and two sizes larger for pipe smaller than 100 mm.
2. Process pipes passing through concrete walls shall be SCH 40 316L stainless steel with a diameter equal to the process pipe. These sleeves shall be puddle flanged and be flanged for a bolted pipe connection each end as indicated on the Drawings.
3. Pipe sleeves shall have a 50 mm by 10 mm thick steel ring continuously welded all around the middle of the pipe length.
4. Special sleeves shall be as shown on the drawings.

## **11. PIPES THROUGH FLOORS AND WALLS**

1. Provide stainless steel pipe sleeves where pipes pass through floors and walls (PVC, tin, or blocked out sleeves are only acceptable where indicated on the drawing).
2. Install sleeves flush at walls and projecting at floors as detailed or 50 mm above floor surfaces and flush with bottom.
3. Provide continuously welded rings on pipes passing through walls below grade or where walls are watertight. The thrust/seepage rings shall be as detailed on the drawings.
4. Coat surfaces of stainless steel in contact with concrete with bitumastic.
5. Where electrical insulation from concrete rebar is required, use link seals with pipe sleeves where shown on drawings.
6. Where thrust restraint is required design according to AWWA Manual M11 or as detailed.
7. There shall be no direct contact between structural steel and stainless steel.

8. Seal space between sleeves and pipes with non-hardening mastic -Daraseal-A or approved alternative.

**12. EXCAVATION AND BACKFILL**

1. Prior to start of excavation check all service invert elevations and locations. Set grades to suit.
2. Provide all excavating to facilitate installation of the mechanical Work, including shoring, pumping, 150 mm (6”) compacted sand bedding under and first 300 mm (12”) of compacted sand over piping and ducting.

**13. CERTIFICATE OF SUBSTANTIAL PERFORMANCE**

1. Refer to General Conditions and Supplementary Conditions.
2. Prior to application for a "Certificate of Substantial Performance" of the Work, the Contractor shall certify the following in writing to the Contract Administrator:
  - .1 The systems are installed and suitable for operation for the purpose intended.
  - .2 All equipment within mechanical rooms is installed.
  - .3 All pumps and equipment are installed and electrical connections made.
  - .4 All Contractor system start-up and test sheets have been completed and submitted for review.
  - .5 All thermal insulation is installed.
  - .6 All static pressure tests are complete.
  - .7 All access doors are suitably located, and equipment easily accessible including plumbing cleanouts.
  - .8 All piping is installed, painted and clearly identified complete with flow arrows.
  - .9 Systems are chemically cleaned, flushed, and water treatment initiated.
  - .10 All equipment is checked for operation, alignment amperage draw and rotation.
  - .11 All equipment is lubricated as per manufacturer's data.
  - .12 All plumbing fixtures are installed, solidly supported and in operation. Domestic water lines are flushed and disinfected.
  - .13 All valves are tagged, terminal air boxes are identified and numbered, and all equipment identified. Painting of equipment is completed and escutcheons are installed.

- .14 All necessary tests and start-up procedures on equipment have been made, including those required by authorities.
- .15 Following information has been submitted:
  - .1 Final draft of O & M Manuals.
  - .2 Final certificates from authorities having jurisdiction.
  - .3 System cleaning reports.
  - .4 Completed record drawings.
- 3. Identify any systems which cannot be installed and/or placed in operation for reasons beyond the normal control of the Contractors and submit a statement of the value of the remaining Work required to complete the project.
- 4. Within ten (10) days of receipt of a written application for a "Certificate of Substantial Performance", the Contract Administrator shall visit the Site.
- 5. If, after the Contract Administrator's Site visit the application for a "Certificate of Substantial Performance" is not approved, the Contractor shall reapply in accordance with the Contract Administrator's Site visit report and pay for costs of re-inspection services.

#### **14. CERTIFICATE OF TOTAL PERFORMANCE**

- 1. Refer to General Conditions and Supplementary Conditions.
- 2. Prior to application for a statement of "Total Performance", the Contractor shall certify the following in writing to the Contract Administrator:
  - .1 All items noted in previous Site visit reports including that performed for Substantial Performance have been completed.
  - .2 Warranty forms are mailed to manufacturer. (Provide copy of original warranty for equipment which has a warranty period of longer than one year).
  - .3 Completed and accepted Operating and Maintenance (O & M) Manuals have been submitted to The City.
  - .4 The City has received instructions in the operation and maintenance of the system.
- 3. Within ten (10) days after receipt of a written application for a "Certificate of Total Performance", the Contract Administrator shall visit the Site.
- 4. The Contract Administrator shall provide one (1) visits for the purpose of reviewing the application for a "Certificate of Total Performance". Subsequent visit if required, shall be at the expense of the Contractor.

#### **15. SHOP DRAWINGS**

- 1. All shop drawing submittals shall be of one original copy (sepia if larger than 275 mm (11") x 425 mm (17")) and six (6) printed copies. Only the original shop drawing will be returned to the Contractor. Identify materials and equipment by manufacturer, trade

name, and model number. Include copies of applicable brochure or catalogue material. Do not assume applicable catalogues are available in the Contract Administrators office. Maintenance and operating manuals are not suitable submittal material. Space must be left on the shop drawing to accommodate the Engineer's review stamp. Where equipment is identified by name or number on the drawings or specification, clearly mark each shop drawing with the identical name and/or number.

2. Clearly mark each sheet of submittal material (using arrows, underlining, or circling) to show differences from what is specified, particularly sizes, types, model numbers, rating, capacities, and options actually being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pump seals, materials or painting.
3. Include dimensional and technical data sufficient to check if equipment meets requirements. Include wiring, piping, service connection data and motor sizes.
4. Prior to submission to the Contract Administrator, the Contractor shall review all shop drawings. By this review, the Contractor certifies that he has determined and verified all field measurements, field construction criteria, materials, catalogue numbers and similar data, and certifies that he has checked and coordinated each shop drawing with the requirements of the Work of the Contract documents. The Contractor's review of each shop drawing shall be indicated by stamp, date and signature of a responsible person.
5. Installed materials and equipment shall meet specified requirements regardless of whether or not shop drawings are reviewed by the Contract Administrator.

**Part 1      Execution**

Not Applicable.



3. For each individual sub-system include the following:
  - .1 System Description - Provide details of system type, composition, areas served, location in the building, design criteria and function of major components. All equipment arranged to operate together as one system shall be considered part of that system description. Design criteria shall, at minimum, include the following:
    - .1 Future load allowances
    - .2 Standby capabilities
    - .3 Calculated load and design capacity of domestic water supply mains.
    - .4 Calculated load and design capacity of drainage mains.
  - .2 System Schematic - Provide a system schematic showing all components comprising the domestic hot/cold/recirculation water systems
  - .3 Operating Instructions - Provide, in "operator" layman language, the specific instructions for start-up, shutdown and seasonal change over of each system component. Include exact type and specific location of each switch and device to be used in the system operation. Identify safety devices and interlocks that must be satisfied in order for the equipment to start. Also, list conditions to be fulfilled before attempting equipment start-up, i.e. valves position correct, glycol mixture concentration proper, piping filled with fluid, filters/strainers in place, etc.
  - .4 Maintenance Division
    - .1 Organize data into the following sections with divider tabs:
      - .1 Maintenance Tasks And Schedules
      - .2 Spare Parts
      - .3 Suppliers And Contractors
      - .4 Tags And Directories
    - .2 Maintenance Tasks and Schedules - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each system category. Summarize maintenance tasks from manufacturers maintenance brochures, for each component of each system in the following format:
      - .1 Daily
      - .2 Weekly
      - .3 Monthly
      - .4 Semiannually
      - .5 Annually
      - .6 When Required.
    - .3 Spare Part List - Organize data according to the system category, with further breakdown into individual systems as used in the operations division of the manual. Provide section index and divider tabs for each

system category. Summarize from manufacturers maintenance brochures the recommended spare parts for each component of each system.

- .4 Suppliers and Contractor List - Provide summary of Suppliers and Contractors for each components of each system. List name, address and telephone number of each.
- .5 Tags and Directories - Provide a copy of the Mechanical Drawing, List, Valve Tag List, Piping Identification Schedule and all other directories as specified in the Contract documents.
- .5 Contract Documentation Division
  - .1 Organize all data required by the construction Contract into sections, with divider tabs, as follows:
    - .1 Drawings List
    - .2 Shop Drawings and Product Data
    - .3 Certifications
    - .4 Warranties and Bonds
    - .5 Maintenance Brochures
    - .6 Reports
  - .2 Shop Drawings and Product Data - Provide final copies of all shop drawings and product data required by the Contract documents. Include section index and divider tabs. Maximum of twenty-five (25) sheets or one (1) system shop drawing per tab.
  - .3 Certifications - Provide copies of Contractor Certifications for the performance of product and systems. Include copies of all pressure tests for piping and ductwork systems, equipment alignment certificates, local authority inspection reviews, backflow prevention certification, and fire protection certifications. Include section index and divider tabs with maximum of twenty-five sheets (25) or one report per tab.
  - .4 Warranties and Bonds - Include one copy each of the Contractor's, warranty, manufacturers' warranties longer than one year, the bond, and any service contract provided by the Contractor. Provided section index.
  - .5 Maintenance Brochures - Include copies of all manufacturers' printed maintenance brochures pertaining to each product, equipment or system. provide section index and divider tabs. Maximum of twenty-five (25) sheets or one system brochure per tab.
  - .6 Reports - Include copies of all reports relating to the testing, adjusting and balancing of equipment and systems, water treatment reports and manufacturer's start-up reports, as required by the Contract specification sections.

