

Senior Services and Long-Term Care
City Of Toronto

CASTLEVIEW WYCHWOOD TOWERS
Interior Upgrades

PROJECT MANUAL
VOLUME 2
(2 OF 2)

ISSUED FOR TENDER
December 2024

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MSA PROJECT NO: 21503.F03

MONTGOMERY SISAM ARCHITECTS INC.
CROSSEY ENGINEERING LTD.
CROSSEY ENGINEERING LTD.

ARCHITECTURAL
MECHANICAL
ELECTRICAL

NO	2
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CASTLEVIEW WYCHWOOD TOWERS
351 CHRISTIE ST,
TORONTO, ON M6G 3C3

MECHANICAL SPECIFICATION

ISSUED FOR TENDER

Dec'2024



Prepared for:
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CEL PROJECT No : 24503-03

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END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

1.2 SHOP DRAWINGS

1.2.1 Submit shop drawings in accordance with Section 22 05 01.

1.2.2 Submit for approval, manufacturer's catalogue literature related to installation and fabrication.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 Supply access doors to the relevant building trade to provide access in furred ceilings and walls for the following:

- .1 Servicing equipment
- .2 Access to plumbing cleanouts
- .3 Access to shut off valves.
- .4 Inspection of life safety equipment.
- .5 Service of operating devices
- .6 All locations where periodic preventative maintenance is required.

2.1.2 Access door sizes shall be as follows:

- .1 Body Entry: 600 x 600 mm (24" x 24")
- .2 For Hand Entry: 450 x 450 mm (18" x 18")
- .3 For Viewing Only: 300mm x 300mm (12" x 12")

2.1.3 All doors shall open 180 degrees and have rounded safety corners

2.1.4 For fire rated ceilings or walls that require fire rated access doors, provide a fire rated access door that matches the fire rating of the wall/ceiling that the access door is installed in. The Division 21/22/23/25 Contractor shall be responsible for reviewing the drawings and providing fire rated access doors where they are required.

2.1.5 Where body access is possible the access doors shall be provided with a releasing mechanism on both sides of the door.

2.2 RECESSED ACCESS DOOR FOR DRYWALL APPLICATIONS

- 2.2.1 Door shall be 20 gauge steel. Mounting frame shall be 26 gauge galvanized steel.
- 2.2.2 Door shall be provided with a 25 mm (1") recess or 14mm (5/8") to suit the thickness of the drywall ceiling.
- 2.2.3 The frame shall be provided with a galvanized steel drywall taping bead on all sides.
- 2.2.4 The hinge shall be a concealed pivoting rod.
- 2.2.5 The latch shall be a flush to the surface, screwdriver operated cam latch.
- 2.2.6 For steel doors the finish shall be a 5 stage iron phosphate preparation with prime coat of grey baked enamel.
- 2.2.7 Standard of Acceptance: Acudor DW-5040, Mifab, Zurn, Watrous, Williams Brothers

2.3 RECESSED ACCESS DOOR FOR PLASTER APPLICATIONS

- 2.3.1 Door shall be 16 gauge steel. Mounting frame shall be 14 gauge galvanized steel.
- 2.3.2 Door shall be provided with a 14mm (5/8") recess and shall be lined with self-furring galvanized lath.
- 2.3.3 The frame shall be provided an expansion casing bead with 75 mm (3") wide galvanized lath, recessed 20mm (3/4") to receive plaster.
- 2.3.4 The hinge shall be a concealed pivoting rod.
- 2.3.5 The latch shall be a flush to the surface, screwdriver operated cam latch.
- 2.3.6 For steel doors the finish shall be a 5 stage iron phosphate preparation with prime coat of grey baked enamel.
- 2.3.7 Standard of Acceptance: Acudor AP-5010, Mifab, Zurn, Watrous, Williams Brothers

2.4 FLUSH ACCESS DOORS FOR TILED WALL APPLICATIONS

- 2.4.1 For doors 300mm x 300mm (12" x 12") and smaller the door and frame shall be 20 gauge.
- 2.4.2 For doors over 375 mm x 375 mm (15" x 15") the door and mounting frame shall be 18 gauge.
- 2.4.3 Door shall be flush to frame with rounded safety corners.
- 2.4.4 The frame shall be one piece welded to the mounting frame.
- 2.4.5 The hinge shall be a continuous concealed hinge.
- 2.4.6 The latch shall be a stainless steel screwdriver cam latch.

- 2.4.7 The finish shall be type 304 #4 satin polish stainless steel.
- 2.4.8 Standard of Acceptance: Acudor UF-5000, Mifab, Zurn, Watrous, Williams Brothers
- 2.5 FIRE RATED ACCESS DOOR WITH INSIDE LATCH RELEASE
 - 2.5.1 Door shall be constructed of 16 gauge steel with a 16 gauge mounting frame.
 - 2.5.2 Door shall be flush to frame with reinforced edges.
 - 2.5.3 The door frame shall be provided with a 25 mm (1") wide flange and shall be provided with anchor straps.
 - 2.5.4 The hinge shall be concealed and shall be provided with a spring closer.
 - 2.5.5 The door shall be UL/ULC rated for 1 ½ hour "B" label or 2 hour "B" label as required where temperature rise is not a factor.
 - 2.5.6 The latch shall be a universal self latching bolt, operated by either a knurled knob.
 - 2.5.7 For steel doors the finish shall be a 5 stage iron phosphate preparation with prime coat of grey baked enamel.
 - 2.5.8 Door shall be provided with an interior latch release.
 - 2.5.9 For drywall applications provide a galvanized steel drywall taping bead flange.
 - 2.5.10 Standard of Acceptance: Acudor FW-5060, Mifab, Zurn, Watrous, Williams Brothers
- 2.6 VALVE BOX – SURFACE MOUNT
 - 2.6.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.
 - 2.6.2 Door and box shall be 16 gauge steel.
 - 2.6.3 The door shall overlap the box, providing a tight and secure fit.
 - 2.6.4 The box shall be fully enclosed, attached to the door.
 - 2.6.5 The hinge shall be a continuous piano hinge.
 - 2.6.6 The door shall be provided with a cylinder lock and key.
 - 2.6.7 For steel doors the finish shall be a 5 stage iron phosphate preparation with prime coat of grey baked enamel.
 - 2.6.8 Stainless steel doors shall be #4 satin finish.
 - 2.6.9 Standard of Acceptance: Acudor ASVB, Mifab, Zurn, Watrous, Williams Brothers

2.7 VALVE BOX – RECESSED

- 2.7.1 Door shall be stainless steel in public areas and steel in mechanical rooms and service areas.
- 2.7.2 Door and box shall be 16 gauge steel.
- 2.7.3 The door shall be flush to the frame with rounded safety corners.
- 2.7.4 The box shall be fully enclosed, completely attached to the frame.
- 2.7.5 The hinge shall be a continuous concealed hinge.
- 2.7.6 The door shall be provided with a cylinder lock and key.
- 2.7.7 For steel doors the finish shall be a 5 stage iron phosphate preparation with prime coat of grey baked enamel.
- 2.7.8 Stainless steel doors shall be #4 satin finish.
- 2.7.9 Standard of Acceptance: Acudor ARVB, Mifab, Zurn, Watrous, Williams Brothers.

PART 3 - EXECUTION

3.1 INSTALLATION

- 3.1.1 On some drawings, access door locations have been indicated for coordination. The drawings do not show all access doors required.
- 3.1.2 The Mechanical Contractor shall provide a set of drawings showing locations and types of all access doors located in public areas to the Consultant for approval, prior to commencing the installation of any piping or ductwork within these areas.
- 3.1.3 The Mechanical Contractor shall turn access doors over to the building trade that is responsible for finishing the wall or ceiling where the access door is required to be installed.
- 3.1.4 The Mechanical Contractor shall be responsible for providing the access doors required to be installed in ductwork. Refer to Section 23 33 00 for requirements.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

1.1 REFERENCE STANDARDS

1.1.1 Do work in accordance with the recommendations and requirements of:

- .1 NFPA 10 - 2022 for portable fire extinguishers.
- .2 Ontario Building Code.
- .3 Ontario Fire Code.
- .4 City of Toronto.

1.2 SHOP DRAWINGS AND PRODUCT DATA

1.2.1 Submit shop drawings and product data in accordance with Section 22 05 01.

1.3 MAINTENANCE DATA

1.3.1 Provide maintenance data for incorporation into manual specified in Section 22 05 02.

PART 2 - PRODUCTS

2.1 MULTI-PURPOSE DRY CHEMICAL AND CO2 EXTINGUISHERS

2.1.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled for A, B and C Class protection. Sizes are as follows:

Location	Agent	Capacity	Manufacturer
Fire Extinguisher Cabinets as indicated in the drawings.	ABC	5 Lb	Wilson and Cousins ABC-050

2.1.2 Standard of Acceptance: Wilson & Cousins, Ansul, Pyrene, Flag, National Fire

2.2 FULLY RECESSED PAINTED STEEL CABINETS FOR 5 lb DRY CHEMICAL EXTINGUISHERS

- 2.2.1 Flush mounted fire extinguisher cabinet constructed of 22 ga (0.76mm) steel tub and 16 ga. (1.57mm) steel door and trim with 1/4" (6mm) return frame. Tub dimension to be 200mm x 425mm x 125mm (8" x 17" x 5").
- 2.2.2 Cabinet shall be able to be installed in a 125mm (5") thick wall.
- 2.2.3 Cabinet to have a full length semi concealed piano hinge and flush stainless steel door latch.
- 2.2.4 Door to be metal panel with 5mm (3/16") safety glass panel 101mm x 330mm (4" x 13").
- 2.2.5 Cabinet finish shall to be white baked enamel suitable for field painting or as a final finish.
- 2.2.6 Cabinet to maintain fire resistive rating of construction in which they occur.
- 2.2.7 Standard of Acceptance: National Fire Equipment 102F, Stelpro, Wilson and Cousins.

2.3 IDENTIFICATION

- 2.3.1 Identify extinguishers in accordance with recommendations of NFPA 10.
- 2.3.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.
- 2.3.3 Provide rigid plastic fire extinguisher sign. Sign to be screen printed with UV inks. Holes to be spaced more than 125mm (5") apart to provide 3D effect.

PART 3 - EXECUTION

3.1 INSTALLATION

- 3.1.1 Provide portable fire extinguisher and cabinet and mount in wall during construction. Cabinet to be surface or recessed as noted on the drawings.
- 3.1.2 Install extinguishers in cabinets or mount on wall.
- 3.1.3 Prior to installing the extinguisher cabinets confirm mounting height and exact location with Consultant.
- 3.1.4 Install all fire extinguisher signs above extinguishers.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

1.1.2 Refer to Section 22 05 02 for maintenance manual requirements.

1.2 ENGINEERING STAMPS

1.2.1 All shop drawings, hydraulic calculations, as built drawings and letter of compliance shall be stamped and sealed by a Professional Engineer registered in the Province of Ontario.

1.3 CONTRACTORS

.1 Acceptable Contractors are as follows:

.2 Grinnell.

.3 Paul and Douglas.

.4 Viking.

.5 Vipond.

.6 Classic.

.7 Forest City Fire Protection.

1.4 SCOPE OF WORK

1.4.1 The Sprinkler Contractor shall be responsible for the installation of a complete sprinkler system. The Sprinkler Contractor shall be responsible for all of the work associated with this system from first isolation valve on the sprinkler/standpipe system.

1.5 SYSTEMS

1.5.1 Wet pipe sprinklers shall be provided throughout the areas being renovated.

1.6 REFERENCES

1.6.1 National Fire Prevention Association (NFPA)

.1 NFPA 13 - 2022, Standard for the Installation of Sprinkler Systems.

.2 NFPA 20-2022, Standard for the Installation of Stationary Pumps for Fire Protection.

.3 NFPA 25-2023, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.6.2 Underwriter's Laboratories of Canada (ULC) Hose.

1.6.3 Ontario Building Code

1.6.4 City of Toronto.

1.7 SCOPE OF WORK

1.7.1 The Sprinkler Contractor shall be responsible for the installation of a complete sprinkler system from the first isolation valve on the incoming fire main. Division 22 shall be responsible for all piping prior to this take off.

1.7.2 Division 22 and the Sprinkler Contractor shall coordinate the location of sprinkler and fire main lines with all other trades prior to the installation of any piping. No extras will be considered for onsite conflicts with other trades due to the lack of coordination.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

1.8.1 Provide submittals in accordance with Front End Documents and Section 22 05 01.

1.8.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

1.8.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Ontario.

.2 Submit shop drawings in accordance with Section 22 05 01.

.3 Indicate:

.1 Materials.

- .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.
 - .7 Assembly details.
 - .8 Accessories.
- .4 Provide hydraulic calculations for all zones, most remote location, highest location and all specialty areas including window sprinklers, close spaced sprinklers, and deluge systems. Hydraulic calculations and submissions to be in accordance to the following and this specification:
 - .1 NFPA 13 – Latest edition
- .5 Obtain approval from authority having jurisdiction prior to fabrication and installation of the system. Bear all costs associated with such approval.
- 1.8.4 Zoning
 - .1 Refer to drawings for system zoning requirements.
- 1.8.5 Samples:
 - .1 Submit samples of following:
 - .1 Signs.
- 1.8.6 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- 1.8.7 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- 1.8.8 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.8.9 Field Quality Control Submittals:

- .1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.9 CLOSEOUT SUBMITTALS

- 1.9.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Front End Documents, Section 22 05 02 and in accordance with NFPA 13, 14 and 20.

1.9.2 Manufacturer's Catalog Data, including specific model, type, and size for:

- .1 Pipe and fittings.
- .2 Valves, including gate, check, and globe.
- .3 Sprinkler heads.
- .4 Pipe hangers and supports.
- .5 Pressure or flow switch.
- .6 Mechanical couplings.

1.9.3 Drawings:

- .1 Sprinkler heads and piping system layout.
 - .1 Prepare detailed working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Show piping schematic of systems supply, devices, valves, pipe, and fittings. Show point to point electrical wiring diagrams.
 - .5 Refer to the Architectural Reflected ceiling plans. Where there is a discrepancy between the Mechanical and Architectural plans bring this to the attention of the Department Representative for a decision.
- .2 Electrical wiring diagrams.

1.9.4 Design Data:

- .1 Calculations of sprinkler system design.
- .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

1.9.5 Field Test Reports:

- .1 Preliminary tests on piping system.

1.9.6 Records:

- .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit drawings in electronic format.

1.9.7 Operation and Maintenance Manuals:

- .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground piping and other documentation for incorporation into manual in accordance with Section 22 05 02 and NFPA 13.

1.10 CERTIFICATES

- 1.10.1 Provide written certificate that components are compatible, and where applicable, certified for intended use by a nationally recognized testing agency.
- 1.10.2 Provide written certificate that the Fire Protection system installation conforms to the National Building Code, local building codes, NFPA, and mechanical requirements.
- 1.10.3 Provide sign off certificate at the completion of the project indicating that the system has been installed in accordance with the OBC and NFPA requirements.