.6 Submissions and Approvals

First Draft Submission

- .1 Contractor shall submit a draft copy of the operations and maintenance manuals for format review at the 50% construction completion stage.
- .2 The draft submission is to be bound in 3 ring loose leaf type binders and shall include the following information:
  - .1 A table of contents for the complete manual.
  - .2 Index of each division of the manual.
  - .3 Index of each section of the operations and maintenance divisions.
  - .4 A sample operations division write-up for a typical system, including sample schematic.
  - .5 A sample maintenance division write-up for the same typical system.
  - .6 Sample proof of binder covers and spines.
- .3 On completion of review of the first draft submission the Contract Administrator will return the copy of the manual with review comments for resubmission.

Provisional Edition

- .4 The Contractor shall submit two (2) copies of the provisional edition of the manual at the 75% construction completion stage.
- .5 The provisional edition shall be complete in all respects, except for reports and certificates to be produced during the facility start-up phase. This manual shall have the same physical format, including divider tabs and indices, as the final edition of the manual. This provisional edition may be bound in standard three-ring loose leaf binders.
- .6 One copy of the provisional edition shall be kept on Site as an interim reference for all parties engaged in the facility start-up phase, and shall be used to familiarize and train the operating staff.
- .7 The second copy shall be returned to the Contractor with review comments.
- .8 The Contractor shall update contents of the Site copy of the provisional edition manual as new information is generated during the facility start-up phase.

Final Edition

- .9 Prior to final acceptance the Contractor shall submit four (4) copies of the final edition of the manual.

- .10 This final edition shall include all outstanding project information and conform to all requirements listed in this document.

**22. RECORD DRAWINGS**

1. Refer to Section 01 77 00, Closeout Procedures.
2. The Contractor shall keep, on Site, available to the Contract Administrator at all times and particularly for each regularly scheduled Site meeting, a complete set of prints, edge bound, that are to be updated daily showing any and all deviations and changes from the Contract Drawings. This set of drawings is to be used only for this purpose, and must not be used as the daily general reference set.
3. Provide record drawings which identify location of smoke and fire dampers, major control lines, access doors, tagged valves, and actual room names or numbers. As well, deviations that are to be recorded shall include, in general, items that are significant or are hidden from view and items of major importance to future operations and maintenance, and to future alterations and additions including cleanouts and isolation valves.

**Part 3 Execution**

**23. GENERAL**

1. Submit documents to the Contract Administrator for approval prior to transmitting to the City.

**24. RECORD DRAWINGS**

1. Enter dimensions from building line to all buried services, including coordinates of manholes, catch basins, tanks, outside shut-off valves, and other similar elements.
2. Service connections to water and sewer lines entering a building shall be recorded as to horizontal dimension from a convenient building element with suitable depth elevations relating to main floor level and sea level datum.
3. Sewer and water lines which are placed beneath floor slabs shall be located such that each point of entry, change in direction, and irregularity is located by dimension from column grid lines on the record drawings. Depth below slabs shall be given.
4. At substantial completion, transfer all deviations, including those called up by addenda, revisions, clarifications, shop drawings, and change orders, to a set of disks to AutoCAD/Revit. Drafting quality layers, symbols, etc. shall be identical to original drawings. Prior to substantial performance, turn over a completed set of disks and a complete set of mylar sepia record drawings.
5. Each “record” drawing shall bear the Contractor’s identification, the date of record and the notation “We hereby certify that these drawings represent the “Work Record of Construction”. The Contractor’s signature and company seal shall be placed below that notation.

**Part 1 General**

**1.1 RELATED SECTIONS**

1. Entire Specification – All areas of common Work.

**1.2 REFERENCES**

1. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**1.3 GENERAL**

1. Provide valves of the same type by the same manufacturer throughout.
6. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.
7. All valves shall meet the requirements of the Manufacturers Standardization Society, Standard Practice standards, latest edition.
8. Ball valves to be ULC listed, MSS SP. 110 Standard.

**1.4 SUBMITTALS**

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

**1.5 QUALITY ASSURANCE**

2. Products shall be product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

**Part 2 Products**

**2.1 ACCEPTABLE MANUFACTURERS**

- .1 Valves: Jenkins, Crane, Toyo, Kitz, Dahl, Mueller SPX, Victaulic, RWV, Val-Matic, APCO, Stream Flo, DeZURIK, FNW, MAS, Hammond.
- .2 Balancing Valves: Armstrong CBV, Taco, Bell and Gossett.
- .3 Strainers: Jenkins, Crane, Kitz, Mueller SPX, Victaulic

**2.2 DOMESTIC COLD WATER SYSTEM**

3. Ball Valves up to 50 mm: Brass body, full port, chrome plated brass ball, threaded or solder ends, PTFE seat and packing. Suitable for 4134 kPa (600 psi) non-shock WOG and maximum 71°C (160°F). Threaded , Red-White Fig. 5044F. Solder joint, Red-White Fig. 5049F.

4. Swing Check Valves up to 50 mm (2"): Bronze body screw-in cap, renewable no. 125 composition disc, threaded ends 860 kPa (125 psi) steam. Red-White Fig. 236T. Toyo #236T.
5. Inline Check Valves up to 50 mm (2"): Forge brass body, spring loaded, threaded ends for horizontal and vertical installation. Pressure rated for 1380 kPa (200 psi) WOG water. Red-White Fig. 232.
6. Silent Check Valves for Pump Discharge:
  - .1 Up to 50 mm (2"): Bronze body, SS stem, 316 SS spring, Teflon disc and seat ring, 430 SS seat screw, threaded ends. 1380 kPa (200 psi) water. Val Matic VM-1400 series.
7. Gate Valves up to 100 mm: Bronze body, brass stem, solid wedge, screw over bonnet (6-50mm) and inserted bonnet (65-100mm), threaded ends rating 1380 kPa (200 psi) WOG water. Threaded, Red-White Fig. 206. Solder ends, Red-White Fig. 207.
8. Gate Valves 65 mm and over: Cast iron body, OS&Y, bronze trim, flanged ends, rating 1380 kPa (200 psi) WOG. Red-White Fig. 421.

### **2.3 DOMESTIC HOT WATER SYSTEM**

9. Valves to be used in the hot water section of the system shall be exactly as specified in the cold water section with one exception, that all composition disc valves shall be fitted with discs suitable for hot water, rated for 2756 kPa (400 psi) at 94°C (200°F).

### **2.4 SANITARY SYSTEM**

10. Ball Valves up to 100 mm: Brass body, full port, chrome plated brass ball, threaded or solder ends, PTFE seat and packing. Suitable for 4134 kPa (600 psi) non-shock WOG and maximum 71°C (160°F). Threaded, Red-White Fig. 5044F. Solder joint, Red-White Fig. 5049F.
11. Gate Valves 65 mm and over: Cast iron body, OS&Y, bronze trim, flanged ends, rating 1380 kPa (200 psi) WOG. Red-White Fig. 421.
12. Inline Check Valves up to 50 mm (2"): Forge brass body, spring loaded, threaded ends for horizontal and vertical installation. Pressure rated for 1380 kPa (200 psi) WOG water. Red-White Fig. 232.
13. Inline Check Valves 50 mm and over: Cast iron body, dual plate bronze discs, stainless steel spring. Pressure rated for 1035 kPa (150 psi) WOG water. Red-White Fig. 442.
14. Resilient Seat Gate/Butterfly Valves 50 mm and over: Cast iron or ductile iron body, stainless steel stem, EPDM or BUNA seat. Pressure rated minimum 695 kPa (100 psi) WOG water and minimum temperature 90°C (194°F).

### **2.5 VALVE OPERATORS**

15. Provide suitable hand wheels for gate, globe or angle, radiation and drain valves.
16. Provide one plug cock wrench for every ten plug cocks sized 50 mm and smaller, minimum of one. Provide each plug cock sized 65 mm and larger with a wrench, with set screw.

17. Provide valves larger than 100 mm located more than 2,100 mm from floor in equipment rooms with chain operated sheaves. Extend chains to 1,500 mm above floor and hook to clips to arrange to clear walking aisles.

## **2.6 STRAINERS**

18. Y pattern
  - .1 Minimum 862 kPa, with 20 mesh, monel, bronze or stainless steel removable screen.
  - .2 Size 50 mm and under: Screwed brass or iron body with 0.75 mm (24 ga) stainless steel perforated screen.
  - .3 Size 65 mm to 100 mm: Flanged iron body with 1 mm (20 ga) stainless steel perforated screen.
  - .4 Size 125 mm and larger: Flanged iron body with 3 mm (11 ga) stainless steel perforated screen.
  - .5 Screen free area shall be minimum three times area of inlet pipe.