1.11 QUALITY ASSURANCE

- 1.11.1 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.12 MAINTENANCE MATERIAL SUBMITTALS

1.12.1 Extra Materials:

- .1 Provide maintenance materials in accordance with the Front End Documents and Section 22 05 02.
- .2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.13 DELIVERY, STORAGE AND HANDLING

1.13.1 Deliver, store and handle materials in accordance with Front End Documents and with manufacturer's written instructions.

1.13.2 Storage and Protection:

- .1 Store materials indoors.
- .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.13.3 Packaging Waste Management: remove for reuse and return in accordance with Front End Documents.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

2.1.1 Design automatic wet pipe fire suppression sprinkler systems in accordance with the following:

- .1 Required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

2.1.2 Hazard

Space	Hazard
Washroom Areas	Light Hazard

2.1.3 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

2.1.4 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

2.1.5 Extra Large Orifice Heads (ELO) and/or Extended Coverage Heads shall not be utilized unless they are indicated on the drawings. Drawings that are submitted which do not conform to the layout shown on the Mechanical Drawings and reflected ceiling plan will be rejected without further review.

2.1.6 Sprinklers with Flexible Connections shall not be utilized.

- 2.1.7 Provide sprinkler head layout in strict conformance to Mechanical layout drawings, architectural reflected ceiling plans, and NFPA 13. Where conflict exists, the contractor shall notify the consultants in writing for a decision.
- 2.1.8 For light hazard applications the sprinkler system hydraulic design must allow for two hose cabinets operating at 100 usgpm simultaneously in addition to the sprinkler requirements.
- 2.1.9 Hydraulic design in office areas shall have the capacity to serve a minimum of ten (10) additional heads at the most remote 1,500 sq.ft. area of application and/or to serve office areas with 30% increase in sprinkler heads. The hydraulic design shall be for the most extreme case.
- 2.1.10 Minimum discharge pressure for any sprinkler head shall be as required by the sprinkler head.
- 2.1.11 Maximum velocity in sprinkler pipe distribution piping shall be 7.62 m/sec. (25 ft/sec.).
- 2.1.12 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- 2.1.13 Design systems for earthquake protection for buildings in seismic zones [3] and [4], and only essential and high risk buildings in seismic zone [2].
- 2.1.14 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed [that permitted by the following:
 - .1 NFPA 13
 - .2 Uniformly space sprinklers on branch.
- 2.1.15 A single air vent shall be installed near a high point in the system to allow air to be removed from that portion of the system to purge air from the system while it is being filled.
- 2.1.16 Water Distribution:
 - .1 Make distribution uniform throughout the area in which sprinkler heads will open.
 - .2 Discharge from individual heads in hydraulically most remote area to be [100] % of specified density.
- 2.1.17 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
- 2.1.18 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote area as defined in NFPA 13.

2.1.19 Outside Hose Allowances:

- .1 Include allowance in hydraulic calculations for outside hose streams.

2.1.20 Friction Losses:

- .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

2.1.21 Water Supply:

- .1 Since the area under renovation is a small portion with respect to the base building, the base building flow and pressure conditions have been assumed adequate for sprinkler protection for the areas being renovated.

2.1.22 Pipe locations:

- .1 Sprinkler lines may have been shown on the drawings. Sprinkler lines are shown for purposes of coordination, indication of available space, and aesthetics. Do not deviate from sprinkler pipe layout shown without prior approval.

2.2 ABOVE GROUND PIPING SYSTEMS

2.2.1 Provide fittings for changes in direction of piping and for connections.

- .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will [not] be permitted.

2.3 PIPE, FITTINGS AND VALVES

2.3.1 Steel pipe:

- .1 Joined by Welding or Roll Grooved:
 - .1 Welding methods shall comply with all of the requirements of AWSI D10.9, Specification for Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3.
 - .2 Pipe joined with grooved fittings shall be joined by a UL listed and FM approved combination of fittings, gaskets, and grooves. Grooves cut or rolled on pipe shall be dimensionally compatible with the fittings.
 - .3 Nominal wall thickness for pressures up to 300 psi (2070 kPa) shall be in accordance with following table:

Pipe Size	Thickness
Up to NPS 5	Schedule 10 for wet systems Schedule 40 for dry systems
NPS 6	0.134 in. (3.40 mm)
NPS 8 and 10	0.188 in. (4.78 mm)

- .4 For all dry pipe and pre-action systems the longitudinal weld in the pipe

shall be installed in the vertical position at the top of the pipe.

.2 Joined by Thread Fittings or by Fittings Having Cut Grooves

- .1 All threaded pipe and fittings shall have threads cut to ANSI/ASME B1.20.1, Pipe Threads, General Purpose.
- .2 Nominal wall thickness for pressures up to 300 psi (2070 kPa) shall be in accordance with the following table:

PIPE SIZE	THICKNESS
Under NPS 8	Schedule 40
NPS 8 and over	Schedule 30

.3 Fittings: 175 psi (1200 kPa) working pressure.

- .1 Cast iron screwed to ANSI B16.4, 150 psi (1000 kPa).
 - .2 Malleable iron, screwed to ANSI B16.3, 150 psi (1000 kPa).
 - .3 Cast iron flanged to ANSI B16.1, 150 psi (1000 kPa).
 - .4 Mechanical groove coupling to ANSI B31.3, 150 psi (1000 kPa).
- .4 Flange bolts: square or hex head bolts with heavy hex nuts to ASTM A307.
- .5 Flange gaskets: 1/16" (1.6 mm) thick plain or cloth inserted red rubber to ANSI B16.20 and ANSI B16.21.
- .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
- .7 For all dry pipe and preaction systems the minimum pipe thickness shall be schedule 40. Light wall pipe will not be accepted.
- .8 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied are not permitted.
- .9 Side outlet tees using rubber gasketed fittings are not permitted.

2.3.2 Copper tube:

- .1 To NFPA 13.
- .2 Screwed, soldered, brazed, grooved.

2.3.3 Valves:

.1 GATE VALVES

- .1 NPS 2 and under: bronze to ASTM B61 double disc and screwed ends.
- .2 NPS 2 1/2 and over: Factory Mutual approved and Underwriters' Laboratories pattern, ductile iron body, bronze mounted, with OS&Y

EPDM coated iron disc, double disc or wedge, grooved or flanged ends.
Standard of Acceptance: Victaulic Series 771H.

.2 GLOBE VALVES

- .1 NPS 2 and under: bronze to ASTM B61 screwed ends, composition disc replaceable without removing valve from line.
- .2 NPS 2 1/2 and over: iron body, bronze mounted, OS&Y, flanged ends bolted bonnet and yoke, bronze seat, solid bronze disc, seat and disc replaceable without removing valve from line.

.3 BUTTERFLY VALVES

- .1 Factory Mutual approved and Underwriters Laboratories approved, iron body, electroless-nickel coated ductile iron or bronze disc, pressure responsive seat or resilient replaceable liner seat, stainless steel stem, plain, flanged or grooved ends. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Standard of Acceptance: Victaulic Series 705.
- .2 Actuator housings shall be weatherproof, and include a handwheel, with two single-pole double-throw, supervisory switches.

.4 CHECK VALVES

- .1 NPS 2 and under: bronze to ASTM B61 for both horizontal and vertical mounting with replaceable composition disc, screwed cap and ends.
- .2 NPS 2 1/2 and over: Underwriters' Laboratories pattern, ductile iron body, bronze or stainless steel mounted, regrind renew bronze disc and seat ring, elastomer coated disc with welded-in nickel seat, or stainless steel disc with elastomer seal, one-piece grooved ends or bolted cap flanged ends. Design for either horizontal or vertical mounting. Standard of Acceptance: Victaulic Series 717.

.5 ALARM CHECK VALVE

- .1 Alarm check valve to NFPA 13 and ULC listed for fire service.
- .2 Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for proper operation of system.
- .3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.

2.3.4 Pipe hangers:

- .1 ULC listed for fire protection services in accordance with NFPA and Section 23 05 29 of the specification.

2.4 SIGNS

2.4.1 Fabricated from metal with chain suspension; white letters on red background.

2.5 SPRINKLER HEADS

2.5.1 General: to NFPA 13 and ULC listed for fire services.

2.5.2 Sprinkler Head Type:

- .1 Refer to the drawings for the location of each type of sprinkler head.
- .2 Upright: bronze.
- .3 Pendant: chrome glass bulb type.
- .4 Recessed: Chrome glass bulb type with ring and cup.
- .5 Flush Mounted (Concealed): White Cover Plate, brass with glass bulb.
- .6 Flush Mounted (Concealed) Custom Coloured: Custom Colour sprinkler head (where shown on the drawings, brass with glass bulb.
- .7 Side wall: Chrome with glass bulb and escutcheon.

2.5.3 Provide non-standard temperature rating sprinkler heads in accordance to code, including:

- .1 Sprinkler heads in proximity to unit heaters: Intermediate classification 225 F (107 C).
- .2 Elevator Machine Room: Intermediate classification 225 F (107 C).
- .3 Skylights: Intermediate classification 225 F (107 C).
- .4 Attics: Intermediate classification 225 F (107 C)

2.6 SUPERVISORY SWITCHES

2.6.1 General: to NFPA 13 and ULC listed for fire service.

2.6.2 Valves:

- .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

2.6.3 Pressure or flow switch type:

- .1 With normally open and normally closed contacts and supervisory capability.
- .2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
- .3 Connect into building Fire Alarm System.

- .4 Connection of switch: Section 28 31 00 - Fire Detection and Alarm.
- .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.
- 2.6.4 Pressure alarm switch:
 - .1 With normally open and normally closed contacts and supervisory capability.
- 2.7 PRESSURE GAUGES
 - 2.7.1 ULC listed and to Section 23 05 19 - Thermometers and Pressure Gauges – Piping Systems.
 - 2.7.2 Maximum limit of not less than twice normal working pressure at point where installed.
- 2.8 PIPE SLEEVES
 - 2.8.1 Provide pipe sleeves where piping passes through walls, floors and roofs.
 - 2.8.2 Secure sleeves in position and location during construction.
 - 2.8.3 Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs.
 - 2.8.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
 - .1 Firmly pack space with mineral wool insulation.
 - .2 Seal space at both ends of sleeve or core-drilled hole with[plastic waterproof cement which will dry to firm but pliable mass,] [provide mechanically adjustable segmented elastomeric seal].
 - .3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.
 - 2.8.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide sleeves in accordance with Section 22 05 01.
 - .2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.
 - 2.8.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.
- 2.9 ESCUTCHEON PLATES
 - 2.9.1 Provide one piece type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

2.9.2 Provide polished chromium-plated finish on copper alloy plates in finished spaces.

2.9.3 Provide paint finish on metal plates in unfinished spaces.

2.10 INSPECTOR'S TEST CONNECTION

2.10.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

2.10.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

2.10.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.11 SIGNS

2.11.1 Attach properly lettered and approved metal signs to each valve and alarm device to NFPA 13.

2.11.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.12 SPARE PARTS CABINET

2.12.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

2.13 EXECUTION

2.14 MANUFACTURER'S INSTRUCTIONS

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

2.15 INTERFERENCE DRAWINGS

2.15.1 Provide interference drawings as required to coordinate work with other trades.

2.15.2 Refer to Section 22 05 01 for requirements.

2.15.3 Refer to details on drawings and locate sprinkler lines to avoid interference with lights, ductwork and other equipment in the ceiling space.

2.15.4 Main sprinkler lines have been shown to show routing of pipes in congested areas. Refer to sections for the elevation assigned for the sprinkler piping. Work closely with the Division 22 and Division 23 Contractor to prepare interference drawings.

2.16 INSTALLATION

2.16.1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

2.16.2 Locate sprinkler heads as shown on architectural reflected ceiling plans and at center lines of panels as required to produce orderly and symmetrical patterns with other ceiling-mounted devices and to meet or exceed the requirements of authorities having jurisdiction.

2.16.3 All sprinkler piping shall be installed so that all parts of each system may be thoroughly drained, preferably at the main drain valve. All trapped heads in excess of five heads shall be provided with drain valves and cast iron plug. Low points where more than twenty heads are trapped shall be provided with an auxiliary drain valve.

2.16.4 Provide sprinkler head guards in mechanical rooms, shafts, elevator machine rooms, storage rooms, and as specified or as shown on the drawings.

2.16.5 Installation of sprinkler mains in exposed areas shall be in accordance with main locations shown on the mechanical drawings.

2.16.6 Provide test and drain connections to meet NFPA 13. Pipe discharge lines as shown on the drawings or to floor drains or service sinks. Do not discharge to the building exterior.

2.17 INSPECTION

2.17.1 Do not recess, paint or conceal piping accessories or work prior to inspection and approval by authorities having jurisdiction or authorized representative.

2.18 PIPE INSTALLATION

- 2.18.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- 2.18.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- 2.18.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- 2.18.4 Allow for expansion and contraction when installing pipe hangers.
- 2.18.5 Discharge drains to safe location in interior of building to visible point of free discharge.
- 2.18.6 Install signs required by local fire protection department.
- 2.18.7 Secure outdoor signs with stainless steel bolts.
- 2.18.8 Inspect piping before placing into position.
- 2.18.9 Provide flow switches where indicated on the drawings.
- 2.18.10 Provide pressure switch location shown on the drawings to supervise loss of water pressure.

2.19 VALVE IDENTIFICATION:

- 2.19.1 Identify drain valve, by-pass valves and main shut-off valve and all auxiliary valves.

2.20 SIGNAGE

- 2.20.1 Provide signs in accordance with NFPA 13 requirements.

2.21 ELECTRICAL CONNECTIONS

- 2.21.1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- 2.21.2 Provide control wiring, including connections to fire alarm systems, in accordance with National Electrical Code.
- 2.21.3 Provide wiring in rigid metal conduit or intermediate metal conduit in accordance with Division 26 of the specification.

2.22 DISINFECTION

- 2.22.1 Disinfect new piping upstream of the alarm check valve.
- 2.22.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

2.22.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

2.22.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

2.23 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

2.23.1 Notify Contracting Officer in writing at least 15 days prior to connection date.

2.23.2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.

2.23.3 Bolt sleeves around main piping.

2.23.4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.

2.23.5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

2.23.6 Disinfect in accordance with requirements listed above.

2.24 FIELD QUALITY CONTROL

2.24.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Consultant.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 200 psig for a 2 hour period with no leakage or reduction in pressure.

.2 When testing with water, install pressure gauge at highest point of installation.

.3 If impossible to test whole installation in single operation, subdivide into several zones and test each zone in manner described.

.4 Flush piping with potable water in accordance with NFPA 13.

.5 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.6 Test alarms and other devices.

- .7 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
 - .8 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.
 - .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least [15] days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish appliances, equipment, instruments, connecting devices and personnel for tests.
 - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- 2.24.2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work.
- 2.24.3 Site Tests:
 - .1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing shall include:
 - .1 Verification of proper installation, system initiation, adjustment and fine tuning.
 - .2 Verification of the sequence of operations and alarm systems.
 - .2 Testing to be witnessed by authority having jurisdiction.
- 2.25 ADJUSTMENT
 - 2.25.1 Adjust equipment to satisfaction of authorities having jurisdiction.

2.26 CLEANING

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

2.27 PROTECTION OF COMPLETED WORK

2.27.1 Assume responsibility for protecting sprinkler heads during painting. Replace damaged and painted components.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification is an integral part of the Contract Documents and shall be read accordingly.

1.1.2 The General Conditions of the Contract, the Supplementary Conditions and all Sections of Division 0 and 1 - General Requirements shall be deemed to apply and be a part of this section of the specification as fully as if recited in full herein.

1.1.3 Definition

.1 Mechanical Contractor: The term "Mechanical Contractor" is used within this specification when referring to the Division 21, 22 and 23 Contractor.

1.1.4 All portions of the Supplementary Bid Form - Mechanical shall be submitted by bidders on this Division of the Work.

1.2 PREQUALIFIED SUB CONTRACTORS TO THE MECHANICAL CONTRACTOR

1.2.1 Where identified, pre-qualified subcontractors have been named for specific sub contracts. When so identified, the bid from the Mechanical Contractor shall include one of the pre-qualified contractors, and the name of the selected Contractor shall be included in the Mechanical Supplementary Tender Form.

1.2.2 Contractors for the trades identified and not included on the pre-qualified list may be named in the Mechanical Supplementary Tender Form as an alternate supplier, with a cost savings. The Owner will decide to accept or reject the proposed alternate. Under no circumstances should the Mechanical Contractor carry any Alternate Price in his base bid.

1.2.3 Carrying an Alternate Contractor or Alternate Supplier in the base bid submitted on the Supplementary Tender Form will result in the bid being disqualified.

1.2.4 Pre-qualified Sub Contractors for this project are:

1.2.5 The Mechanical Contractor shall provide all required test ports and assistance required by the Air and Hydronic Balancing Contractor.

1.2.6 The Air and Hydronic Balancing Contractor shall be one of the following:

.1 Dasstab.

.2 Design Test and Balance.

.3 VPG.

.4 Flowset.

.5 ProAir.

1.3 INTENT

- 1.3.1 Bidders for work under this Division shall include for all labor, material, equipment and all other related cost including all applicable taxes and fees to provide the complete mechanical work specified in Division 21, 22, 23 and 25 and shown on the mechanical drawings, and all mechanical work noted in the specifications and shown on the drawings for other Divisions of this Contract as being the responsibility of the Mechanical Contractor.
- 1.3.2 Misinterpretation of any requirement of the drawings and specifications will not relieve the Mechanical Subcontractor of responsibility to complete the specified work. If in any doubt, the Subcontractor shall contact the Consultant for written clarification prior to submitting a bid for the Work.
- 1.3.3 The Mechanical Contractor shall assume full responsibility for the entire mechanical installation noted in the specifications and drawings. Demarcation of the responsibilities among various mechanical sub trades shall be the sole responsibility of the Mechanical Contractor.

1.4 CONTRACT

- 1.4.1 The mechanical drawings do not show all the Architectural and structural details, and any Specifications information involving accurate measuring of the building shall be taken from the building drawings or at the building. Make without additional charge, any necessary changes or additions to the runs of drains, pipes, ducts, etc., to accommodate the above conditions. The location of equipment may be altered without charge providing the change is made before installation and does not necessitate major additional material. The Architectural, Structural, and Electrical drawings may show details relevant to the mechanical systems and should be referred to equally with the Mechanical drawings.
- 1.4.2 Wherever differences occur between plans and riser diagrams or schematics and drawings, the maximum conditions shall govern and the bid shall be based on whichever indicates the greater cost.
- 1.4.3 Field verifications of dimensions on plans shall be made since actual locations, distances, and levels will be governed by actual field conditions.
- 1.4.4 Discrepancies between different plans, or between plans and actual field conditions, or between plans and specifications shall promptly be brought to the attention of the Consultant for a decision.
- 1.4.5 As the work progresses and before installing apparatus, equipment, fixtures and devices which may interfere with the interior treatment and use of the building or with the work of other trades, provide interference drawings and consult with the Consultant for instructions for the exact locations of all drains, pipes, ducts, and equipment. Refer to Division 1 specification Section 01 31 00 – Project Management and Coordination and provide information and interference drawings as may be required by this Section.
- 1.4.6 Install all mechanical services including but not exclusive to drains, pipes, and ducts, to conserve headroom and interfere as little as possible with the free use of the

- space through which they pass. All drains, pipes, ducts, etc., particularly those which may interfere with the inside treatment of the building, or conflicting with other trades, shall be installed only after the locations have been approved by the Consultant. Special care shall be taken in the installation of all mechanical services including, but not exclusive to drains, pipes, and ducts, which are to be concealed to see that they come within the finished lines of floors, walls, and ceilings. Where such drains, pipes, ducts, etc., have been installed in such a manner as to cause interference, they shall be removed and re-installed in suitable locations without extra cost to the owner.
- 1.4.7 Before commencing work, check and verify all grade and invert elevations, levels, and dimensions, to ensure proper and correct installation of the work.
 - 1.4.8 In every place where there is space indicated as reserved for future or other equipment, leave such space clear, install blank offs, shut off valves with blind flanges and other work so that the necessary connections can be made without any stoppages to the system. Consult with the consultant whenever necessary for this purpose.
 - 1.4.9 In addition to the work specifically mentioned in the specifications and shown on the drawings, provide all other items that are obviously necessary to make a complete working installation, including those required by the authorities having jurisdiction over the work.
 - 1.4.10 Install all ceiling mounted components (diffusers, grilles, etc.) in strict accordance with reflected ceiling plans, and instructions from the Consultant.
 - 1.4.11 The mechanical plans show approximate locations for wall mounted devices. Obtain Consultant's approval of mounting heights and locations before commencement of work.
 - 1.4.12 The Mechanical Contractor shall provide a list of the foreman for each trade who will be involved with this project prior to the start of construction. The list is to contain their credentials and a list of previous projects that they have been involved with.
 - 1.4.13 The Mechanical Contractor is responsible for coordinating the installation of the mechanical services with the Electrical, Sprinkler and Structural elements within the building. Provide coordination/interference drawings prior to installation of the services in accordance with item 1.5 of this section of the specification and include in the Mechanical bid price the cost of all minor offsets of ductwork, piping, etc to coordinate the installation of the services.
 - 1.4.14 The approximate location of terminal devices such as thermostats, humidistats, sinks, water closets, lavatories, sprinkler heads, grilles and diffusers etc located within the finished space are shown on the mechanical drawings. The dimensioned location for these devices is to be obtained from the Architectural drawings. Where these devices are not dimensioned on the Architectural drawings request the final elevation and location from the Design Group prior to installation. Locate the devices within 1.5 metres of the position shown on the Mechanical Drawings at no cost to the Owner.
 - 1.5 EXAMINE SITE

1.5.1 Examine the site and the local conditions and Conditions affecting the work. Examine carefully the Architectural, Structural, Mechanical, Electrical and all other drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown. Before commencing work, examine the work of the other Divisions and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Consultant.

1.6 PROGRESS PAYMENTS

1.6.1 Refer to Section 22 05 03 - Progress Draw.

1.6.2 Please pay particular attention to the requirement for cash allowances for both the TAB Contract and for the Submission of Schedules.

1.6.3 Please note the requirement to allocate 10% of the Control Contract (up to a maximum of \$75,000) for the provision of testing, trending and trend reporting.

1.7 CONTRACTOR'S SHOP

1.7.1 Provide Job site office, work-shop, tools, scaffolds, material storage, etc., as required to complete the work of the Mechanical Contractor.

1.8 SUBMITTALS

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

1.8.2 Shop drawings to show:

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

1.8.3 Shop drawings and product data accompanied by:

- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify current model production.
- .5 Certification of compliance to applicable codes.
- .6 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures. Identify section and paragraph number.

1.8.4 Closeout Submittals:

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Close Out Submittals.

.2 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.

.2 Refer to Section 22 05 02 – Maintenance and Operation Manuals.

.3 Approvals:

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

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

.4 Additional data:

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

.5 Record drawings:

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

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

.3 Submit to Consultant for approval and make corrections as directed.

.4 The Mechanical Contractor shall incorporate the As Built information into the electronic file specified above and submit the updated drawings to the Consultant.

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

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

.7 Submit copies of record drawings for inclusion in final TAB report.

.8 Record, as the job progresses, all approved changes and deviations made to any work shown on the original contract drawings whether by addenda, requested changes, field instructions, and changes due to job conditions.

1.8.5 Site records:

.1 Consultant will provide either 1 set of either CAD or PDF files of the mechanical drawings. The Mechanical Contractor shall identify which format he prefers.

.2 Site record drawings can be kept up to date by marking up changes to the work that have been implemented and documenting the progress to date in either an Electronic PDF format or on hard copies.

.3 Hard Copies

.1 Transfer information weekly to PDF, to show work as actually installed.

.2 Use different colour waterproof ink for each service.

.3 Highlight on the drawings the work that has been completed to date. Ensure that the drawings are updated prior to the Consultant / Contractor progress draw meeting that is to be held at the last site meeting prior to the Progress Draw submission to the General Contractor/Construction Manager.

.4 Soft Copies

.1 Update CAD drawings showing work as actually installed.

.2 Ensure that the drawings are updated prior to the Consultant / Contractor progress draw meeting that is to be held at the last site meeting prior to the Progress Draw submission to the General Contractor/Construction Manager.

1.9 QUALITY ASSURANCE

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

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 – Health and Safety Procedures.

1.10 MAINTENANCE

1.10.1 Furnish spare parts in accordance with Section 01 78 00 – Close Out Submittals.

1.10.2 Provide additional filters in accordance to Section 23 44 00 - HVAC Air Filtration.

1.10.3 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 – Close Out Submittals.

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

1.11 DELIVERY, STORAGE, AND HANDLING

1.11.1 Waste Management and Disposal:

- .1 Dispose of waste as directed by the Front End Documents prepared by the Construction Manager / General Contractor.

1.12 TEMPORARY SERVICES

- 1.12.1 For temporary mechanical services required for construction, temporary sanitary facilities, and potable water refer to Section 01 51 00 – Temporary Facilities.

1.13 INSTALLATION OF WORK

1.13.1 Be responsible for:

- 1.13.2 The layout of the work of the Mechanical Contractor and for any damage caused to the Owner, or other Divisions of the contract by improper location or carrying out of this work.

- 1.13.3 The prompt installation of the work of the Mechanical Contractor in advance of concrete pouring or similar work.

- 1.13.4 The protection of finished and unfinished work and equipment and work of other Divisions from damage due to the carrying out of the work of the Mechanical Contractor.

- 1.13.5 The condition of all material and equipment supplied under the Mechanical Contract, and for the protection and maintenance of work completed.

- 1.13.6 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract. Refer to Section 01 31 00 – Project Management and Coordination. Furnish items to be "built-up" in ample time and give necessary information and assistance in connection with the building in of the same.

- 1.13.7 Provide drawings showing all sleeving and openings required. Notify the Construction Manager of the size and location of recesses, openings and chases before walls, floors, etc., are erected.

- 1.13.8 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.

- 1.13.9 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.
- 1.13.10 Furnish promptly information required for the construction schedule.
- 1.13.11 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.
- 1.14 CODES, PERMITS, FEES AND CONNECTIONS
 - 1.14.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By-Laws and Regulations in force in area where the building is to be erected.
 - 1.14.2 Apply for, obtain, and pay for permits, fees and service connections for the work of this Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.
 - 1.14.3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.
 - 1.14.4 When part of equipment does not bear the required UL label, the contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.
 - 1.14.5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.
- 1.15 MATERIALS
 - 1.15.1 Where materials, equipment, apparatus, or other products are specified by the manufacturer, brand name, type or catalogue number, such designation is to establish standards of desired quality style or dimensions and shall be the basis of the Bid. Materials so specified shall be furnished under this Contract, unless changed by mutual agreement. Where two or more designations are listed, the contractor shall choose one of those listed and state the choice made on the "Supplementary Bid Form-Mechanical".
 - 1.15.2 The use of equivalent, alternate and/or substitute materials and equipment is subject to the following:
 - 1.15.3 Where the use of equivalent, alternate or substitute equipment alters the design or space requirements indicated on the plans, the contractor for Division 21, 22, 23 and Division 25 shall include all items of cost for the revised design and construction, including cost of all the related trades involved.

1.15.4 Acceptance of the proposed equivalents, alternates or substitutions shall be subject to the approval of the Consultant and, if requested by the Consultant, the Mechanical Subcontractor shall submit samples of both the specified and the proposed items for review.

1.15.5 In all cases where the use of equivalents, alternates or substitutions is permitted, the Mechanical Subcontractor shall bear any extra costs of independent testing agencies of evaluating the quality of materials and the equipment to be installed.

1.16 EQUIVALENTS AND ALTERNATES

1.16.1 Should the base Mechanical Subcontractor propose to furnish material and equipment other than those specified, he shall apply in writing to the Consultant for approval of equivalents at least fourteen days prior to opening of Bids, submitting with his request for approval complete descriptive and technical data on the item or items he proposes to furnish. Approval for changes in base bid specifications will be considered only upon individual requests of the Subcontractors. No blanket approval for equipment will be given to suppliers, distributors or contractors.

1.16.2 Unless requests for changes in base bid specifications are received and approved prior to the opening of the bids, as defined above, the Subcontractors will be held to furnish specified items under his base bid. After the Contract is awarded changes in specifications will be made only as defined in Article: Material Substitutions (22 05 01 – Item 1.18)

1.16.3 Equipment of the Subcontractors' choice may be offered as alternates to the items named in the specifications, in the space provided in the Supplementary Bid Form. Alternate proposals must be accompanied by full descriptive and technical data on the article proposed, together with a statement of the amount of addition or deduction from the base bid if the alternate is accepted. Prior approval from the Consultant is not required on items submitted as alternate bids, but the decision on acceptance of the alternate(s) will rest with the Consultant.

1.16.4 Unspecified materials and/or rejected alternates built into the work shall be replaced with specified or accepted materials at no additional cost to the Owner.

1.17 MATERIAL SUBSTITUTIONS

1.17.1 After execution of the Contract, requests for substitution of materials of makes other than those specifically named in the Contract Documents may be approved by the Consultant as specified in Section 01 23 10 – Alternatives.

1.18 SHOP DRAWINGS AND SAMPLES

1.18.1 Submit to the Consultant detailed dimension shop drawings and installation wiring diagrams for all mechanical equipment. Further details and special requirements called for in these specifications shall be shown on the shop drawings.

1.18.2 Refer to Section 22 05 06 - Mechanical Project Schedule Requirements for the provision of the shop drawing schedule.