## **Part 3 Execution**

### **3.1 INSTALLATION AND APPLICATION**

1. Install valves with stem upright or horizontal, not inverted.
2. Install valves for shut-off and isolating service, to isolate all equipment, parts of systems, or vertical risers.
3. Use memory balancing valves in domestic hot water recirculation systems.
4. Provide drain valves at main shut-off valves, low points of piping and apparatus and terminal units.
5. Size drain lines and drain valves equal to size of apparatus drain connection.
6. For pipe sizes 20 mm (¾") and over, minimum drain size to be 20 mm (¾").
7. Provide hose thread connection with cap and chain for 20 mm (¾") drain valves located in ceiling and public areas.
8. Provide male NPT nipples with threaded pipe cap for drain sizes over 20 mm (¾") where not piped directly to floor drains.
9. Provide valved drain and hose connection off the bottom of all strainers.
10. Install strainers on the inlet to all pumps. Use temporary strainers during construction and system cleaning. Remove temporary and install permanent strainers prior to system balancing.

### **11. VALVES AND VALVE BOXES**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes by means of using bedding the same as adjacent pipe.
- .3 Ensure valves are installed plumb.
- .4 Fill around valve using sand material for a minimum 0.5 m radius around the valve to avoid damage to valve during backfilling.
- .5 Install marker posts as indicated on the drawings

**Part 1           General**

**1.1           RELATED SECTIONS**

- .1   Entire Specification – All areas of common Work.

**1.2           References**

- .1   Pipe supports shall meet the requirements of ANSI B31.1 Power Piping.

**1.3           General Requirements**

- .1   Provide hangers and supports to secure equipment in place, prevent vibration, maintain grade, and provide for expansion and contraction.
- .2   Install supports of strength and rigidity to suit loading without unduly stressing building. Locate adjacent to equipment to prevent undue stresses in piping and equipment.
- .3   Select hangers and supports for the service and in accordance with manufacturer's recommended maximum loading. Hangers shall have a safety factor of 5 to 1.
- .4   Fasten hangers and supports to building structure or inserts in concrete construction.
- .5   Provide sleeves for all piping and ductwork penetration through walls, ceilings, floors and footings. Sleeves to be sized to allow insulation to pass through and to project through both sides of wall.
- .6   Do not weld piping supports to building metal decking or building structural steel supports unless prior written approval has been obtained from the Contract Administrator.
- .7   Obtain approval prior to drilling for inserts and supports for piping system. Discuss and obtain approval for hanging systems and methods with Contract Administrator.
- .8   Obtain approval prior to using percussion type fastenings.
- .9   Use of piping for hanger supports and use of perforated band iron, wire or chain as hangers is not permitted.

**1.4           shop drawings**

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

**Part 2           Products**

**2.1           Inserts**

- .1   Inserts shall be malleable iron or galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, and lugs for attaching to forms.
- .2   Size inserts to suit threaded hanger rods.

**2.2           Pipe Hangers AND Supports**

- .1   Hangers, Pipe Sizes 15 mm (½”) to 40 mm (1½”): Adjustable wrought steel ring.

- .2 Hangers, Pipe Sizes 50 mm (2") and over: Adjustable wrought steel clevis.
- .3 Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods. Cast iron roll and stand for hot pipe sizes 150 mm (6") and over. Cup washers for hot piping below 150 mm (6").
- .4 Wall Support, Pipe Sizes to 75 mm (3"): Cast iron hook.
- .5 Wall Support, Pipe Sizes 100 mm (4") and Over: Welded steel bracket and wrought steel clamp, adjustable steel yoke and cast iron roll for hot pipe sizes 150 mm (6") and over.
- .6 Vertical Support: Steel riser clamp.
- .7 Floor Support, Pipe Sizes to 100 mm (4") and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange and concrete pier or steel support.
- .8 Floor Support, Hot Pipe Sizes 125 mm (5") and Over: Adjustable cast iron roll and stand, steel screws and concrete pier to steel support.
- .9 Design hangers so they cannot become disengaged by movements of supported pipe.
- .10 Provide copper plated hangers and supports for copper piping.
- .11 Provide galvanized hangers and supports for galvanized piping.
- .12 Support all piping below grade and under floor slabs in 3.2 mm (10 gauge) continuous cadmium plated channel. Support channel with cadmium plated clevis hangers and rods. Install supports on centers as specified in 3.2. Extend cadmium plated hanger rods 450 mm (18") above slab rebar and bend back over rebar so as to provide a minimum of 450 mm (18") of support in slab. Do not stress rod when bending.

### **2.3 Hanger Rods**

- .1 Provide stainless steel or galvanized steel hanger rods, threaded both ends, threaded one end, or continuous threaded.

### **2.4 SPRING HANGERS**

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/- 5% spring rate tolerance, tested for free height, spring rate, loaded height.
- .2 Load adjustability: 15% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities. Total travel to be actual travel +/- 20%. Difference between total travel and actual travel 25 mm minimum.
- .3 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .4 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

### **2.5 Flashing**

- .1 Steel Flashing: 0.5 mm (26 gauge) galvanized steel.
- .2 Lead Flashing: 24.4 kg/m<sup>2</sup> (5 lb/ft<sup>2</sup> sheet lead for waterproofing, 4.88 kg/m<sup>2</sup> (1 lb/ft<sup>2</sup> sheet lead for soundproofing).

- .3 Safes: 24.4 kg/m<sup>2</sup> (5 lb/ft<sup>2</sup> sheet lead or 0.5 mm (26 gauge) neoprene.
- .4 Caps: Steel, 0.8 mm (22 gauge) minimum, 1.6 mm (16 gauge) at fire resistance structures.

## **2.6 Sleeves**

- .1 Pipes through Floors: Form with stainless steel pipe or approved PVC sleeves.
- .2 Pipes through Walls: Form with stainless steel pipe.
- .3 Size large enough to allow for movement due to expansion and to provide for continuous insulation.

## **2.7 Seals**

- .1 Provide modular mechanical type seals between pipes and sleeves where passing through perimeter walls below grade (basement). These to consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve when linking bolts are tightened in sequence. Equal to "Link-seal" by Thunderline.

## **2.8 Access Doors**

- .1 Steel frame access panel with stainless steel piano-type hinge, channel reinforced steel door panel, three "Symmons" fasteners per door. Door panel recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners. Provide acoustic gasket between door panel perimeter and steel frame. Rated access doors shall be ULC-listed.

## **Part 3 Execution**

### **3.1 Inserts**

- .1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.
- .2 Set inserts in position in advance of concrete Work. Provide reinforcement rod in concrete for inserts carrying pipe over 100 mm (4") or ducts over 1500 mm (60") wide.
- .3 Where concrete slabs form finished ceiling, finish inserts flush with slab surface.
- .4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed 100 mm (4") minimum square steel plate and nut above slab.

### **3.2 Pipe Hangers SPACING**

- .1 Plumbing piping: to Canadian Plumbing Code, Provincial Code and/or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .4 Support horizontal steel and copper piping as follows:

Maximum Pipe Size UP to:	Maximum Spacing Steel	Maximum Spacing Copper	Hanger Rod Diameter
up to 30	2.1 m	1.8 m	10 mm
40	2.7 m	2.4 m	10 mm
50	3.0 m	2.7 m	10 mm
65	3.6 m	3.0 m	10 mm

- .5 Install hangers to provide minimum 15 mm (½") clear space between finished covering and adjacent Work.
- .6 Use oversize hangers to accommodate pipe insulation thickness. For pipes up to 50 mm (2") use high density rigid pipe insulation at hanger location, with an insulation protection shield. For pipes 65 mm (2½") and over use insulation protection saddle.
- .7 Ensure that rod is vertical under operating conditions at equalize loads.
- .8 Place a hanger within 300 mm (12") of each horizontal elbow.
- .9 Use hangers which are vertically adjustable 40 mm (1½") minimum after piping is erected.
- .10 Support cast iron horizontal drainage pipe near each hub and on each side of gasket and clamp joints, with 1500 mm (60") maximum spacing between hangers.
- .11 Support vertical piping at every other floor. Support vertical soil pipe at each floor at hub.
- .12 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- .13 Where practical, support riser piping independently of connected horizontal piping.

### 3.3 Flashing

- .1 Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors and roofs.
- .2 Flash vent and soil pipes projecting 75 mm (3") minimum above finished roof surface with lead worked 25 mm (1") minimum into hub, 200 mm (8") minimum clear on sides with minimum 600 mm (24") x 600 mm (24") sheet size. For pipes through outside walls, turn flange back into wall and caulk.
- .3 Flash floor drains over finished areas with lead 250 mm (10") clear on sides with minimum 900 mm (36") x 900 mm (36") sheet size. Fasten flashing to drain clamp device.
- .4 Provide curbs for mechanical roof installations 200 mm (8") minimum high. Flash and counterflash with galvanized steel, soldered and made waterproof.

**3.4** Sleeves

- .1 Set sleeves in position in advance of concrete Work. Provide suitable reinforcing around sleeve.
- .2 Extend sleeves through potentially wet floors 25 mm (1") above finished floor level. Caulk sleeves full depth and provide floor plate.
- .3 Piping passing through floor, ceiling or wall, close off space between duct and sleeve with non-combustible insulation. Caulk both sides.
- .4 Sleeves provided through walls or floors where liquids could potentially pass from one side to the other, provide sleeves with a 25 mm (1") 'flange' welded to the external face of the sleeve at the mid point of the thickness of the structure to provide a water stop.
- .5 Install chrome plated escutcheons where piping passes through finished surfaces.