- 1.18.3 All 8 ½" x 11" and 11" x 17" shop drawings shall be submitted in searchable electronic format. The procedure shall be as follows:
- 1.18.4 Shop drawings are to be sent through the proper channels in electronic PDF format.
- 1.18.5 The Shop Drawing submission must identify the relevant Mechanical or Electrical Project Manager at Crossey Engineering that the shop drawings are being sent to.
- 1.18.6 Crossey Engineering will return one electronic copy of the shop drawings through the proper channels for the project. All printing costs associated with printing hard copies of the shop drawings shall be the responsibility of the Contractor.
- 1.18.7 All shop drawing submittals that are larger than 275 mm x 425 mm (11" x 17") shall be submitted in either hard copy or electronic format as agreed to by Crossey Engineering's designated Project Manager.
- 1.18.8 Ensure that one hard copy of all reviewed shop drawings are available on the job site for reference.
- 1.18.9 Provide samples of mechanical equipment as requested in the specification in accordance with Section 01 33 00 – Submittal Procedures at the same time as the shop drawing submission.
- 1.18.10 For all equipment that consists of multiple pieces of equipment that must be wired together or equipment that requires a connection from the BMS the following must be provided:
- 1.18.11 A single line drawing indicating how all of the equipment is to be wired together. This shall include all power and control wiring.
- 1.18.12 A drawing that shows the internal wiring within the equipment which clearly identifies the terminal location where the BAS is to make its connection to the equipment.
- 1.18.13 Failure to provide this information with the shop drawing will result in the shop drawing being rejected for resubmittal.
- 1.19 TEMPORARY AND TRIAL USAGE
 - 1.19.1 After any part of the work for Mechanical Contract has been completed, the Consultant will make an inspection, and performance tests of such parts shall be carried out under the direction of the Consultant. If deficiencies are found, they shall be immediately rectified to the satisfaction of the Consultant. After such deficiencies have been rectified, the work shall be placed in service at such time and in such order as the Consultant may direct. If, in placing a portion of the equipment in service, it is necessary to make temporary connections in the wiring in order to obtain proper operation, such connections shall be provided to the extent and in the manner required by the Consultant.

1.19.2 Temporary or trial usage of any mechanical devices, machinery, apparatus, equipment or materials shall not be construed as evidence of the acceptance of same.

1.19.3 No claims for damage will be considered for damage to, or the breaking of any parts of such work which may be used.

1.20 CONSULTANT'S INSTRUCTIONS

1.20.1 During construction the Consultant will issue such instructions as may be necessary for verification and correction of the work. These instructions shall be binding as part of the specification.

1.21 ADDITIONAL WORK AND CHANGES

1.21.1 Refer to Division 0 Amendments to CCDC 2 – 2008 of the specification for the procedures to be followed and the mark ups for Overhead and Profit that will be accepted for additional work and changes.

1.21.2 All contemplated change notice submissions shall include material, equipment and labour costs itemized on a system by system basis. Detailed breakdowns are required for all subtrades as well as the Mechanical Contractor.

1.21.3 Breakdowns for labour and material are required for all extras and all credits.

1.21.4 Pricing

.1 Change notice pricing must be submitted in a timely manner.

.2 All material prices shall be based on the "All Pricer" with a 30% discount.

.3 Labour rates shall be based on the MCAA labour rates.

.4 Pricing is to be Net. Where labour and materials are deleted from the project in a change notice the credit provided shall be utilized as the basis of the extra costs if an equivalent amount of labour and materials is added back into the project in another change notice. Once the labour and materials added exceed the amount of labour and materials in the credit the pricing is to be based on items .2 and .3 above.

1.21.5 Overtime

.1 Where overtime rates have been applied to the change they must be clearly identified and the reason for including the work as Overtime must be identified.

1.21.6 Schedule

.1 If the Mechanical Contractor believes the change will have an impact to the Project Schedule this must be identified in the change notice submission.

1.22 WARRANTY

1.22.1 Refer to Section 01 77 00 – Close Out Procedures and this section of the specification.

1.22.2 The Mechanical Contractor shall provide a warranty for all work and apparatus installed under his contract against all defects of workmanship and material for a period of one year after the substantial performance of the work , unless otherwise mentioned in the specifications, and shall make good any and all defects developing during such time without expense to the Owner. Any materials shall be further guaranteed as may be called for in these specifications. Where warranties on equipment extend beyond one (1) year the Mechanical Contractor shall honor the extended warranty.

1.23 SCHEDULING OF WORK

1.23.1 For all work to be performed under this contract, adhere to construction schedule detailed in other parts of the contract, and/or as prepared by the Construction Manager.

1.23.2 Provide schedule information in accordance with Section 22 05 06 - Mechanical Project Schedule Requirements.

1.23.3 All connections to the services serving existing buildings that remain operational shall be coordinated with the Owner a minimum of two weeks prior to any shut down.

1.24 SCHEDULING OF SHOP DRAWINGS

1.24.1 Mechanical Contractor shall submit a detailed shop drawing schedule as indicated in Section 22 05 06 - Mechanical Project Schedule Requirements.

1.25 SITE VISIT REPORTS

1.25.1 During the course of construction the Consultant will issue Site Visit Reports which will identify the amount of work completed to date and items that need to be rectified.

1.25.2 At the same time that the Mechanical Contractor submits the Monthly Progress Draw a marked up copy of the most recent Site Visit Report shall be submitted. The mark ups shall include:

- .1 Status of the Rectification of the Deficiency and when it is intended to be rectified.
- .2 Identification of any items in the report which the Mechanical Contractor does not agree with or requires further clarification.

1.26 BONDS AND CASH ALLOWANCES

1.26.1 Refer to Section 00 21 13 – Instruction to Bidders and Section 01 21 00 – Allowances for details of Bonding requirements and Cash Allowances.

1.27 EQUIPMENT REQUIREMENTS AND INSTALLATION

- 1.27.1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from building structure or other equipment.
- 1.27.2 Provide accessible means for lubricating equipment including permanent lubricated bearings.
- 1.27.3 For housekeeping pads refer to Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
- 1.27.4 Pipe all drain lines to drains. For glycol systems, pipe drains and relief lines to their respective glycol make up tanks.
- 1.27.5 Line-up equipment, rectangular cleanouts and similar items with building walls wherever possible.
- 1.27.6 Provide supports such as saddles, platforms, etc for equipment requiring auxiliary supports including but not limited to heat exchangers, hot water tanks, etc.

1.28 SLEEVES

1.28.1 General

- .1 Provide pipe and duct sleeves at points where pipes pass through masonry, concrete, drywall or other floors or full height walls.

1.28.2 Locations

- .1 On typical floors, provide one diameter between adjacent sleeves. Where Structural Drawings indicate that additional spacing between sleeves is required follow requirements detailed on Structural drawings.
- .2 All sleeved or formed openings through the structure must be shown on sleeving drawings which shall be submitted to all Consultants for review prior to Construction. No holes through the structure will be permitted without written approval of the Consultant.
- .3 The Mechanical Contractor shall be responsible for showing all sleeve locations required by the Mechanical Sub Contractors on the interference drawings.
- .4 The Mechanical Contractor shall be responsible for installing all of the sleeves required for the Mechanical contract and the Mechanical Sub Contractors.
- .5 All sleeves shall be installed in the locations detailed on drawings.

1.28.3 Sleeve Construction

- .1 Sleeves of: minimum 22-gauge (0.8 mm) thick galvanized sheet steel with lock seam joints.

- .2 1/4" (6 mm) clearance all around, between sleeve and pipes or between sleeve and insulation.
- .3 Extend sleeves 6" (150 mm) above floors in mechanical rooms and all areas where waterproofing is required.

1.28.4 Floor Penetrations

- .1 Use cast iron or steel pipe sleeves with annular fin continuously welded at midpoint. PVC sleeve with annular fin is also acceptable:
 - .1 Through foundation walls.
 - .2 Where sleeves are specified to extends above finished floor.

1.28.5 Floor Penetrations

- .1 Terminate sleeves flush with surface of concrete and masonry where waterproofing is not required.
- .2 Extend sleeves 6" (150 mm) above floors in mechanical rooms and all areas where waterproofing is required.

1.28.6 Pipe Penetrations Through Roof

- .1 HVAC Piping
 - .1 Use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water-tight durable joint.
- .2 Sanitary Vents
 - .1 Standard Vents:
 - .1 1.6 millimetre finish constructed of 1100-OT aluminum alloy.
 - .2 Corrosive Atmospheres
 - .1 0.79 millimetre finish constructed of type 304 Stainless steel.
 - .3 To CSA B272-93 with EPDM triple pressure grommet seal and EPDM base seal.
 - .4 Premoulded urethane insulation liner.
 - .5 Treated deck flange
 - .1 PVC coated for proper adhesion to PVC/TPO membrane or bituminous painted for BUR or ModBit membranes.
 - .6 Height:
 - .1 Minimum of 330mm. Where required due to thicker insulation provide 483 mm.

.7 Installation

.1 Follow Manufacturer's recommendations.

.8 Standard of Acceptance: Thaler SJ-38 or approved equal.

1.28.7 Sealing

.1 Fill voids around pipes.

.2 Foundation Walls and Below Grade Floors

.1 For sleeves and pipe in foundation walls and below grade floors, provide "link seal" clamp manufactured by Thunderline or Innerlynx.

.2 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.3 Above Grade Walls Not Fire Rated

.1 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non-hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non-hardening mastic.

.2 Ensure no contact between copper tube or pipe and ferrous sleeve.

.3 Fill future-use sleeves with easily removable waterproof filler.

.4 Above Grade Walls Fire Rated

.1 Where pipes and ducts pass through fire rated walls, floors and partitions, pack space with fire stopping materials as specified in Section 07 84 00 – Fire Stopping.

.2 Ensure no contact between copper tube or pipe and ferrous sleeve.

.3 Fill future-use sleeves with easily removable fire stop filler.

1.29 ESCUTCHEONS AND PLATES

1.29.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

1.29.2 Use chrome or nickel plated brass, solid type with set screws for ceiling or wall mounting. All escutcheons and plates in exhibition spaces shall be flat black.

1.29.3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

1.29.4 Where sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

1.29.5 Secure to pipe or finished surface but not to insulation.

1.30 TESTS

1.30.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

1.30.2 Inform the Consultant when tests will be conducted. The Consultant will periodically be present for tests. All tests are to be documented test results submitted and included in the maintenance manuals. Refer to attached Appendix A for the format to be utilized for the test reports.

1.30.3 Bear costs including retesting and making good.

1.30.4 Pipe pressure:

.1 For hydronic systems hydraulically test piping systems at 1- 1/2 times system operating pressure or minimum 125 psi (860 kPa), whichever is greater in accordance with CSA B31.3 pressure testing requirements.

.2 For steam systems test piping systems at 1- 1/2 times system operating pressure or minimum 125 psi (860 kPa), whichever is greater in accordance with CSA B31.1 pressure testing requirements.

.3 Maintain test pressures without loss for 4h unless otherwise specified.

.4 Test natural gas systems to requirements of authorities having jurisdiction and as per CGA and Ontario Building Code.

.5 Test drainage, waste and vent piping to code.

1.30.5 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.31 PAINTING

1.31.1 Apply at least one coat of corrosion resistant primer paint to supports, and equipment fabricated from ferrous metals.

1.31.2 Touch-up paint all damaged equipment with products matching original finish in quality and appearance.

1.31.3 Provide flat black painting behind grilles and diffusers.

1.31.4 Paint the gas line in its entirety where it is exposed outside. In locations within building where the gas line is above T-bar or hard ceilings the gas line shall be banded in accordance with the CGA requirements. In all areas where the gas line is exposed within the building it shall be painted in its entirety.

1.32 ACCESS DOORS

1.32.1 Refer to Section 08 31 00 - Access Doors of the specification for access door requirements.

1.33 DIELECTRIC COUPLINGS

1.33.1 Provide wherever pipes of dissimilar metals are joined.

1.33.2 Provide insulating unions for pipe sizes NPS 2 and under and flanges for pipe sizes over NPS 2.

1.33.3 Cast brass adapters may be used on domestic water systems and where approved by the Consultant.

1.33.4 Provide rubber gaskets to prevent dissimilar metals contact.

1.34 INSTRUCTION OF OPERATING STAFF

1.34.1 Supply certified personnel to instruct operating staff on operation of mechanical equipment. Supply maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

1.34.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

1.34.3 Use operation and maintenance data manual for instruction purposes. On completion of instruction, turn manuals over to the Consultant.

1.34.4 Scheduling of the timing for the training of the operating staff shall be arranged 45 days prior to the completion of the project.

1.35 MAINTENANCE MANUALS

1.35.1 Refer to Section 22 05 02 - Maintenance and Operation Manuals.

1.36 FLASHING

1.36.1 Coordinate with requirements for roofing, water-proofing and flashing in Section 07 62 00 - Sheet Metal Flashing and Trim.

1.36.2 Flash mechanical parts passing through, or built into a roof. Leave flashing as directed by the Roofing Trade to permit Roofing Trade to make a watertight connection.

1.36.3 Provide zinc coated steel flashing in accordance with Section 07 62 00 - Sheet Metal Flashing and Trim pipes and ducts passing through waterproof floors.

1.36.4 Co-operate with Division 7 at all times, and do not break any waterproofing seal without consent of the Waterproofing Trade. Provide piping passing through waterproof walls with extra heavy cast iron sleeves with asphalt roofing wrapped around so as to leave a 1" x 2" (25 mm x 50 mm) recessed on both sides of wall. These recesses and the space between pipe and sleeve shall be caulked as specified in Section 07 92 00 - Joint Sealants.

1.36.5 Fit counter flashing over flashing or curb, and make watertight.

1.36.6 Detailed dimensioned drawings showing all roof penetrations shall be submitted to the Structural Consultant for review.

1.37 CURBS AND SLEEPERS

1.37.1 Prefabricated curbs for mechanical equipment will be provided by the Mechanical Contractor. Built-up curbs and sleepers will be supplied and installed under work of other sections, except as specified herein and noted on the drawings.

1.37.2 It shall be the responsibility of the Mechanical Trade to supply detailed requirements for curbs, including their locations, sizes and materials to be used, and loads imposed on the curbs.

1.37.3 Curbs are required for roof mounted equipment, surrounding holes where groups of pipes and/or ducts pass through equipment room floors, and where indicated on the Drawings.

1.37.4 Roof curbs shall be minimum 12" (300 mm) height above finished roof.

1.37.5 Curbs around holes in equipment room floors shall be concrete or steel, extending at least 6" (150 mm) above finished floor. Make watertight connection between curb and floor.

1.37.6 Fill spaces between curbs and pipes and ducts with glass fibre material. Caulk with fire resistant waterproof compound to make watertight connection.

1.37.7 Sleepers shall be provided for the equipment installed outdoor without a roof curb. Sleepers shall be constructed of pressure treated lumber and shall be covered by 18-gauge steel cladding, primed and painted unless otherwise noted on the drawings.

1.38 CONCRETE

1.38.1 All concrete work required by the Mechanical Contractor shall be done by this Division in accordance with Section 03 10 00 – Concrete Formwork and Section 03 20 00 - Concrete Reinforcement and Section 03 30 00 – Cast in Place Concrete.

1.38.2 Refer to Item Section 22 05 01 Item 1.27 for requirements for housekeeping pad.

1.39 METALS

1.39.1 Steel construction required solely for the work of Mechanical Subcontractor and not shown on Architectural or Structural Drawings shall be supplied and installed by this Subcontractor in accordance with applicable requirements of Division 05, Metals, Structural and Miscellaneous.