**3.5** Finishes on Hanger and Supports

- .1 All hanger rods, hangers and supports shall be stainless steel or factory primed with alkyd red oxide primer to CAN/CGSB-1.40.

**3.6** Access Doors

- .1 Provide access doors for maintenance or adjustment purposes for all mechanical system components including:
  - .1 Valves
  - .2 Cleanouts and traps
  - .3 Expansion joints
  - .4 Control components
- .2 Mark removable ceiling tiles used for access with color coded pins. See Painting and Identification.
- .3 Sizes to be 600 mm (24") x 600 mm (24") minimum for general access.
- .4 Sizes to be 300mm (12") x 300 mm (12") for inspection and hand access only.
- .5 Provide ULC-listed fire rated access doors installed in rated walls and ceilings.
- .6 Access doors will be provided under section 22 05 29, but installed by the trade governing the surface in which they are to be installed.

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Entire Specification – All areas of common Work.

**1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 1.60-97, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB 24.3-92, Identification of Piping Systems.

**1.3 SUBMITTALS**

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

**1.4 QUALITY CONTROL**

- .1 Color code mechanical equipment, piping and exposed ductwork
- .2 Legend and direction of flow arrows shall consist of adhesive backed labels, yellow color, with minimum 20 mm (¾") high black lettering equal to Brady System B-500, vinyl cloth labels for non insulated surfaces; and Brady B946 for insulated surfaces.

**1.5 EQUIPMENT PROTECTION AND CLEAN-UP**

- .1 Ensure that equipment and surfaces are carefully covered with tarping, or heavy duty plastic. Ensure that spills and splatter on finishes and equipment are cleaned up totally and promptly.

**Part 2 Products**  
Not Applicable

**Part 3 Execution**

**3.1 GENERAL**

- .1 Identify piping with labels, color bands, and flow arrows. On all systems, provide identification at 15 m (50 ft) maximum intervals, before and after pipes passing through walls, at all sides of tees, behind access doors and in equipment rooms as required.
- .2 Apply color bands at both ends of the label with primary color bands used to secure both ends of individual labels. Refer to color schedule at end of this section.
- .3 Provide 20 mm (¾") diameter brass, lamacoid or metal photo black numbers, secured to valve stem with key chain.
- .4 Provide neat, typewritten directories, giving valve number, services and location. Frame one copy under glass for wall mounting as directed, second copy to be forwarded to Contract Administrator. Include copies in O & M Manuals.
- .5 Identify all equipment excluding pipe with screwed down lamacoid plates having 6 mm (¼") minimum letter size. Identification to match as built drawings equipment name and number.

.6 Identify electric starting switches, thermostats controlling motors, remote push button stations, and controls equipment supplies under this Section with lamacoid plates having 6 mm (1/4") minimum letter size. Identification to state equipment controlled and match to control shop drawing identification numbers.

.7 Identification Symbols and Colors for Piping

	<u>Pipe Color</u>	<u>Stripe Color</u>	<u>Symbol</u>
Domestic Cold Water	Light Blue	None	Cold Wat.
Domestic Hot Water	Green	Orange	Hot Wat.
Domestic Hot Water Recirculation	Green	Blue	Hot Wat. R.
Drains	Aluminum	Red or Orange	Drain
Vent	Aluminum	Red or Orange	Vent
Hangers, Brackets, & Supports	Black Machinery Enamel		

**Part 1 General**

**1.1 SUMMARY**

- .1 Piping insulation.
- .2 Adhesives, tie wires, tapes.
- .3 Recovering.

**1.2 RELATED SECTIONS**

- .1 Entire Specification – All areas of common Work.

**1.3 REFERENCES**

- .1 American Society for Testing and Materials (ASTM International)
  - .1 ASTM C335-05ae1, Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .2 ASTM C411-05, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .3 ASTM C449-07, Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
  - .5 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
  - .6 ASTM C553-08, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .7 ASTM C612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .8 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .9 ASTM C921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52MA-89, Vapor Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB 51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .3 Thermal Insulation Association of Canada (TIAC)
  - .1 National Insulation Standards 1992 (R1999).

**1.4 QUALITY ASSURANCE**

- .1 Insulation shall be installed by skilled workmen regularly engaged in this type of Work.
- .2 Materials shall meet or exceed fire and smoke hazard ratings as stated in this section and defined in applicable building codes.

**1.5 SHOP DRAWINGS**

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

- .2 Submit shop drawings which indicate complete material data, "K" value, temperature rating, density, finish, recovery jacket of materials proposed for this project and indicate thickness of material for individual services.
- .3 Submit samples of proposed insulating and recovering materials.

## **1.6 JOB CONDITIONS**

- .1 Deliver material to job Site in original non-broken factory packaging, labeled with manufacturer's density and thickness.
- .2 Perform Work at ambient and equipment temperatures as recommended by the adhesive manufacturer. Make good separation of joints or cracking of insulation due to thermal movement or poor workmanship.

## **1.7 ALTERNATIVES**

- .1 Alternative insulations are subject to approval. Alternatives shall provide the same thermal resistance within 5% at normal conditions as material specified.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Owen's Corning/Fiberglas Canada Inc., Manson, Knauf Fiberglass.

### **2.2 GENERAL**

- .1 Insulation Materials, Recovery Jackets, Vapor Barrier Facings, Tapes and Adhesives shall be In accordance with CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.
- .2 All insulation materials shall meet Building Code Standards, and packages or containers of such materials shall be appropriately labeled.
- .3 Insulate fittings and valve bodies with preformed insulated fittings.

### **2.3 MATERIALS**

- .1 Cold Piping: Formed fine fibrous glass or formed mineral fiber pipe insulation, with factory applied vapor barrier jacket, factory molded to conform to piping, "K" value maximum 0.035 W/m. °C at 24°C (0.24 btu in/hr/ft2 at 75°F). Service temperature: 4°C (40°F) to 100°C (212°F).
- .2 Hot Piping: Formed fine fibrous glass or mineral fiber pipe insulation, with factory applied general purpose jacket, factory molded to conform to piping, "K" value maximum 0.035 W/m. °C, at 24°C (0.24 btu in/hr/ft2 at 75°F). Service temperature up to 150° C (300°F).
- .3 Recovery Jackets:
  - .1 Polyvinyl Chloride (PVC): One-piece molded type and sheet to CAN/CGSB 51.53 with pre-formed shapes. All PVC jacket joints shall be sealed with CFIA compliant sealants.

## **2.4 INSULATION SECUREMENTS AND SEAL**

- .1 Tape: Self-adhesive, aluminum 50 mm wide minimum.
- .2 Contact adhesive: Quick setting and canvas adhesive: Washable.
- .3 Tie wire: 1.5 mm diameter stainless steel.
- .4 Bands: Stainless steel, 20 mm wide and 0.5 mm thick.
- .5 Waterproof Caulking to all outdoor pipe:

## **2.5 VAPOUR RETARDER**

- .1 Lap adhesive: Water based, fire retardant type, compatible with insulation.
- .2 Indoor finish: Vinyl emulsion type acrylic, compatible with insulation.
- .3 Outdoor: Vinyl emulsion type acrylic, compatible with insulation.
- .4 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.

## **Part 3 Execution**

- .1 Do not install covering before piping and equipment has been tested and approved.
- .2 Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application. Finish with systems at operating conditions.

## **3.1 INSTALLATION**

- .1 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.
- .2 Insulate complete system including piping, fittings, valves, unions, flanges, strainers. Do not insulate flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.
- .3 Finish insulation neatly at hangers, supports and other protrusions.
- .4 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.
- .5 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in crawl spaces, pipe shafts and suspended ceiling spaces is not considered exposed. Make smooth uneven insulated surfaces before recovering.
- .6 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm (8") centre. Lap circumferential joints 75 mm (3") minimum and seal with compatible waterproof lap cement. Lock form longitudinal joints and seal.
- .7 Cold Piping: Seal lap joints with 100% coverage of vapor barrier adhesive. Seal butt joints with 50 mm (2") wide strips of vapor barrier sealed with vapor barrier adhesive. For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.
- .8 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm (4") centers.

- .9 Hot Piping: For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells.

### 3.2 INSULATION THICKNESS SCHEDULE

	<b>Piping</b>	<b>Pipe Sizes mm (in)</b>	<b>Insulation Thickness mm (in)</b>	<b>Recovery Jacket</b>
.1	Domestic Cold Water Piping	15 (1/2") to 20 (3/4") 25(1") and Over	15 (1/2") 25 (1")	Low smoke PVC
.2	Domestic Hot Water Supply and Recirculation Piping	15 (1/2") to 50 (2") Over 50 (2")	25 (1") 40 (1 1/4")	Low smoke PVC
.3	Domestic Cold/Hot Water Piping (Outdoor)	All Sizes	50 (2")	Aluminum
.4	Condensate Drains from Equipment (Indoor)	15 (1/2") to 20 (3/4") 25(1") and Over	15 (1/2") 25 (1")	Low smoke PVC
.5	Vents within 3 m (10'-0") of roof or wall Outlet	All Sizes	25 (1")	Low smoke PVC

**NOTE:** Pipe insulation for piping installed in 40 x 90 mm (2" x 4") wall cavity can be reduced to 15 mm (1/2"), for pipe sizes 40 mm (1 1/2") to 65 mm (2 1/2"). Install insulation to thickness specified for piping outside the wall cavity.

Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

**Part 1            General**

**1.1                SUMMARY**

- .1        Section Includes
  - .1        General requirements for Commissioning of Plumbing equipment and systems.
  - .2        Related Sections:
    - .1        Section 01 91 00 Third Party Commissioning
    - .2        Section 23 08 00 Commissioning of HVAC
  - .3        Acronyms:
    - .1        Cx - Commissioning.
    - .2        CxA - Commissioning Agent

**1.2                INTENT**

- .1        Provide commissioning of plumbing equipment and systems in accordance with this Section and related sections.
- .2        All items noted in this document are the responsibility of the Contractor supplying and installing the equipment, unless noted otherwise.

**1.3                MANUFACTURER'S SERVICE ON SITE**

- .1        Arrange and pay for qualified Manufacturer's representatives to supervise starting and testing the following mechanical equipment and systems:
  - .1        Pumps
  - .2        Chemical cleaning and treatment
- .2        Use manufacturers factory trained personnel where required to maintain manufacturer's warranty.
- .3        Maintain documentation of all equipment start-up and commissioning and provide to Commissioning Agent.

**1.4                PLUMBING SYSTEM TESTING, ADJUSTING & BALANCING**

- .1        The Contractor will hire a Certified Balancing Agent for completion of the testing, adjusting and balancing of all plumbing systems.

**Part 2            Products**

**2.1                TEST EQUIPMENT**

- .1        None

**Part 3 Execution**

**3.1 GENERAL**

- .1 Commission all equipment and systems installed as part of this Contract. Typical required information or actions are listed below for each equipment or system.
- .2 Provide check sheets for equipment not listed in this section.
- .3 Document the commissioning process by completing the System (functional) Tests and Integrated System Tests.

**3.2 PLUMBING SYSTEMS – DOMESTIC WATER**

- .1 Check that installation is in accordance with drawings, specifications and Manufacturer's recommendations.
- .2 Complete Manufacturer's installation and start-up check sheets and include the following:
  - .1 Inspect domestic water systems including piping layout, pipe support, expansion provisions, and slope for draining and venting, before pressure testing any section of pipe.
  - .2 Pressure test sections of pipe prior to application of insulation or to concealment.
  - .3 Pressure test each completed system before any equipment is started.
  - .4 Start domestic hot water system's circulator pumps.
  - .5 Balance Domestic Hot Water system return circulation circuits by temperature drop measurement.
  - .6 Sterilize Domestic water systems..
  - .7 Ensure all air chambers and expansion compensators are properly installed.
  - .8 Ensure entire system can be completely drained.
  - .9 Check operation of water hammer arrestors. Let one outlet run for ten seconds, then shut water off quickly. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.
  - .10 Check operation of domestic cold water storage tank and booster pump system to ensure the system Work as designed.
- .3 Provide maintenance services:
  - .1 Ensure that all equipment is serviced prior to the City takeover.
  - .2 Ensure that all equipment is installed so as to provide easy access for maintenance and removal.

**3.3 PLUMBING SYSTEMS - PLUMBING DRAINAGE**

- .1 Check that installation is in accordance with drawings, specifications and Manufacturer's recommendations.
- .2 Complete Manufacturer's installation and start-up check sheets and include the following:

- .1 Inspect plumbing drainage systems including above ground drainage piping layout, pipe support, slope, venting, before pressure testing or concealing any section of the Work.
  - .2 Hydraulically test above ground installations within buildings.
  - .3 Ensure all traps are fully primed.
  - .4 Ensure all fixtures are properly anchored and connected to system.
  - .5 Flush each valve, drain each sink and operate each fixture to ensure drainage and trap anti-siphon venting is effective.
  - .6 Open each cleanout, cover with linseed oil and reseal each cleanout. Ensure each cleanout is fully accessible and access doors are properly installed. Check cleanouts after building finishes (flooring, wall covering) have been installed.
  - .7 Check operation of sump pit SMP-1 and 2 to ensure the sump pits Work as designed.
  - .8 Check operation of grey water storage tank system to ensure the system Work as designed
  - .9 Check the installation of composters COMP-1, 2, 3, 4, AND 5 to ensure the installation follow design drawings and manufacturer's recommendation. Check the pump and fan, which come with composter, to ensure the pumps and fans Work properly.
- .3 Provide maintenance services.
- .1 Ensure that all equipment is serviced prior to The City takeover.
  - .2 Ensure that all equipment is installed so as to provide easy access for maintenance and removal.

### **3.4 MISCELLANEOUS EQUIPMENT AND SYSTEMS – TANKS**

- .1 Check that installation is in accordance with drawings, specifications and Manufacturer's recommendations.
- .2 Complete Manufacturer's installation and start-up check sheets and include the following:
  - .1 Tank is level on housekeeping base.
  - .2 No visible damage to vessel.
  - .3 Check PRVs for correct operation and specified relief pressure. Adjust as required.
  - .4 Clearances have been provided and piping is flanged for easy removal and servicing.
  - .5 Labels are clearly visible.
  - .6 Controls, gauges, alarm devices, etc. are operational.
  - .7 Access ports/manholes provided.
  - .8 Piping sizes - inlets/outlets are correct.
  - .9 Lining is intact and not damaged.
  - .10 Tank has dielectric unions on piping connections.
  - .11 Verify drain line.
- .3 Provide maintenance services.

- .1 Adjust thermostat to final setting
- .2 Clean unit
- .3 Confirm that all equipment is accessible for maintenance and operations

**3.5 MECHANICAL EQUIPMENT AND SYSTEMS DEMONSTRATION AND INSTRUCTION**

- .1 Provide demonstrations and instruction.

**Part 1            General**

**1.1                SUMMARY**

- .1    Piping and Fittings
- .2    Expansion Tank
- .3    Thermostatic Mixing Valve
- .4    Backflow Preventers.
- .5    Hose Bibb
- .6    Water Hammer Arrestors
- .7    Unions, Flanges, and Couplings

**1.2                RELATED SECTIONS**

- .1    Entire Specification – All areas of common Work.

**1.3                REFERENCES**

- .1    National Plumbing Code of Canada 2005.
- .2    Manitoba Plumbing Code 2006.
- .3    American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
  - .1    ANSI/ASME B16.15-2006, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2    ANSI/ASME B16.18-2001 (R2005), Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3    ANSI/ASME B16.22-2001 (R2005), Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
  - .4    ANSI/ASME B16.24-2006, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .4    American Society for Testing and Materials International, (ASTM).
  - .1    ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .2    ASTM B88M-05, Standard Specification for Seamless Copper Water Tube (Metric).
  - .3    ASTM F492-95, Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings.
- .5    American Water Works Association (AWWA).
  - .1    ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .6    Canadian Standards Association (CSA International).
  - .1    CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

**1.4                SHOP DRAWINGS**

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

## **1.5 GENERAL REQUIREMENTS**

- .1 Provide materials, equipment and labor to install plumbing as required by Provincial and Local Codes as specified herein.
- .2 Provide water connections to equipment furnished in other sections of this specification and by the The City.
- .3 Provide and include charges for connections to Municipal and Utility Company services, including costs to maintain temporary water supply pending acceptable water quality tests, where applicable.
- .4 Provide an approved water meter and bypass installation conforming to Local Codes and Standards.

## **1.6 QUALITY ASSURANCE**

- .1 Domestic Water, Piping: Federal, Provincial and Municipal codes.
- .2 Non specified pipe joining and pipe fitting methods such as T-drill and Press Fit are not permitted in any piping system covered under Section 22.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Expansion Tank: Amtrol , Armstrong, TACO, Berkeley.
- .2 Thermostatic Mixing Valves: Lawler, Powers, Leonard, Symmons
- .3 Backflow Preventers: Febco, Watts, Hersey, Singer, Zurn
- .4 Hose Bibbs: Mifab, Zurn, Febco, Watts
- .5 Water Hammer Arrestors: Roto Tech Smith, Zurn, Watts, Ancon

### **2.2 GENERAL**

- .1 Refer to 22 05 23 - General Duty Valves and Strainers for Plumbing.
- .2 Refer to plumbing fixture schedule on drawings for specific selections.

### **2.3 PIPING AND FITTINGS**

- .1 Domestic water, above ground (inside building)
  - .1 Piping:
    - .1 Type 'L' hard seamless copper tubing to ASTM B88M
  - .2 Fittings:
    - .1 Wrought copper, bronze with lead free solder, brazed for pipes over 50 mm
    - .2 Cast bronze with screwed joints
    - .3 Ductile Iron with rigid grooved mechanical joints.
- .2 Domestic water, buried
  - .1 Piping:
    - .4 Type K soft copper to ASTM B88M
    - .5 PVC, Class 150, conforming to CSA B137.3 and AWWA C900, complete with tracer wire

- .2 Fittings:
  - .6 PVC Hub & Spigot, with "O" Ring joints.
  - .7 Copper no joints permitted.