1.40 CUTTING AND PATCHING

- 1.40.1 Cutting and patching shall be in accordance with General and Supplementary Conditions and the following:
- 1.40.2 No openings shall be permitted through the completed structure without the written approval of the Architect. Any openings which are required through the completed structure must be clearly and accurately shown on a copy of the structural drawings. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Architect for review, well in advance of doing the work.
- 1.40.3 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations. Where this information is not furnished in time, the Subtrade contractor for this Division shall bear the cost of all sleeving, provision for inserts, cutting and patching.
- 1.40.4 Should any cutting and/or repairing of finished surfaces be required, the Subtrade contractor for this Division shall employ the particular trades engaged on the site for this type of work to do such cutting and/or repairing. Obtain the approval of the Consultant before doing any cutting. In the event that tradesmen required for particular cutting and/or repairing are not already on the site, bring to the site tradesmen to do this work.
- 1.40.5 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Consultant in writing.
- 1.40.6 Prior to cutting any existing walls and floors the Division 21, 22 and 23 Contractor shall consult with the Structural Engineer for approval. Where X-rays are requested by the Structural Engineer the Division 21, 22 and 23 Contractor shall provide x-rays at no cost to the Owner. All X-raying shall be done during off hours.

1.41 PERFORMANCE TESTS

- 1.41.1 Refer to Section 01 77 00 – Close Out Procedures and Section 01 79 00 – Demonstration and Training for performance test requirements.
- 1.41.2 In addition, provide all labour to complete the requirements outlined in Section 01 91 31 – Commissioning Plan and Section 01 91 13 – General Commissioning Requirements.

1.42 MECHANICAL PROJECT COMPLETION

- 1.42.1 Refer to Section 01 77 00 – Close Out Procedures and the requirements outlined in this section.
- 1.42.2 Thirty days prior to substantial performance of work obtain documentation and/or prepare certification of the following times and submit them to the Owner's representative:

- .1 All inspection certificates.

- .2 Warranty certificates as called for under "Warranty".
- .3 Record drawings.
- .4 Operating and Maintenance Manuals.
- .5 Test certifications as called for under "Testing". All test certificates to be included in maintenance manuals.
- .6 Provide a signed statement to the effect that all tests for mechanical systems and equipment have been completely carried out in the Trade Sections of these Specifications and to the manufacturer's recommendations, and in accordance with the requirements of all authorities having jurisdiction.

1.43 WORK WITHIN THE EXISTING BUILDING

- 1.43.1 Refer to Division 22 Section 22 05 08 - Work Within Existing Building for the requirements for work within existing buildings.

1.44 REQUESTS FOR INFORMATION - RFI

- 1.44.1 The successful Contractor may submit if he chooses, a Request for Information also known as an RFI to the Consultant Team for clarification to an item within his Scope of Work.
- 1.44.2 It is understood that an RFI is a form of dialogue between the Contractor and Consultant(s).
- 1.44.3 In order to expedite the RFI response time, the RFI must be clearly identified and directed to the Consultant responsible for that work.
- 1.44.4 All RFI's that involve a site interference issue shall include the Contractor's proposed solution to the interference.
- 1.44.5 RFI's must be submitted in a timely manner. The Contractor shall never place the Consultant's in a situation where, due to poor planning by the Contractor an RFI requires an immediate response by the Consultant in order to avoid a delivery date being put in jeopardy.
- 1.44.6 The Contractor shall submit all RFI's in a timely manner to ensure that the Construction Schedule is not impacted.
- 1.44.7 All RFI's that are received after 1500 hrs by the Consultants will be dated for the next working day if it is a weekday and the following Monday (Tuesday if it is a Statutory Holiday) if it is received on a Friday.
- 1.44.8 It is the Mechanical Contractor's responsibility to ensure that RFI's are directed to the appropriate Consultant. For example, a slab core drilling request shall be directed to the Structural Engineer, the Mechanical and Prime Consultants shall be copied.
- 1.44.9 The Contractor shall submit Individual RFI's for items that are not related.

1.44.10 The Mechanical Consultant will respond to each RFI within five (5) working days. The Contractor shall factor this response time into the Schedule and shall submit the RFI's in a timely manner taking this into account.

1.44.11 The Contractor should submit RFI's as issues arise rather than accumulating multiple RFI and submitting them together. Where multiple RFI's are issued at the same time the Contractor shall identify the order of priority for each RFI. If an order of priority is not received they will be dated and processed in the order of receipt. If Multiple RFI's are received at the same time the five (5) working day response time may not be applicable.

1.45 MECHANICAL AND ELECTRICAL COORDINATION

1.45.1 The following is a list of mechanical and electrical responsibilities for the above mentioned project.

1.45.2 All starters, motor control centres, etc., along with input and output power wiring will be by Division 26. This is with the exception of equipment that is shipped to site as a package with a single power feed and includes internal transformers and starters. Refer to individual specification sections to identify equipment that is to be provided with single power feeds.

1.45.3 Package units will have integral starters and only power feeders need be provided. The package unit starters will be by Division 21, 22 and 23.

1.45.4 Division 26 to provide all remote disconnect switches with the exception of disconnect switches specified to be provided with the Mechanical Equipment.

1.45.5 All control wiring inclusive of BAS and 120 V mechanical control wiring, except fire alarm shall be by Division 21, 22 and 23.

1.45.6 Voltages for motors 1/2 HP and larger will be either 208 V or 600 V, 3-phase. All motors that are smaller than 1/2 HP will be 120V single phase or 208V 1 or 3-phase as coordinated with CEL. Refer to the equipment schedules for power requirements.

1.45.7 All multi-speed motors to be consequent pole.

1.45.8 All motors shall be by Division 21, 22 and 23. Refer to Section 23 05 13 - Motors for HVAC Equipment for requirements.

1.45.9 No two-speed double winding motors are to be used unless a request is made by the Division 21, 22, and 23 Contractor to the Electrical Consultant and the request is approved by the Electrical Consultant.

1.45.10 Where 208 V 3 phase equipment is specified 208 V 1 phase equipment shall not be submitted as an equal. If equipment is not available as 208 V 3 phase the Division 21, 22 and 23 Contractor may make a request to the Electrical Consultant to revise the equipment to 208 V 1-phase however, all redesign costs incurred by the Electrical Consultant due to these revisions shall be paid by the Division 21, 22 and Division 23 Contractor.

1.45.11 Motor Thermistor

- .1 Division 21, 22 and 23 to provide thermistor protection on motors 20 HP and larger using approved thermistors. Where the motor is connected to a variable frequency drive a thermistor is not required.
 - .2 Thermistors shall be provided by Division 21, 22 and 23.
 - .3 Division 26 to provide manual reset devices for motor starters for thermistor interface. (Only for starters provided by Division 26).
 - .4 Division 26 to wire between the thermistor and the starter.
- 1.45.12 All fire alarm work shall be done by Division 26. Division 26 will provide all relays for interface to control wiring for fan shutdown etc.
- 1.45.13 Division 26 to wire EP switches for smoke damper control. Life safety control wiring and relays to interface to general control wiring to be by Division 26.
- 1.45.14 All relays required for Division 21, 22 and 23 will be by Division 21, 22 and 23.
- 1.45.15 Sprinkler and Standpipe
- .1 Division 21, 22 and 23 to provide all pressure switches, supervisory valves, flow switches, dry pipe alarm valves, etc. for interface to fire alarm system.
 - .2 All wiring of these items shall be by Division 26.
- 1.45.16 All electric tracing will be by Division 21 and 22 with power connections by Division 26. All electric tracing will be 208V. All electric tracing will be self-limiting type of cable. The Division 21 and 22 Contractor shall provide loads of circuits to Division 26.
- 1.45.17 All electric heaters will be supplied by Division 22 and installed by Division 26. Division 22 to provide any formwork for recessed heaters.
- 1.45.18 All level switches for sump pumps will be wired by Division 21, 22 and 23.
- 1.45.19 All electrical connections for trap seal primers, softeners and faucets shall be wired by Division 22 from nearest electrical panel.

PART 2 - PRODUCTS

- 2.1 N/A.

PART 3 - EXECUTION

- 3.1 CLEANING
- 3.1.1 Clean interior and exterior of all systems including strainers.
 - 3.1.2 Vacuum interior of ductwork and air handling units.
- 3.2 DEMONSTRATION

- 3.2.1 Consultant will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- 3.2.2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- 3.2.3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- 3.2.4 Instruction duration time requirements as specified in appropriate sections.
- 3.2.5 Consultant will record these demonstrations on video tape for future reference.
- 3.3 PROTECTION
- 3.3.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

1.2 NUMBER OF COPIES

- 1.2.1 Provide minimum of six (6) copies of Mechanical Maintenance Manuals.

1.3 SCHEDULE

- 1.3.1 Mechanical Maintenance Manuals to be delivered to the Engineer's office 30-days prior to the start of the Operator Training.

1.4 DELIVERY

- 1.4.1 Manuals to be bound in a hard cover neatly labeled: "OPERATING AND MAINTENANCE INSTRUCTIONS".

1.5 SPARE PARTS

- 1.5.1 Manuals shall include recommended spare parts and consumables for start up, commissioning, first six months of operation and yearly maintenance requirements.

1.6 FORMAT

- 1.6.1 Manuals shall be provided to identify the overall system requirements as well as identifying individual components.
- 1.6.2 The information included within the manuals shall be for the equipment that was supplied to the project site. Where the shop drawings indicate multiple features that can be provided with the equipment they shall be marked up to show exactly what was provided.
- 1.6.3 Provide the Operating and Maintenance manuals that are supplied with the Equipment.
- 1.6.4 Any deviations that were made to the equipment that is not consistent with what is shown on the shop drawings shall be clearly identified in the Maintenance Manuals. The item that has not been installed shall be crossed out and the item that has been installed shall be inserted into the drawings.
- 1.6.5 Where equipment is wired together as a system a control schematic drawing shall be provided showing how all of the devices are interconnected including terminals and labeling.
- 1.6.6 Where equipment is piped together as a system a schematic drawing shall be provided showing how all of the devices are piped together.

1.7 MANUFACTURER'S START UP REPORTS

1.7.1 The manufacturer's start up reports shall be included in the maintenance manuals with each system.

1.7.2 Include manufacturers follow up reports for all issues identified in the start up reports.

1.8 FLUSHING AND CLEANING

1.8.1 Include a copy of the flushing and cleaning water quality reports for each system.

1.9 FACTORY TESTING

1.9.1 Reports generated by factory testing of the equipment prior to shipment to site shall be included with the applicable piece of equipment shop drawing.

1.10 SERVICE AGREEMENTS

1.10.1 Include any service agreements and their length that are part of the contract.

1.11 WELDING

1.11.1 Refer to Section 23 05 17.

1.11.2 The Contractor shall include in the Operating and Maintenance manuals the following information:

.1 Material Certifications

.2 Weld Procedures/Logs

.3 Weld Maps

.4 Weld Inspection Reports

.5 Welder/Inspector Certifications.

.6 Electropolishing, passivation and cleaning procedures/logs/certificates.

.7 Test Reports

1.12 VALVE DIRECTORIES

1.12.1 Valve shall be numbered by system.

.1 Plumbing and Drainage

.2 Fire Protection

1.12.2 Valve directories shall be provided in both hard copy and electronic files.

1.12.3 Install one copy of the valve directory in the Operations and Maintenance Manual.

- 1.12.4 Install one framed copy with clear face glass of the valve directory to be hung in the mechanical room.
- 1.12.5 Include an electronic version of the valve directory in the maintenance manual.
- 1.13 SPARE PARTS
 - 1.13.1 Provide a list of spare parts provided for the building. List shall be organized by category.
 - 1.13.2 From the Manufacturer's Maintenance Manuals identify recommended spare parts for each piece of equipment/system.
 - 1.13.3 Identify any spare parts that were turned over to the Owner as part of the Contract.
- 1.14 WARRANTIES
 - 1.14.1 Provide a warranty letter from the Contractor within the Maintenance Manuals.
 - 1.14.2 For any equipment that has an extended warranty include the Manufacturer's warranty with the equipment shop drawing and identify the date of the extended warranties expiration.
- 1.15 MAINTENANCE
 - 1.15.1 The maintenance requirements for each piece of equipment shall be taken from the Manufacturer's Operation and Maintenance Information.
 - 1.15.2 Provide a summary page for each piece of equipment which identifies the following:
 - .1 Daily Maintenance
 - .2 Weekly Maintenance
 - .3 Monthly Maintenance
 - .4 Semi Annual Maintenance
 - .5 Annual Maintenance
 - .6 As Required Maintenance.
- 1.16 PAYMENT
 - 1.16.1 Final payment to the mechanical contractor will not be released until following test and certificates are submitted to the consultant:
 - .1 Release of HVAC and P&D permit from the City where the building is being erected.
 - .2 TSSA certificate/letter of final review and approval for high pressure steam., fuel oil installation, refrigeration piping etc.,

- .3 Test certificate approved by the City for all BFPA's installed in the building
 - .4 Test certificate by the fire protection contractor signed and sealed by a professional engineer confirming design, construction and test in accordance and satisfaction to the City, NFPA 13-2022 and Fire Department,
 - .5 Video scope result of below grade piping,
 - .6 Final as-built drawings (soft copy).
- 1.16.2 Confirmation by the client or minutes of meeting stating training /demonstration sessions have all been completed.

2 EXECUTION

2.1 FORMAT

2.1.1 Maintenance manuals shall be divided into sections with neatly labeled and tabbed dividers between each section.

2.1.2 Each binder shall include a table of contents.

2.2 SECTION 1 – GENERAL

2.2.1 Section 1 shall include the following:

2.2.2 A list giving name, address and telephone number of the following:

- .1 Consultant,
 - .2 Engineers
 - .3 Construction Manager
 - .4 Mechanical Trade
 - .5 Mechanical Sub Trades
 - .6 Controls Trade
- 2.2.3 Provide documentation indicating when Operator Training took place and who was present at the Training.

2.3 SECTION 2 – WARRANTIES AND SHOP DRAWINGS.

2.3.1 Include a list giving the name, address and telephone number of all suppliers.

2.3.2 A copy of the Contractor's Warranty letter.

2.3.3 A copy of all approved shop drawings for all equipment. Provide a tab with each shop drawing to identify the relevant section of the specification that the equipment is associated with.

2.3.4 The Contractor shall include a report which identifies any deviations from the approved shop drawings that occurred on site. The report shall also identify any field installed components (transformers, relays, switches) that do not appear on the shop drawings.

2.4 SECTION 3 – PLUMBING AND DRAINAGE

2.4.1 This section shall be organized by system. Systems shall include

- .1 Domestic Hot Water.
- .2 Domestic Cold Water
- .3 Sanitary Drainage

2.4.2 A system description shall be provided for each system. The description shall include the following:

- .1 System Type
- .2 Areas Served
- .3 Function of Major Components
- .4 Location in Building
- .5 A system schematic shall be provided for each system.