## **2.4 EXPANSION TANK**

- .1 Tank shall be ASME diaphragm type for domestic portable water system rated for working pressure at 862 Kpa (125 PSI) and temperature at 93°C (200°F).
- .2 Tank shall be constructed carbon steel shell with polypropylene liner, stainless steel connections and butyl diaphragm.
- .3 Factory precharged to 380 kPa (55 PSI) diaphragm type sealed in EPDM and 100% tested for maximum 862 kPa working pressure and maximum 93°C operating temperature.

## **2.5 THERMOSTATIC MIXING VALVE**

- .1 CSA B125.3 certified exposed mixing valve with liquid-filled motor.
- .2 Carbon steel baked enamel surface mounted cabinet include hinged door and lock with two keys.
- .3 Polished chrome finish with 20 mm valve.
- .4 Supplied with shutoff device, stop and check valve and strainer.

## **2.6 BACKFLOW PREVENTERS**

- .1 Backflow preventer assembly complete with shut-off valves before and after check valves and test cocks. Assembly shall meet current AWWA requirements and CSA B64 standards.
- .2 Provide complete atmospheric vent backflow preventer assembly, consisting of two (2) positive sealing replaceable check valves with bronze seats, integral strainer and threaded vent connection.

## **2.7 HOSE BIBB (EXTERIOR)**

- .1 A.S.S.E. 1019-B certified exposed type, self draining, non freeze wall hydrant with A.S.S.E. 1011 approved anti-siphon and vandal resistant integral vacuum breaker with 3/4" (19) male hose connection.
- .2 Hydrant assembly complete with neoprene plunger to control both the flow and drain functions, hardened bronze operating stem, drain port under the hexagon nut, heavy duty brass casing, 360 degree swivel inlet connection, heavy duty chromeplated bronze head casting, polished chrome plated face plate and satin finished nickel bronze box with hinged locking cover.

## **2.8 WATER HAMMER ARRESTORS**

- .1 Pre-charged hard drawn copper shock water hammer arrestors complete, with brass piston, EPDM o-ring seals and threaded connection.
- .2 Designed for operate on domestic water to maximum 1034 kPa (150 psi) working pressure at maximum temperature 82°C (180°F).

## **2.9 UNIONS, FLANGES, AND COUPLINGS**

- .1 Rigid grooved mechanical couplings shall have an angle bolt pattern design and shall provide system support and hanging requirements in accordance with ASME B31.1. Rigid couplings shall be used in all locations unless otherwise noted. Standard of acceptance Victaulic and Straub.
- .2 Flexible grooved mechanical couplings shall only be used around equipment to attenuate noise and vibration. Noise and vibration reduction at mechanical equipment is achieved by installing three (3) flexible couplings near the vibrations source. Standard of acceptance Victaulic and Straub.
- .3 For grooved mechanical couplings on hot water, glycol, chilled water and potable water service the gasket material shall be Grade "E" EPDM compound (green color coded stripe) conforming to ASTM D-2000 designation. Grade "E" gaskets are UL/ULC classified to ANSI/NSF 61 for -34°C to 110°C-30°F to +230°F operating temperature range. Any deviations from the above in the way of special lubricants or special clauses in the manufactures literature as to limitations on hot water must be brought to the attention of the Contract Administrator and may not be accepted.
- .4 For domestic water, grooved mechanical coupling housings are cast with an angle pattern bolt pad for direct connection of copper tubing without flaring to IPS dimensions. Gaskets shall be molded of synthetic rubber in a FlushSeal configuration conforming to the copper tube size (CTS) outside diameter and coupling housing. Standard of acceptance Victaulic and Straub.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Ream pipes and tubes. Clean off scale and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- .2 Use roll grooving tools to groove pipe in accordance with manufacturer's specifications. Use copper rolls for copper pipe as provided by manufacturer.

### **3.2 CONNECTION**

- .1 Use grooved mechanical couplings and mechanical fasteners as where allowed in accessible locations and mechanical rooms and where access can be obtained without removal of equipment or other materials such as ductwork etc. All grooved components shall be of one manufacturer and conform to local code approval. A gauged torque wrench must be used if required by the manufacturer.
- .2 Make connections to equipment, specialty components, and branch mains after isolation valves, with unions or flanges.
- .3 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.
- .4 Use insulating plastic spacers for copper pipe installation in metal studs.

### **3.3 ESCUTCHEONS**

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

- .2 Construction: One piece type with stainless steel set screws.
- .3 Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

### **3.4 ROUTE AND GRADES**

- .1 Route piping in orderly manner and maintain proper grades. Install to conserve headroom and interfere as little as possible with use of space. Run exposed piping parallel to walls. Group piping wherever practical at common elevations. Install concealed pipes close to the building structure to keep furring to a minimum.
- .2 Slope water piping 0.2% and provide hose bibb drains at low points.
- .3 Provide air collection chambers with manual air vent at all high points of system. Collection chambers to be 25 mm (1") diameter or line size whichever is greater and 150 mm (6") high minimum. Square tees may only be used to assist with complete venting and draining.
- .4 Make reductions in water and steam pipes with eccentric reducing fittings installed to provide drainage and venting. Top flat for water.
- .5 Pipe the discharge from all relief valves, safety valves, vents, drains, equipment blowdowns, water columns, and overflows to the nearest building floor drain.

### **3.5 GENERAL INSTALLATION**

- .1 Installation complies with National Plumbing Code of Canada 2005, Manitoba Plumbing Code 2006.
- .2 Install a water hammer arrestor to each flush valve water supply or group of fixtures. Provide air chambers as same size as supply line or 20 mm (3/4") minimum.
- .3 Hose bibb: Install a shut off valve inside of wall before penetrate exterior wall.
- .4 Install expansion tanks as indicated on drawings.
- .5 Install Thermostatic Mixing Valves as indicated on drawings.
- .6 Install piping to allow for expansion and contraction without unduly stressing pipe or equipment connected.
- .7 Provide proper insulation for all piping. Refer to Section 22 07 19 – Plumbing Piping Insulation.
- .8 Provide proper piping supports clearance and access to valves, air vents, drains and unions without removal of equipment or other materials such as ductwork etc.
- .9 Provide proper labels and colors for piping. Refer to Section 22 05 53 - Painting and Identification for Piping.
- .10 Install piping material specified as inside the building to 2500 mm (8'-0") outside of building and bury minimum 2400 mm (8'-0") deep..
- .11 Provide dielectric type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.
- .12 Use insulating plastic spacers for copper pipe installation in metal studs.

- .13 Make systems completely operational, totally filled, thoroughly vented, and completely started.

**3.6 SERVICE CONNECTION**

- .1 Provide new domestic water services. Before commencing Work check invert elevations required for connections, confirm inverts and ensure that these can be properly connected with sufficient slope and adequate cover to avoid freezing.

## **Part 1 General**

### **1.1 SCOPE**

- .1 Provide for flushing and disinfection of domestic water systems.
- .2 Isolate and bypass equipment listed in Clause 3.1.

### **1.2 ACCEPTABLE AGENCY**

- .1 Chemical treatment agency shall provide equipment, chemicals and Site supervision so as to fully comply with all requirements and their intent contained within this specification section.

### **1.3 QUALITY ASSURANCE**

- .1 Provide chemical treatment as specified herein and provide written reports. Reports shall be signed by the chemical treatment agency, mechanical Contractor and commissioning agency.
- .2 Include for the costs of an independent testing agency, selected by the City, to take samples of domestic water, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the City. Should the lab rewsults prove that standards for drinking water quality have not been met, the Contractor shall correct the deficiency and cover the costs of the independent testing agency to take additional samples and tests.

### **1.4 SUBMITTALS**

- .1 Submit procedure instructions and analysis reports to be used on this project.
- .2 Provide written reports containing procedure of system cleaning and degreasing, giving times, dates, conditions of water and problems and actions encountered.
- .3 Comply with Section 01 77 00, Closeout Submittals.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Provide sufficient chemicals to treat domestic water systems and test the systems from the time of activation and acceptance of the building.
- .2 Chemicals used must comply with environmental and health standards applicable to the usage on this project.

**Part 3 Execution**

**3.1 SYSTEM CLEANING**

- .1 Ensure reasonable care is exercised to prevent debris, dirt and other foreign material from entering the pipe during construction. This is to include proper protection of piping on Site prior to installation, temporary caps on partial systems, and complete evacuation of moisture within systems being hydrostatically pressure tested.
- .2 Chemical treatment agency shall, in conjunction with the mechanical Contractor, review connections for complete draining and venting of the systems. The mechanical Contractor shall provide adequate drain connections to completely drain the systems within one hour.
- .3 Protect and/or remove control devices from systems during cleaning. All terminal control valves shall be in open position during cleaning. Particular attention is to be made to control valves which have a normally closed position.
- .4 Make systems completely operational, totally filled, thoroughly vented, and completely started.
- .5 All domestic hot, cold and domestic recirculation water systems will be required to be flushed and disinfected. Add chlorine to water in system to 50 milligrams per litre (50 ppm) and let stand for 24 hours. Check chlorine content after 24 hours and insure the content is not less than 20 milligrams per litre (20 ppm). If less than 20 milligrams per litre (20 ppm) repeat process. Flush system until the chlorine content of water being drained is equal to the chlorine content of the make-up water. Utilize plumbing fixtures (i.e. lav, sinks, flushometers, etc.) for drainage.