2.4.3 Operating Instructions shall be included. They shall include:

- .1 Type and specific location of each device used in the system operation.
- .2 Include Manufacturer's Equipment Start Up Sheets for Each System.
- .3 Include Warranty information for each piece of equipment where warranty extends beyond standard one year.
- .4 Include maintenance tasks and schedules for the system.
- .5 Test certificates for all backflow preventers approved by the City.
- .6 Provide a copy of all video scoping that was performed.
- .7 Provide a copy of all Authorities Having Jurisdiction inspection and test reports.
- .8 Include a copy of all pressure tests that were performed.
- .9 Include a copy of all operational tests that were performed.
 - .1 Where there are open issues on the original operational test report the Contractor shall include a letter with the operational test report indicating how each of the open issue was resolved.

2.4.4 Include a copy of all Equipment Factory Test Reports.

2.5 SECTION 4 – AIR CONDITIONING AND VENTILATION

2.5.1 The section shall be organized by system. Systems shall include the equipment that is supplying, exhausting and returning the air and all ductwork and equipment that is required to deliver the air into the space.

2.5.2 Systems shall include the following:

.1 Force Flow Heaters

2.5.3 A system description shall be provided for each system. The description shall include the following:

.1 System Type

.2 Location in Building

.3 The following design criteria shall be provided:

.4 Occupied space conditions

2.5.4 Operating Instructions shall be included. They shall include:

.1 Type and specific location of each device used in the system operation.

.2 Identify safety devices and interlocks that must be satisfied in order for the system to start.

.3 Operation of Equipment when building is operating on emergency power.

.4 Include Manufacturer's Equipment Start Up Sheets for Each System.

.5 Include Warranty information for each piece of equipment.

.6 Include maintenance tasks and schedules for the system.

.7 Include a copy of all pressure tests that were performed.

.8 Include a copy of all operational tests that were performed.

.1 Where there are open issues on the original operational test report the Contractor shall include a letter with the operational test report indicating how each of the open issue was resolved.

2.6 SECTION 7 – FIRE PROTECTION

2.6.1 Section shall be organized by System. Systems shall include the following:

.1 Wet Pipe Sprinkler Systems

.2 Fire Extinguishers.

- 2.6.2 Provide a system description identifying the major pieces of equipment in each system, where they are located and what their purpose is.
- 2.6.3 Include a Test certificate by the Fire Protection Contractor signed and sealed by a professional engineer confirming design, construction and test in accordance and satisfaction to the City, NFPA 13-2022 and Fire Department.
- 2.6.4 Aqueous Film Forming Foam Systems
 - .1 Include the concentration test results.
- 2.6.5 Include a control schematic which identifies how extinguishing systems are connected together and all terminal points where the BAS/Fire Alarm are connected to the fire alarm system.
- 2.6.6 Sprinklers
 - .1 Contractor's material and test certificates for above ground piping certificate.
 - .2 Fire pump manufacturers certified pump shop test characteristic curve
 - .3 Results of field acceptance test in accordance with NFPA 20-2022 with the fire pump manufacturer present.
 - .4 Engineers Certification for Window Sprinkler Systems
 - .5 In addition to being included in the Operating and Maintenance Manuals the above information shall be submitted to the City.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

PART 2 - PRODUCTS

2.1 RESERVED

PART 3 - EXECUTION

3.1.1 Scheduling of Work:

- .1 Notify and obtain agreement from Owner before connecting or making modification to existing electrical, or mechanical services. Disruptions shall be kept to a minimum. Whenever the Contractor contemplates entering any occupied areas and any existing floors to carry out Work or to obstruct or take out of use any area, he shall make such request to the Owner in writing 72 hours before he intends to do the Work. Coordinate all work with the General Contractor.

3.1.2 Owner's Use of Existing Building:

- .1 The existing buildings will remain in full use and occupancy throughout the majority of the construction of the Work. Refer to the Schedule provided by the General Contractor/Construction Manager.

3.1.3 Protection:

- .1 Work shall include temporary, weathertight, dust tight partitions between areas, and enclosing areas within the building where Work is performed.
- .2 Protection of existing building, including roofs, shall be substantial enough to prevent damage to them by falling objects, demolition, and mandatory construction traffic during new Work.
- .3 Protection of property in, or on, existing building shall include equipment, furniture, and other similar furnishings, hardware, trim, and supplies, whether fixed to building or not.
- .4 Take all precautions to ensure that no structural damage is caused to existing building by demolition and alternation Work.
- .5 Ensure during demolition and construction Work that materials, components, and similar items to be reused are protected from damage, and that measures are taken to keep down dust and noise at all times.
- .6 Take extraordinary means to protect relics, weathered surface, and materials and components which cannot be replaced.
- .7 Provide all necessary coverings to protect existing surfaces from damage during course of renovation.

3.1.4 Removal of Existing Work:

- .1 Remove building elements, components, materials, and equipment. Store and protect materials from damage for re-installation when Work above is complete.
- .2 Store and protect relocated items until built into new locations.
- .3 Limit removal of items to smallest areas possible, and make good disturbed existing Work.
- .4 Remove debris and accumulated dirt from existing building immediately as it accumulates, on a daily basis. Ensure that during removal operations through the existing building that existing Work is not damaged and dirt, debris, and dust is not spread.
- .5 Maintain Work areas in existing building constantly broom clean to avoid tracking of dirt into adjacent areas. Immediately clean up debris resulting from Work of Contract that is deposited in existing building outside of Work areas. Make a daily inspection to ensure that Work and construction access areas are maintained clean and undamaged as specified.

3.1.5 New and Replacement Work:

- .1 Where existing work is altered, do all necessary cutting and fitting required to make satisfactory connections with existing work so as to leave entire work in a finished and acceptable condition.
- .2 Execute work with least possible interference and disturbance to occupants, public and normal use of premises. Arrange with Consultant to facilitate execution of work.
- .3 Make good all existing materials and finishes, which are not to be removed nor altered, but which are damaged or disturbed during the progress of work under this contract.
- .4 Where existing work is to be made good, match the new work exactly to the old work in material, form, construction and finish, unless otherwise specified or approved.
- .5 Existing ductwork serving adjacent areas shall not be removed until all material for ductwork replacing it is on site.

- .6 Where ductwork is being removed and replaced to improve available ceiling heights, the interference drawings shall show:
 - .1 All existing services including current duct location;
 - .2 New duct and service locations;
 - .3 New ceiling height.
- .7 No work shall proceed until interference drawings have been submitted and revised by the Consultant.

3.1.6 Contractor's Use of Existing Building:

- .1 Access of construction personnel to the buildings will be permitted only at locations approved by the Owner and General Contractor.
- .2 Ensure that construction personnel perform Work in existing building only as required under the Contract, and that they do not use it as access to Work areas, except for Work in existing building, or for other approved purposes. Access for construction personnel to their Work areas shall be approved by the Owner before the Work commences.
- .3 Use of washroom and other services in existing building by construction personnel is prohibited, unless agreed upon with the Owner. The Contractor shall clean all spaces needed at the completion of the job to the satisfaction of the Owner and General Contractor.
- .4 Construction personnel shall use areas of the existing building for their purposes only as designated by the Owner and the General Contractor only while Work is in progress. Prohibit lounging and smoking in assigned areas. Keep assigned areas clean under Work of Contract, and return them to an "as was" condition at completion of construction. Make good damage to building, fixtures, and fittings caused during use by construction personnel by replacement with new Work. Include cost of installation and making good of other Work thereby affected in replacement.
- .5 Construction personnel shall use areas of the existing buildings only in a manner as determined by the Work.
- .6 All noisy and disrupted work shall be identified to the Owner and General Contractor with 48 hours minimum notice. Cooperate with the Owner in regards to any special arrangements which may have to be made as a result.

3.1.7 Existing Services:

- .1 Shut down of existing services shall be identified in the required Construction Schedule identified in Section 22 05 06.
- .2 Ensure that existing services are not damaged during demolition and construction. Immediately cut off and cap concealed services uncovered during Work by qualified mechanical and electrical workers.
- .3 Relocate exposed existing mechanical and electrical services where alteration Work occurs.
- .4 Do not interrupt mechanical or electrical services of the existing building except for temporary close-downs to make connections to new Work, and as approved by prior arrangements with Consultant and Owner. Give the General Contractor/Construction Manager, Consultant and Owner three working days written notice of intention to interrupt mechanical or electrical services in existing building in any area, and obtain written permission from Owner and General Contractor/Construction Manager.
- .5 In no case shall services interruptions affect the total building.
- .6 Should existing services be accidentally uncovered and disrupted, make complete restoration immediately, and provide adequate protection to avoid further disruption until alternative means of providing permanent continuation of the services are made.
- .7 Payment for Work specified in the foregoing shall be made by the Contractor at no additional cost to the Owner, if, in the opinion of the Consultant, such Work could have been foreseen at time of tendering and which has been caused by lack of proper care and protection.
- .8 Payment for Work specified in the foregoing shall be paid for by the Owner at standard rates established in the industry if, in the opinion of the Consultant, such Work could not have been foreseen at time of tendering.
- .9 Advise the General Contractor/Construction Manager, Consultant and Owner of the commencement, duration and termination dates of this Work. Contractor shall keep a record of work hours, number of workers, tools, equipment rentals, quantities of material used, mileage, etc. to present with his claim if requested by Consultant or Owner.
- .10 Unless otherwise specified, restore services on which Work is performed to original condition.
- .11 Where services such as mechanical equipment, piping or ductwork are to be removed as part of the demolition work and/or services needs to be removed to facilitate installation of new services or equipment, the mechanical contractor shall review the site and ensure that these services are not "live" and that their removal/demolition will not cause any damage or any disturbance to the building or its occupant.

- .12 If there are existing isolation valves in the piping, prior to cutting any of the piping, the contractor shall examine all of these isolating valves to ensure they are in good working condition. If they are not in good condition and they cannot be counted on to provide isolation of the system the Contractor shall either freeze the piping or drain it down prior to making the connection.
- .13 If the Contractor chooses to drain the system, all necessary provisions shall be made to keep the system in operation during drain down time. The drain down shall be kept to a minimum duration. All necessary water treatment requirements shall be reinstated, such as providing water treatment for HVAC piping systems, Chlorination of plumbing systems. System shall be completely vented for air and shall be brought into operation.
- .14 If the Contractor discovers any issues or deficiencies with respect to the existing services during his/her site review the Contractor shall report these issues or deficiencies to the Consultant prior to any demolition work taking place. The Contractor shall be responsible for any damage caused by their failure to review the existing systems prior to proceeding with the work.

3.1.8 Return Air Ductwork

- .1 Install temporary filters on all return air ducts within the construction zone prior to the start of construction.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01
- 1.1.2 All valves must have a valid CRN Number. Statutory declaration must be provided on request.
- 1.1.3 Ductwork and piping shall be installed in accordance with the proposed sections and layouts shown on the Mechanical Drawings. In accordance with Good Installation Practices all hydronic piping shall be installed below the ductwork. Where it is not possible for pipes running perpendicular to the ductwork to pass below the ducts it is acceptable for pipes to cross above the ducts. All pipes running parallel to ductwork shall not be run above the ductwork unless the proposed location is submitted on an interference drawing and the specific location where this is to occur is approved in writing by the Mechanical Consultant.
- 1.1.4 All fixtures and equipment installed in the domestic water systems shall be lead free.

1.2 REFERENCES

- 1.2.1 Do the work in accordance with the Ontario Building Code Plumbing Code and local authority having jurisdiction.
- 1.2.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
- .1 ANSI/ASME B16.15-2024 Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-2021, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-2021, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-2021, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
 - .5 ANSI/ASME B16.5-2020 Pipe Flanges and Flanged Fittings.
 - .6 ANSI/ASME B16.11-2021 Forged Fittings, Socket Welding.
- 1.2.3 ASTM International Inc.
- .1 ASTM B62-17 Specifications for Composition Bronze or Ounce Metal Castings.
 - .2 ASTM A307-21 Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A536-84(2019)E1- Standard Specification for Ductile Iron Castings.

- .4 ASTM B88M-20 Standard Specification for Seamless Copper Water Tube (Metric).
- .5 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
- .6 ANSI/AWWA C111/A21.11-2023, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .7 ASTM A312 24a Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
- .8 ASTM A351 24 Castings, Austenitic, Austenitic-Ferritic (Duplex), for pressure Containing Parts
- .9 ASTM A403 22 Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
- .10 ASTM A743 21 Castings, Iron-Chromium Nickel, Corrosion Resistant, for General Applications
- .11 ASTM A774 24 Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
- .12 ASTM A778-24 Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products
- .13 ASTM B813 24 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
- 1.2.4 Canadian Standards Association (CSA International)
 - .1 CSA B242 2005 (R2021), Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CSA B125.3-2022 Plumbing Products and Materials
- 1.2.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- 1.2.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67 (2022) Butterfly Valves.
 - .2 MSS-SP-70 (2011) Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71 (2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .4 MSS-SP-80 (2019) Bronze Gate, Globe, Angle and Check Valves.
- 1.2.7 National Research Council (NRC)/Institute for Research in Construction

.1 Ontario Building Code

.2 National Plumbing Code.ACTION AND INFORMATIONAL SUBMITTALS

1.2.8 Refer to Front End Documents and Section 22 05 01.

PART 2 - PRODUCTS

2.1 PIPING

2.1.1 Domestic hot, cold and recirculation systems, within building.

.1 Above ground: copper tube, hard drawn, type L to ASTM B88M.

.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

.3 Stainless steel butt-welded fittings, Type 304, Schedule 10, conforming to ANSI B16.9 and ASTM A312.

2.1.2 All piping shall have certification markings for compliance with ASTM B88.

2.2 FITTINGS

2.2.1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.

2.2.2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.

2.2.3 Cast copper, solder type: to ANSI/ASME B16.18.

2.2.4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.2.5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.

2.2.6 NPS 1 1/2 and smaller : wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa .

2.2.7 Grooved fittings, stainless steel, Type 304 Schedule 10, conforming to ASTM A403. Segmentally fabricated fittings shall not be allowed.

2.2.8 Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12) or malleable iron, ASTM A 47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper coloured alkyd enamel.

2.3 JOINTS

2.3.1 Rubber gaskets 1.6 mm thick to AWWA C111.

2.3.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

2.3.3 For installation of the potable water system only lead free solder shall be used in accordance with Ontario Building Code Standards.

2.3.4 Solder, tin antimony, 95:5: to ASTM B32.

2.3.5 Teflon tape: for threaded joints.

2.3.6 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.

2.3.7 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GROOVED COPPER METHOD

2.4.1 Application

- .1 Grooved piping system may be used in lieu of flanged or sweated copper in size 50 mm and larger. Couplings shall be designed with angle bolt pads to provide a rigid joint, complete with EPDM flush seal gasket suitable for temperatures from -34°C to 110°C.

2.4.2 Fittings

- .1 Housing: ductile iron conforming to ASTM-A536, Grade 65-45-12
- .2 Coating: rust inhibiting lead free paint
- .3 Bolts and nuts: heat treated, zinc electroplated carbon steel oval-neck track bolts conforming to ASTM A-183 and zinc electroplated carbon steel heavy hex nuts conforming to ASTM A-563,
- .4 Hinge Pin: carbon steel
- .5 Gaskets: in accordance with ASTM D-2000. Grade E: EPDM rated for service between 34°C to 110°C.
- .6 Copper Fittings: Copper per ASTM B-75 and ASTM B-584.
- .7 When connecting dissimilar metals in liquid systems from grooved end steel (IPS) to Copper (CTS) provide a dielectric waterway between the two materials.