**Part 1            General**

**1.1                RELATED SECTIONS**

1.        Entire Specification – All areas of common Work.

**1.2                SUBMITTALS**

2.        Submittals in accordance with Section 01 33 00 – Submittal Procedures.
3.        Submit shop drawings indicating capacity rating, physical dimensions, wiring diagrams, materials of construction, code compliance, etc. As indicated on schedules.
4.        Provide operating and maintenance manuals with complete description of product for incorporation into manual specified in Section 01 77 00 – Closeout Submittals.

**1.3                QUALITY INSURANCE**

5.        Domestic Water Pumps shall be the product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

**Part 2            Products**

**2.1                ACCEPTABLE MANUFACTURERS**

1.        Booster Pump/Tank Package:    Goulds or approved equal in accordance with B7
6.        See pump and expansion tank schedule.

**Part 3            Execution**

**3.1                INSTALLATION**

1.        Install in accordance with manufacturer's recommendations.
7.        Provide air cock and drain connection on horizontal pump casings.
8.        Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 100 mm and over.
9.        Check and align pumps prior to start-up.

**Part 1            General**

**1.1                SUMMARY**

- .1     Piping and Fittings
- .2     Piping Sleeves
- .3     Cleanouts
- .4     Floor drains
- .5     Trap Seal Primers

**1.2                RELATED SECTIONS**

- .1     Entire Specification – All areas of common Work.

**1.3                REFERENCES**

- .1     National Plumbing Code of Canada 2005.
- .2     Manitoba Plumbing Code 2006.
- .3     American Society for Testing and Materials International, (ASTM).
  - .1     ASTM C564-08, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .4     Canadian Standards Association (CSA International).
  - .1     CSA B67-1972 (R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
  - .2     CAN/CSA B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .3     CAN/CSA B125-01, Plumbing Fittings.

**1.4                SUBMITTALS**

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

**1.5                GENERAL REQUIREMENTS**

- .1     Provide materials, equipment and labor to install sanitary system as required by Provincial and Local Codes as specified herein.

**Part 2            PRODUCTS**

**2.1                ACCEPTABLE MANUFACTURERS**

- .1     Floor Drains:                             Watts, Tech Smith, Zurn,
- .2     Cleanouts:                                 Roto Tech Smith, Zurn, Ancon.
- .3     Trap seal primes, Oil Interceptor:     Zurn, MIFAB

## **2.2 GENERAL**

- .1 Refer to 22 05 23 - General Duty Valves and Strainers for Plumbing Piping.
- .2 Refer to plumbing fixture schedule on drawings for specific selection.

## **2.3 PIPING AND FITTINGS**

- .1 Sanitary drainage, and vent, inside building, above ground
  - .1 Piping:
    - .1 Cast iron, CSA B70
    - .2 PVC-DWV, CAN/CSA B181.2
  - .2 Fittings:
    - .1 Cast iron with Gasket clamp joints.
    - .2 PVC-DWV with solvent weld joints
- .2 Sanitary drainage, and vent, inside building, below ground
  - .1 Piping:
    - .1 Cast iron, CSA B70
    - .2 PVC-DWV, CAN/CSA B182.1
  - .2 Fittings:
    - .1 Cast iron with Gasket clamp joints.
    - .2 PVC-DWV with solvent weld joints
- .3 Equipment drains and overflows
  - .1 Piping:
    - .1 Sch.40, galvanized steel, ASTM A120
  - .2 Fittings:
    - .1 Galvanized banded malleable iron with screwed joint

## **2.4 PIPE SLEEVES**

- .1 Pipe sleeves through exterior walls shall be of SCH 40 316L stainless steel pipe and shall be, unless detailed otherwise, one size larger than the penetrating pipe for 100 mm and larger pipe, and two sizes larger for pipe smaller than 100 mm.
- .2 Pipe sleeves shall have a 50 mm by 10 mm thick steel ring continuously welded all around the middle of the pipe length in the concrete slab.
- .3 Install sleeve flush at floors as 50 mm above floor surface and flush at bottom.
- .4 Coat surfaces of stainless steel in contact with concrete with bitumastic.
- .5 There shall be no direct contact between structural steel and stainless steel.
- .6 Seal space between sleeves and pipes with non-hardening mastic-Daraseal-A or approved alternative.

## **2.5 CLEANOUTS**

- .1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
- .2 Access Covers: face or wall type, polished stainless steel round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
- .3 Floor Clean-outs: Adjustable floor cleanout. Dura-coated cast iron upper and lower bodies, neoprene flex gasket, bronze plug, isolation ferrule with polished bronze top.
- .4 Wall Clean-outs: Wall cleanout, dura-coated cast iron body, bronze plug, and round, smooth stainless steel access cover with securing screw.

## **2.6 TRAP SEAL PRIMERS**

- .1 Pressure drop activated brass trap seal primer, with inlet opening of 1/2" (13) male N.P.T. and outlet opening of female 1/2" (13) N.P.T. Complete with four view holes and removable filter screen. Serves up to 6 floor drain traps and requires no adjustments and no air pre-charge.
- .2 Can be connected to any cold water line, and will be automatically activated when a valve or faucet, that is on the line, is opened. A pressure drop of three p.s.i. will activate all of the trap seal primers.
- .3 Design permits filter replacement without affecting the performance of the primer. The "O" ring seals are tested for reliability at a temperature range of -40 degrees to 450 degrees F. The operating range is 20 to 125 p.s.i.
- .4 Listed with I.A.P.M.O. and C.S.A. and are tested and certified to the A.S.S.E. Standard 1018

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Installation complies with National Plumbing Code of Canada 2005, Manitoba Plumbing Code 2006.
- .2 Protect sanitary piping below foundation slab and crawl space from falling, breaking and freezing.
- .3 Lubricate cleanout plugs with mixture of graphite and linseed oil. Prior to building turnover, remove cleanout plugs, re-lubricate and re-install using only enough force to ensure permanent leak proof joint.
- .4 Trap Primer: Install a BFP or in-line check valve to trap primer supply pipe.

- .5 Connect floor drains with trap primer connection to the trap primer, as shown on detail drawings.
- .6 Grade horizontal vent piping 2% minimum unless specified otherwise.
- .7 Provide proper insulation for all piping. Refer to Section 22 07 19 – Plumbing Piping Insulation.
- .8 Provide proper piping supports clearance and access to valves, air vents, drains and unions. Refer to Section 22 05 29 – Hangers and Supports Plumbing.
- .9 Provide proper labels and colors for piping. Refer to Section 22 05 53 - Painting and Identification for Plumbing.
- .10 Drainage lines shall grade 2% for size equal or smaller than 75mm unless otherwise noted on drawings.
- .11 Plumbing vents shall be located minimum 5 m from outside air intakes.
- .12 Pipe the drainage from all relief valves, safety valves, vents, drains, equipment blowdowns, neutralization tank, water columns, and overflows to the nearest floor drain.
- .13 Provide a vent for all sump pits and connect the vent to a common vent out of the building.
- .14 Provide a back water valve for each sump pump system.
- .15 When sanitary / drainage pipe penetrates walls or floors, either core drill a hole then seal with proper link seal at both sides or cast in place with a flange that diameter of flange is minimum 150 mm greater than pipe diameter in the middle of the walls or floors then with proper caulking seal both sides.

### **3.2 SERVICE CONNECTION**

- .1 Provide new sanitary sewer services. Before commencing Work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with sufficient slope for drainage and adequate cover to avoid freezing.

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Entire Specification – All areas of common Work.

**1.2 SHOP DRAWINGS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings indicating capacity rating, physical dimensions, wiring diagrams, materials of construction, code compliance, etc. As indicated on schedules.
- .3 Provide operating and maintenance manuals with complete description of product for incorporation into manual specified in Section 01 77 00 – Closeout Submittals.

**1.3 QUALITY ASSURANCE**

- .1 Sump Pumps shall be the product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

**Part 2 Products**

**2.1 ACCEPTABLE MANUFACTURERS**

- .1 Sump Pumps: Myers, Zoeller, Myers, Grundfos.

**2.2 GENERAL**

- .1 Refer to Pump Schedule on drawings for selection.