2.5 VALVES

2.5.1 All valves utilized in domestic hot and cold water systems shall be lead free.

2.6 GLOBE VALVES

2.6.1 NPS 2 and under, balancing, soldered:

- .1 To MSS SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet.

.2 Lockshield handles: as indicated.

.3 Standard of Acceptance: Jenkins, Crane, Toyo 222, Kitz 10, Ginnel, Eastern Foundry and Fittings.

2.6.2 NPS 2 and under, balancing, screwed:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, screwed over bonnet, renewable composition disc.

.2 Lockshield handles: as indicated.

.3 Jenkins, Crane, Toyo 220, Kitz 03, Grinnell. Eastern Foundry and Fittings.

2.7 SWING CHECK VALVES

2.7.1 NPS 2 and under, soldered:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Standard of Acceptance: Jenkins, Crane, Toyo 237, Kitz 30, Grinnell.

2.7.2 NPS 2 and under, screwed:

.1 To MSS SP-80, class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Jenkins, Crane, Toyo 236, Kitz 29, Grinnell.

2.7.3 NPS 2 1/2 and over, flanged: - NSF/ANSI 372 compliant

.1 Working pressure 300psi, ductile iron epoxy coated body, Bronze ASTM B62 seat ring, ductile iron epoxy coated disc, bolted bonnet.

.2 .Standard of Acceptance: Jenkins, Kitz, Crane, M.A.Stewart W30-A-RD-FF

2.8 BALL VALVES (NSF/ANSI 372 Compliant)

2.8.1 NPS 2 and under, branch isolators, screwed:

.1 600 WOG, brass body C49300, solid stainless steel ball, PTFE packing or double "o" ring design, blowout proof stem, lever handle.

.2 Ball valves shall have full port opening.

.3 Standard of Acceptance: Jenkins, Crane, Toyo, Kitz 58, Grinnell, Apollo, Eastern Foundry and Fittings.

2.9 GROOVED END BALL VALVES (NSF/ANSI 372 Compliant)

2.9.1 1000 psi rated, CF8M stainless steel body, 316 stainless steel ball and stem, RTFE seats, reinforced fluoroelastomer seals, standard port, two-piece valve.

2.9.2 Standard of Acceptance: Victaulic Series 726S, Anvil

2.10 BUTTERFLY VALVES

2.10.1 NPS 2 1/2 and Over Grooved End Pipe

- .1 Grooved end butterfly valves shall have dual seal disc providing bubble tight service up to 2068 kPa. Ductile iron body conforming to ASTM A 536, Grade E EPDM disc coating. EPDM disc coating with stainless steel trim.
- .2 Utilize for all on/off applications up to 1380 kPa operating pressure.
- .3 Valves to be bubble tight shutoff up to 1380 kPa rating if downstream equipment is removed. (full dead end service)
- .4 Operator
 - .1 NPS 6 and under: lever handle.
 - .2 NPS 8 and over: gear operated
- .5 Standard of Acceptance: Victaulic Series 608, Grinnell, Mueller, Anvil,

2.10.2 NPS 2 1/2 and Over Full Lug Body (1380 kPa)

- .1 NSF/ANSI 372 compliant, lug type, MSS SP 67, 1380 kPa WOG water, cast iron or ductile iron body with A351 CF8M (austenitic stainless steel) disc, 416 stainless steel stem, EPDM liner. Lugs shall be tapped. Valves to be bubble tight shutoff up to 1380 kPa rating if downstream equipment is removed. (full dead end service)
- .2 Utilize for all on/off applications with operating pressures 1380 kPa and less.
- .3 Operator
 - .1 NPS 6 and under: lever handle.
 - .1 Standard of Acceptance: Kitz 6141EL, MA Stewart L-D-4-S-E-LH, Challenger, Dezurik
 - .2 NPS 8 and over: gear operated
 - .1 Standard of Acceptance: Kitz 6141EG, MA Stewart L-D-4-S-E-LH, Challenger, Dequirk

2.11 AUTOMATIC CIRCUIT BALANCING VALVES

2.11.1 Circuit balancing valves shall be of the automatic variety. Manual circuit balancing valves will not be accepted.

2.11.2 Circuit Balancing Valves are required on the domestic hot water recirculation system.

2.11.3 Provide the following sizes:

- .1 Provide 0.032 l/s for 12 mm pipe size.

.2 Provide 0.063 l/s for 20 mm pipe size.

2.11.4 Product Warranty and Performance Guarantee

- .1 Valves shall be warranted by the manufacturer to be free of defects in material and workmanship for a period of five years.
- .2 Valves shall control flow to within plus/minus 5 percent of design over an operating differential range of at least 14 times the minimum required for control. Four operating pressure ranges shall be available with the minimum range requiring less than 3 psid to actuate the mechanism.
- .3 The valve flow curve shall be smooth over its entire nominal control range. Gaps, bumps and dips in flow curves shall not be acceptable.

2.11.5 Shop Drawing Submission

- .1 The Balancing Valve Manufacturer shall submit a complete list of balancing valves, their location and their performance.
- .2 The Balancing Valve Manufacturer shall mark up a set of full size plans showing the location of each balancing valve and assign an appropriate identification tag for the balancing valve.
- .3 The Balancing Valve Manufacturer shall submit these drawings for the Consultant to review, incorporate any comments from the Consultant and then submit copies of this drawing to the Mechanical Contractor, Mechanical Consultant, Architect and Construction Manager.
- .4 All balancing valves shall be shipped to site with this tag number firmly attached to the valve and the full size drawings shall be utilized to identify the location where they are to be installed.

2.11.6 Valve Flow Control Cartridge (Typical for all valves)

- .1 The non adjustable flow control cartridge shall be 100% type 304 stainless steel. Parts made of soft metals such as brass with only a coating of hard metal such as nickel shall not be allowed. Rubber based materials whose properties change with temperature and pressure shall not be allowed.
- .2 The cartridges shall have segmented ports through which water can pass, rather than a continuous large port, to eliminate noise and full travel linear coil spring.
- .3 The cartridge movement shall result in a shearing action that will dislodge or shear any particle that may tend to get stuck in a port.
- .4 Cartridge shall be removable from the housing and shall be held in place in the housing without adhesive.
- .5 All flow control cartridges shall be warranted by the manufacturer for five years from the date of sale.

2.11.7 Sizes 40mm and smaller

- .1 Valves shall have forged "lead free" brass bodies and type 304 stainless steel cartridge assembly rated for a minimum of 2757 kPa and 121 C (400 psi at 250 F).

2.11.8 Valve end connections shall be either female sweat or FPT.

2.11.9 Valves shall be provided with two pressure/temperature taps.

2.11.10 Valves shall be provided with a union tailpiece and built in isolation valve.

2.11.11 The body design shall allow for inspection or removal of the cartridge without disturbing piping connections.

2.11.12 The valve shall come fully assembled and shall be permanently marked to show direction of flow and shall have a body tag to indicated flow rate and model number.

2.11.13 Provide a shut off valve upstream of the valve to allow the system to be shut off and the balancing valve to be removed without shutting down the entire heating system.

2.11.14 Standard of Acceptance: Griswold Isolator R valve, Red and White

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

3.2.1 Install in accordance with Ontario Plumbing Code and local authority having jurisdiction.

3.2.2 All flux utilized for soldering must be water soluble certified to ASTM B813.

3.2.3 Assemble piping using fittings manufactured to ANSI standards.

3.2.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2.5 Compression fittings are not acceptable.

3.2.6 All valves packing shall be asbestos free.

3.2.7 Provide isolation valves on all main branch feeds to each washroom group.

3.2.8 Install all grooved end components as per manufacturer's latest recommendation.

3.2.9 Stainless Steel Piping

- .1 Full penetration welds, free of cracks, overlaps and cold laps.
- .2 Weld reinforcement and concave root (1/16 in. (1.6 mm)).
- .3 Undercut Limit: 1/32 in. (0.8 mm) or 10% on base metal thickness, whichever is less.
- .4 Prevent or remove heat tint on all water side surfaces.
- .5 Secure end closure after welding to remain in place until final assembly.

3.3 VALVES

- 3.3.1 Isolate equipment, fixtures and branches with butterfly and ball valves.

3.4 PRESSURE TESTS

- 3.4.1 Conform to requirements of Section 22 05 01 - Common Work Results for Mechanical.
- 3.4.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- 3.5.1 New or repaired potable water systems shall be purged of deleterious matter and disinfected prior to utilization. The method to be followed shall be that prescribed by the health authority having jurisdiction or in the absence of a prescribed method as follows:
 - .1 The pipe system shall be flushed with clean, potable water until dirty water does not appear at the points of outlet.
 - .2 The system or part thereof shall be filled with a water/chlorine solution containing at least 50 parts per million (50 mg/L) of chlorine, and the system or part thereof shall be valved off and allowed to stand for 24 hours; or the system or part thereof shall be filled with a water/chlorine solution containing at least 200 parts per million (200mg/l) of chlorine and allowed to stand for three (3) hours.
 - .3 Following the required standing time, the system shall be flushed with clean potable water until the chlorine is purged from the system.
 - .4 The procedure shall be repeated where shown by a bacteriological examination that contamination remains present in the system.

3.6 PRE-START-UP INSPECTIONS

- 3.6.1 Systems to be complete, prior to flushing, testing and start-up.
- 3.6.2 Verify that system can be completely drained.
- 3.6.3 Ensure that pressure booster systems are operating properly.

3.6.4 Ensure that air chambers, expansion compensators are installed properly.

3.7 START-UP

3.7.1 Timing: start up after:

- .1 Pressure tests have been completed.
- .2 Disinfection procedures have been completed.

3.7.2 Start-up procedures:

- .1 Establish circulation and ensure that air is eliminated.
- .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .3 Bring HWS storage tank up to design temperature slowly.
- .4 Monitor piping HWS and HWR piping systems for freedom of movement, pipe expansion as designed.
- .5 Check control, limit, safety devices for normal and safe operation.

3.7.3 Rectify start-up deficiencies.

3.8 PERFORMANCE VERIFICATION

3.8.1 Scheduling:

- .1 Verify system performance after pressure and leakage tests and disinfection are completed, and Certificate of Completion has been issued by authority having jurisdiction.

3.8.2 Procedures:

- .1 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
- .2 Verify performance of temperature controls.
- .3 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
- .4 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.1.2 Ductwork and piping shall be installed in accordance with the proposed sections and layouts shown on the Mechanical Drawings. In accordance with Good Installation Practices all hydronic piping shall be installed below the ductwork. Where it is not possible for pipes running perpendicular to the ductwork to pass below the ducts it is acceptable for pipes to cross above the ducts. All pipes running parallel to ductwork shall not be run above the ductwork unless the proposed location is submitted on an interference drawing and the specific location where this is to occur is approved in writing by the Mechanical Consultant.

1.2 REFERENCES

1.2.1 ANSI

.1 ANSI B16.29. 2017

1.2.2 ASTM International Inc.

.1 ASTM B32-20, Standard Specification for Solder Metal.

.2 ASTM B306-20, Standard Specification for Copper Drainage Tube (DWV).

.3 ASTM B88, ASTM B88M-22 Specifications for Seamless Copper Water Tube

.4 ASTM A74-21, Specification for Cast Iron Soil Pipe and Fittings

.5 ASTM C564 19a, Specification for Rubber Gasket for Cast Iron Soil Pipe and Fittings

1.2.3 Canadian Standards Association (CSA International).

.1 CSA B67 2014 - Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CAN/CSA-B70 90 (2019), Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CAN/CSA-B125.3 (2022) - Plumbing Fittings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1.3.1 Provide submittals in accordance with Front End Documents and Section 22 05 01.

1.3.2 Product Data:

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

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

2.1.1 Above ground sanitary, storm and vent Type DWV to:

- .1 ASTM B306-20 - Specification for copper drainage tube (DWV).
- .2 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.3.
 - .2 Wrought copper: to CAN/CSA-B125.3.
- .3 Solder: tin-lead, 50:50, type 50A to ASTM B32.
- .4 ASTM B88
- .5 ASTM C564

2.2 CAST IRON PIPING AND FITTINGS

2.2.1 Above grade sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating of bitumous coating.

- .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.

2.3 DRAINAGE FROM URINALS

2.3.1 Drainage piping from the urinals to the sanitary main shall be PVC in accordance with Section 22 13 18.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

3.2.1 Install in accordance with the Ontario Plumbing Code.

- 3.2.2 Install piping parallel and close to walls to conserve space, and to grade indicated, and to suit installation of related work.
- 3.2.3 Apply two coats of asphalt paint to pipe laid in, or passing through concrete.
- 3.2.4 Where piping passes through floor or wall below grade pack and seal in concrete complete with Link Seal in accordance with Specification Section 22 05 01.
- 3.2.5 PVC piping shall not be utilized above grade with exception for the branch from the urinals. PVC piping as specified in Section 22 13 18 is acceptable for below grade piping. The PVC piping shall convert to cast iron prior to the point where it penetrates the floor slab.
- 3.2.6 Provide venting to plumbing fixtures and fixture groups in accordance with the Ontario Building Code Plumbing Code and local authorities having jurisdiction.
- 3.3 TESTING
 - 3.3.1 The drainage and vent system shall be tested in accordance with the Ontario Building Code - Plumbing Code and tested in accordance with the requirements of the authority having jurisdiction, perform tests in the presence of each governing authority and obtain certification. Repeat tests as often as necessary to obtain certification.
 - 3.3.2 Perform tests before piping is covered or concealed.
 - 3.3.3 Remove all fittings which will not withstand test pressure, and replace after test.
 - 3.3.4 Eliminate leaks, or remove and refit defective parts.
- 3.4 PERFORMANCE VERIFICATION
 - 3.4.1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - 3.4.2 Test to ensure traps are fully and permanently primed.
 - 3.4.3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - 3.4.4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.1.2 All fixtures and equipment installed in the domestic water systems shall be lead free.

1.2 REFERENCES

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

.1 ASTM A126-04(2023) Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.

.2 ASTM B62-17 Specification for Composition Bronze or Ounce Metal Castings.

1.2.2 American Water Works Association (AWWA).

.1 AWWA C700 - 2020 Cold Water Meters-Displacement Type, Bronze Main Case.

.2 AWWA C701 - 2019 Cold Water Meters-Turbine Type for Customer Service.

.3 AWWA C702 - 2019 Cold Water Meters-Compound Type.

1.2.3 Canadian Standards Association (CSA International).

.1 CSA-B64 Series - 2021 Backflow Preventers and Vacuum Breakers.

.2 CSA B125.3-2022 Plumbing Products and Materials

.3 CSA-B356 – 2023 Water Pressure Reducing Valves for Domestic Water Supply Systems.

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

.1 Material Safety Data Sheets (MSDS).

1.2.5 Plumbing and Drainage Institute (PDI).

.1 PDI-G101 - 2010 Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.

.2 PDI-WH201-2010, Water Hammer Arresters Standard.

1.3 SUBMITTALS

1.3.1 Submittals in accordance with Front End Documents prepared by the Construction Manager

1.3.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
- .2 Indicate dimensions, construction details and materials for specified items.