**2.3 SIMPLEX SUMP PUMP PACKAGE SMP-1 AND 2**

- .1 Basin: 600mm diameter x 1800mm deep pre-Assembled fiberglass basin with
  - .1 Solid Fiberglass Cover with 50mm vent hub
  - .2 Anti Flootation Ring
  - .3 50mm PVC Internal Piping
  - .4 50mm Cast Iron Discharge Check Valves
  - .5 50mm Bronze Isolation Valves
  - .6 Two 100mm Cast Iron inlet Hub to match weeping tile and/or sanitary drain size (Shipping loose)
- .2 Submersible Pump:
  - .1 Durable Epoxy Coated Cast Iron Construction for pump
  - .2 Thermal Overload Protected Motor
  - .3 Non Clogging Vortex Impeller Design
  - .4 Stainless Steel Shaft
  - .5 Dual Mechanical Shaft Seals
  - .6 Silicon Carbide Faces on Lower Seal
  - .7 7.6m (25 ft) Power Cable
  - .8 20mm Solids Handling Capability
  - .9 50mm NPT Discharge
- .2 Control:
  - .1 Simplex Control Panel with Disconnect
  - .2 Thermomagnetic Motor Protectors

- .3 Nema 1 Enclosure
- .4 3 Float Switches
- .5 High Level Alarm Relay for Signal

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with national and local plumbing codes and manufacturer's recommendations.

## **Part 1 General**

### **1.1 SUMMARY**

1. Electric Water Heater

### **1.2 RELATED SECTIONS**

- .1 Entire Specification – All areas of common Work.

### **1.3 REFERENCES**

- .1 National Plumbing Code of Canada 2005.
- .2 Manitoba Plumbing Code 2006.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

### **1.4 GENERAL REQUIREMENTS**

- .1 Provide materials, equipment and labor to install domestic water heater as required by Provincial and Local Codes as specified herein.

### **1.5 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit shop drawings indicating capacity rating, physical dimensions, wiring diagrams, materials of construction, code compliance, etc. As indicated on schedules.
- .3 Provide operating and maintenance manuals with complete description of product for incorporation into manual specified in Section 01 77 00 – Closeout Submittals.

### **1.6 QUALITY INSURANCE**

- .1 The products shall be the product of manufacturer regularly engaged in production of such units who issues complete catalogue data on such products.

## **Part 2 Products**

### **2.1 ACCEPTABLE MANUFACTURERS**

- .1 Electric Water Heater: A O Smith, or approved equals in accordance with B7

### **2.2 GENERAL**

- .1 Construct electric domestic hot water heaters to CSA C22-110, CSA C191 and ASHRAE 90.1-2007.
- .2 Refer to Domestic Water Heater and Expansion Tank Schedules for selections.

### **2.3 ELECTRIC WATER HEATER**

- .1 The heater(s) shall be Gold Series Commercial Electric Model Number DRE-52-9 as manufactured by A. O. Smith. Heater(s) shall be rated at 9 kW, 600 volts, 3 phase, 60 cycle AC, and listed by Underwriters' Laboratories and approved to the NSF Standard 5 by UL. Tank(s) shall be 50 gallon capacity Tanks shall have 150 psi working pressure and be equipped with extruded high density anode. All internal surfaces of the heater(s) exposed to water shall be glasslined with an alkaline borosilicate composition that has been fused-to-steel by firing at a temperature range of 1400°F to 1600°F. Electric heating elements shall be low watt density Goldenrod 1" screw-in type. Each element shall be controlled by an individually mounted thermostat and high temperature cut-off switch. All internal circuits shall be fused. The outer jacket shall be of baked enamel finish and shall be provided with full size control compartment for performance of service and maintenance through hinged front panel and shall enclose the tank with foam insulation. Electrical junction box with heavy duty terminal block shall be provided. The drain valve shall be located in the front for ease of servicing. Heater tank shall have a three year limited warranty as outlined in the written warranty. Manufacturer shall supply ASME rated temperature and pressure relief valve. Fully illustrated instruction manual to be included. Meets standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install in accordance with CAN/CSA B149.1.
- .2 Installation complies with National Plumbing Code of Canada 2005, Manitoba Plumbing Code 2006.
- .3 Install in accordance with manufacturer's recommendations.
- .4 Install domestic water heaters on minimum 100mm thick concrete pad.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Manufacturer's factory trained, certified Contract Administrator to start up domestic water heaters.

#### **3.2 START-UP**

- .1 Provide the services of a factory trained representative to start up the domestic water heaters, test the efficiency and train the operators.
- .2 The water heaters have integral aquastat controls to maintain the hot water at a setpoint of 60°C (140°F).

**Part 1            General**

**1.1                SUMMARY**

- .1    Water Closets
- .2    Lavatories
- .3    Sinks
- .4    Mop Sinks
- .5    Baths
- .6    Showers
- .7    Water tanks
- .8    Composters

**1.2                RELATED SECTIONS**

- .1    Entire Specification – All areas of common Work.

**1.3                REFERENCES**

- .1    National Plumbing Code of Canada 2005.
- .2    Manitoba Plumbing Code 2006.

**SPEC NOTE: Edit to suit standards specified in project specifications.**

- .3    Canadian Standards Association (CSA International).
  - .1    CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2    CAN/CSA-B125, Plumbing Fittings.
  - .3    CAN/CSA-B651, Barrier-Free Design.
  - .4    CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

**1.4                SUBMITTALS**

- .1    Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Closeout Submittal in accordance with Section 01 77 00 - Closeout Submittals.

**Part 2            Products**

**2.1                GENERAL**

- .1    Fixtures: manufacture in accordance with CAN/CSA-B45 and CAN/CSA-B651.
- .2    Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3    Exposed plumbing brass to be chrome plated.
- .4    All “request for equal” on fixtures shall be in accordance with B7.
- .5    Refer to Plumbing Fixture Schedule for specific selections.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install all items in strict accordance with the National Plumbing Code and manufacturer's recommendations and instructions.
- .2 Install each fixture with its own trap, easily removable for servicing and cleaning. At completion thoroughly clean plumbing fixtures and equipment.
- .3 Provide chrome plated rigid or flexible supplies to fixtures with screw driver stops, reducers and escutcheons.
- .4 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA B651.
- .5 Mop Sink (MS-1)
  - .2 Mount mop sink with 6 mm clearance between mop service basin and building wall. Provide 15 mm mortar for entire area between basin and building floor and level the basin.
  - .3 Provide full width x1500H stainless steel plate to protect building wall around the mop basin.

**3.2 START-UP**

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

**3.3 TESTING & 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 flush valves to suit actual Site conditions.
- .2 Checks:
  - .1 Aerators: operation, cleanliness.
  - .2 Vacuum breakers, backflow preventers: operation under all conditions.
  - .3 Water closets & urinals: flushing action.
    - .1 Temperature settings, operation of control, limit and safety controls.

**Part 1 General**

**1.1 SUMMARY**

- .1 Drinking Fountain

**1.2 RELATED SECTIONS**

- .1 Entire Specification – All areas of common Work.

**1.3 REFERENCES**

- .1 National Plumbing Code of Canada 2005.
- .2 Manitoba Plumbing Code 2006.

**SPEC NOTE: Edit to suit standards specified in project specifications.**

- .3 Canadian Standards Association (CSA International).
  - .1 CAN/CSA-B45 Series, Plumbing Fixtures.
  - .2 CAN/CSA-B125, Plumbing Fittings.
  - .3 CAN/CSA-B651, Barrier-Free Design.
  - .4 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.

**2. GENERAL REQUIREMENTS**

- 1. Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth and bright.
- 2. Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.
- 3. Fixtures shall be product of one manufacturer. Fittings of same type shall be product of one manufacturer.
- 4. Protect fixtures against use and damage during construction.

**1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Closeout Submittals in accordance with Section 01 77 00 - Closeout Submittals.

**Part 2 Products**

**2.1 GENERAL**

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 and CAN/CSA-B651.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Refer to Plumbing Fixture Schedule for specific selections.

**2.2 DRINKING FOUNTAIN**

- .1 ACCEPTABLE MANUFACTURERS: ELKAY or approved equals in accordance with B7.
- .2 High-efficiency electric, refrigerated water cooler and bottle filling station. Model LZSG8WS shall deliver 8 GPH of 50°F drinking water at 90°F ambient and 80°F inlet water. Lower unit shall have pushbar activation. Bottle filling unit shall include an electronic sensor for touchless activation with auto 20-second shut-off timer. Shall include Green Ticker™ displaying count of plastic bottles saved from waste. Bottle filler shall provide 1.1 gpm flow rate with laminar flow to minimize splashing. Shall include the WaterSentry® Plus 3000-gallon capacity filter, certified to NSF/ANSI 42 and 53, with visual monitor to indicate when replacement is necessary. Shall include integrated silver ion anti-microbial protection in key areas. Unit shall meet ADA guidelines. Unit shall be lead-free design which is certified to NSF/ANSI 61 and 372 and meets Federal and State low-lead requirements. Unit shall be certified to UL399 and CAN/CSA 22.2 No. 120. Unit shall be GreenSpec® Listed

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Installation complies with National Plumbing Code of Canada 2005, Manitoba Plumbing Code 2006 and City of Winnipeg by law.
- .2 Prior to rough-in consult with local, state and federal codes for proper mounting height and manufacturer's instructions.
- .3 Check millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
- .4 Removable lower panel provides easy access for installation Fixtures Rough-In Schedule
- .5 Mount fixtures the following heights above finished floor:

Standard	750 mm (30") to 1000 mm (40") to top of basin rim
Handicapped	900 mm (36") to top of basin rim

**3.2 ADJUSTING**

- .1 Adjust water flow rate to design flow rates.
- .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .1 Adjust drinking fountain flow stream to ensure no spillage.