1.3.3 Shop Drawings:

- .1 Submit shop drawings to indicate materials, finishes, method of anchorage, number of anchors, dimensions construction and assembly details and accessories
- .2 Submit detailed drawings showing proposed location of trap seal primer assemblies for review and approval.

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

1.3.5 Instructions: submit manufacturer's installation instructions.

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

1.3.7 Closeout submittals: submit operation maintenance and engineering data for incorporation into manual specified in Front End Documents prepared by the Construction Manager and section 21 05 03, include:

- .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
- .2 Details of operation, servicing and maintenance.
- .3 Recommended spare parts list.

1.3.8 Mixing Valve Report

- .1 For all mixing valves installed on the project a report shall be submitted once the systems are made operational. The report shall include the following for each mixing valve:
 - .1 Location
 - .2 Size
 - .3 Service (Lavatory, Eyewash, etc.)
 - .4 Setpoint Temperature
 - .5 Actual Temperature Delivered.

1.3.9 Backflow Preventer Report

- .1 For all backflow preventers installed on the project submit a backflow preventer report in accordance with Ontario Building Code requirements which includes the location, size, service and test data for the back flow preventer.

1.4 DELIVERY, STORAGE AND HANDLING

1.4.1 Waste Management and Disposal:

- .1 Provide in accordance with Front End Documents prepared by the Construction Manager.

1.4.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.4.3 Storage and Handling Requirements:

- .1 Store in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

2.1.1 General: all floor drains to be provided with trap primer tapping.

2.1.2 Division 22 Contractor shall review the Architectural drawings to determine if the floor has a membrane.

2.1.3 Floor Drains Finished "FD 1"

- .1 Watts FD-200-6-1-6 Floor Drain - Epoxy coated cast iron, Floor drain, Adjustable Round 13 mm (1/2") thick nickel bronze top, 152 mm (6") diameter nickel bronze strainer, Anchor flange, Collar with weepholes, 52 cm² (8 sq. in.) free area, Vandal-proof, Certification and Compliances include: ASME A112.21.1M compliant.

2.1.4 Floor Drains – Showers "FD 3" (For Non Sheet floors)

- .1 All epoxy coated cast iron body with reversible clamp device and adjustable 5" diameter (127 mm) nickel bronze 1/8" (3.2 mm) thick strainer, secured with stainless steel screws, 4" (100 mm) throat on strainer. In quarry or mosaic tiled areas provide square - 6" x 6" (152 mm x 152 mm) nickel bronze 1/8" (3.2 mm) thick square strainer.
- .2 Standard of Acceptance: JR Smith 2005-A05NB-EP (Round) 2005-B06NB-EP (Square), Zurn ZN-415-A5-P (Round) ZN-415-H-P (Square)
- .3 Contractor shall check architectural floor finishes prior to submitting shop drawings to ensure that the floor drain matches the floor finish.

2.2 CLEANOUTS

2.2.1 Line Cleanouts

- .1 Line cleanouts in cast iron pipe with polyurethane gasketted cover secured to body with full size pipe opening.
- .2 Standard of Acceptance: JR Smith 4420, Zurn Z1440

2.2.2 Stack Cleanout

- .1 In base of cast iron stacks with neoprene gasketted secured cover. Where cleanouts are concealed behind finished walls access shall be round stainless steel plate and slotted flat head S.S. screws.
- .2 Standard of Acceptance: JR Smith 4510, Zurn Z1445

2.2.3 Floor Cleanouts

- .1 Body (For all cleanouts)
- .2 Epoxy coated cast body with integral clamp device, and removable positive seal cleanout plug

2.2.4 In Finished Areas

- .1 All cleanouts shall be coordinated with the Architectural floor finish. Submit shop drawing showing all floor cleanouts on Architectural Terrazzo Finish Drawing to coordinate location with Architectural Terrazzo prior to installation.

2.2.5 In tiled areas:

- .1 Square nickel bronze cover secured with stainless steel screws and frame recessed for tile. Cover shall be adjustable to suit floor lines when installing finished floor.
- .2 Standard of Acceptance: JR Smith 4140-EP-FC, Zurn ZN1400-K Series
- .3 For Non-membrane areas (less clamp device) JR Smith SQ-4-1753-EP-SQNBCO-SP, Zurn Z1600 Series

2.3 RECESSED ACCESS DOORS

2.3.1 Refer to Section 08 31 00 of the specification for access door requirements.

2.3.2 The Mechanical Contractor shall prepare a drawing showing the location of all access doors required in hard ceilings prior to proceeding with the installation of the piping for these areas.

2.4 WATER HAMMER ARRESTOR

2.4.1 Brass piston in a type K copper casing size according to manufacturers recommendation chart below to eliminate water hammer and shock from piping system. Provide water hammer arrester on hot and cold water supplies to all quick

valves, solenoids and plumbing fixtures and locate in an upright position between the last two fixtures on a line, or horizontally at the end of line closets to supply source.

SIZE	FIXTURE UNITS	MODEL NO.	CONN. SIZE
A	1-11	SC-500	2" (12 mm)
B	12-32	SC-700	3/4" (20 mm)
C	33-60	SC-1000	1" (25 mm)
D	61-113	SC-1250	1-1/4" (32 mm)
E	114-154	SC-1500	1 2" (38 mm)
F	155-330	SC-2000	2" (50 mm)

2.4.2 Standard of Acceptance: PPP Series SC, Watts SG Series, Zurn-1705, JR Smith 5200-SC Series

2.5 BACK FLOW PREVENTERS

2.5.1 REDUCED PRINCIPAL BACK FLOW PREVENTERS

- .1 Protect entire potable water distribution system against contamination due to back flow from non potable sources. Back flow preventer reduced pressure principle type: to CSA B64.10.
- .2 The back flow preventer assembly shall consist of a pressure differential relief valve located in a zone between two positive seating check valves and captured springs.
- .3 Back siphonage protection shall include provision to admit air directly into the reduced pressure zone via a separate channel from the water discharge channel.
- .4 The assembly shall include two tightly closing shutoff valves before and after the valve and test cocks.
- .5 Standard of Acceptance for 4" and larger: Watts 909 series, Hersey 6CM Series, Conbraco, Zurn.
- .6 Standard of Acceptance for less than 4": Watts 009 series, Hersey, Conbraco, Zurn

2.5.2 DUAL CHECK VALVES

2.5.3 Provide dual check valves in the locations shown on the drawings.

2.5.4 The dual check backflow preventer shall meet the domestic requirements of CSA B64.10 and bear the seal of approval.

2.5.5 It shall be bronze-bodied and include not less than one union, with the union nut drilled to accept a tamper-proofing lock wire. A brass identification tag indicating direction of flow shall be securely attached to the valve body by corrosion-resistant mechanical fasteners.

2.5.6 Temperature Range: 33°F – 180°F (0.5°C-82°C) continuous

2.5.7 Maximum Working Pressure: 150psi (10.3 bar)

2.5.8 Standard of Acceptance: Watts Series 7, Hersey, Conbraco, Zurn.

2.6 BACKWATER VALVES

2.6.1 Shall meet the following:

.1 Cast Iron

.1 CAN/CSA-B70

.2 ABS

.1 CAN/CSA B181.1

.3 PVC

.1 CAN/CSA B181.2

.2 CAN/CSA B182.1

2.6.2 Epoxy coated cast iron body, bolted access cover with gasket, normally open, with bronze seat and revolving double fulcrum flapper, and stainless steel pin.

2.6.3 Standard of Acceptance: JR Smith 7012, Zurn Z-1090

2.7 TRAP SEAL PRIMERS

2.7.1 Provide for all floor and hub drains.

2.7.2 All Locations

.1 The unit shall supply a minimum of 10 oz. Of water per opening, once in each 24 hour period based on system pressure of 60 psi. Factory assembled with a bronze body ball valve, water hammer arrester, solenoid valve, atmospheric vacuum breaker, 24 hour timer, 3/4" NPT connection, and a type L copper manifold. Electronic single point power connection 120 V 1 amp draw and manual override switch

.2 Trap primer shall be mounted 1 foot above the floor for every 20 feet of make-up water line.

.3 Standard of Acceptance: PPP PT-4 through 24 as required.

3 EXECUTION

3.1 CLEANOUTS

3.1.1 In addition to those required by code, install at base of all soil and waste stacks, and rainwater leaders and where indicated.

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

3.1.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS 4.

3.2 WATER HAMMER ARRESTER

3.2.1 Install on branch supplies to each fixture or group of fixtures and where indicated.

3.3 BACK FLOW PREVENTERS

3.3.1 Install in accordance with manufacturers instructions.

3.3.2 Pipe discharge to nearest drain.

3.3.3 TESTS AND CERTIFICATES

.1 Mechanical Contractor shall be responsible to test back flow preventers, and any other plumbing equipment and provide certificate as required by local building authority. Cost associated with testing and certification shall be paid by the mechanical contractor.

3.3.4 Backflow preventers shall be provided in the make up water supply for all heating and cooling systems to isolate the systems from the domestic cold water supply.

3.4 HOSE BIBBS

3.4.1 Install at bottom of all risers, at low points to drain systems, and as indicated.

3.5 TRAP SEAL PRIMERS

3.5.1 Install on cold water supply to nearest plumbing fixture, in concealed space and in accordance with manufacturers recommendations.

3.5.2 Install shut off valves, solenoid valves and timer in accordance with manufacturer's instructions. Provide wiring and connections as required. Mechanical contractor shall be responsible for all electrical wiring to the timer from the nearest junction box and circuit provided by Electrical Contractor and all control wiring from the timer to the solenoid valves. The electrical work carried out shall comply with Electrical Division.

3.5.3 The trap seal primers are not shown on the drawing. The Mechanical Contractor shall be responsible for locating the trap seal primers in Janitor's closets, Storage Rooms or Mechanical rooms and providing all piping and wiring from these locations.

3.6 STRAINERS

3.6.1 Install in accordance with manufacturers' instructions. Allow sufficient room to remove basket.

3.7 FLOOR DRAINS AND AREA DRAINS

3.7.1 Install all square floor and area drains perpendicular to walls and in accordance with manufacturer's recommendations.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.1.2 Provide maintenance manuals in accordance with Section 22 05 03.

1.2 REFERENCE STANDARDS

1.2.1 Do the work in accordance with the Ontario Building Code - Plumbing Code and in accordance with local regulations except where specified otherwise.

.1 CAN/CSA-B45 Series-02(R2013), Plumbing Fixtures.

.2 CAN/CSA-B125.3-2022, Plumbing Fittings.

.3 CAN/CSA-B651-2012, Accessible Design for the Built Environment.

.4 CSA Z317.1 latest edition, Special Requirement for plumbing installation in health care facilities

.5 CSA Z8000-2018, Canadian Health Care Facilities (Where applicable)

1.2.2 Green Seal Environmental Standards (GSES)

.1 Standard GS-36, Commercial Adhesives.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1.3.1 Provide submittals in accordance with Front End Documents and Section 22 05 01.

1.3.2 Product Data:

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

1.3.3 Indicate fixtures and trim:

.1 Dimensions, construction details, roughing-in dimensions.

.2 Factory-set water consumption per flush at recommended pressure.

.3 For water closets, urinals: minimum pressure required for flushing.

1.3.4 Shop Drawings:

1.3.5 Submit in accordance with Section 22 05 01 and Front End

1.4 CLOSEOUT SUBMITTALS

1.4.1 In accordance with Front End Documents and Section 22 05 03.

1.4.2 Include:

- .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
- .2 Details of operation, servicing, maintenance.
- .3 List of recommended spare parts.

1.5 FIXTURES AND TRIM

1.5.1 Architectural drawings to govern in determination of number and location of fixtures.

1.5.2 Fixtures to be product of one manufacturer.

1.5.3 Unless specified otherwise, trim to be product of one manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

2.1.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

2.1.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.3.

2.2 ELECTRONIC "NO TOUCH FAUCETS/URINALS/WC'S

2.2.1 Provide transformers for each group of "no touch" faucets/flush valves as recommended by the Manufacturer or specified herein.

2.2.2 Male, Female and Handicap washrooms shall be provided with independent transformers so that if there is a transformer failure only one washroom is affected.

2.3 GENERAL

2.3.1 Plumbing fixtures shall be as indicated and specified with all required supports, accessories, wastes, vent and water connections as required to make the fixture complete.

2.3.2 Unless specified otherwise, fixtures shall be white.

2.3.3 Unless specified otherwise, all exposed valves, pipe, escutcheon, etc., shall be polished chrome finish.

2.3.4 Fixtures and trim shall be new and free of all defects or blemishes. Finished surfaces shall be clean, smooth, and bright guaranteed not to craze, change color or scale. Imperfections of any kind shall be sufficient reason for rejection and the item shall be removed and an acceptable replacement installed at no additional cost.

- 2.3.5 The flush tank lever on a barrier free WC shall be located such the lever meets the following
- .1 Is located between 500 mm and 900 mm above the finished floor level.
 - .2 All flush tanks shall have the option of a right hand or a left hand side lever to meet the transfer side of the WC and is operable from the transfer side of the WC.
 - .3 The contractor shall coordinate with the architectural drawings for the transfer side of the WC and ensure that the lever is located accordingly.
 - .4 Is operable with a closed fist and with a force of not more than 22.2 N.
- 2.3.6 Provide all lavatory hot and cold water supply lines with a renewable disc, chromium plated lock shield stop valve.
- 2.3.7 Provide cast brass chrome plated escutcheon plates with set screws on all water and drain pipes where such lines pass through, floors, walls and partitions.
- 2.3.8 Protect fixtures with enamel or glazed surface from damage by covering or coating as recommended in the Bulletin "Handling & Care of Enameled C.I. Plumbing Fixtures".
- 2.3.9 Ontario Building Code conforming wheel chair accessible assemblies shall be covered with an under sink/lavatory protective pipe cover.
- 2.3.10 Standard of Acceptance Plumbing Trim: American Standard, Sloan, Chicago Faucet, Zurn, Delta (Teck)
- 2.4 WATERCLOSETS:
- 2.4.1 Water Closet Type WC-1:
- .1 American Standard 3353101.020 Toilet - AFWALL® MILLENNIUM™ FloWise®, Toilet, Wall-hung with wall outlet, Toilet operates in the range of 4.2 to 6.0 LPF (1.1 - 1.6 GPF), White finish Vitreous china, EverClean® antimicrobial surface, Elongated bowl, Concealed trapway design, Direct-fed siphon jet flush action, 38 mm (1-1/2") back spud, Flush valve by others, 254 x 305 mm (10" x 12") water surface area, Fully-glazed 54 mm (2-1/8") trapway, Static load rating of 454 kg (1000 lb), this product is not recommended for bariatric use, Condensation channel, Toilet seat not included, 356 mm (14") wide, 660 mm (26") from finished wall, ASME A112.19.2 compliant, CSA B45.1 compliant.
 - .2 Centoco AM500STSCCFE-001 Seat - FAST-N-LOCK, For elongated bowl, Open front, Heavy-duty, For commercial applications, Polypropylene, Toilet seat, Less seat cover, Plastic commercial check hinges, and Stainless steel hinge pin, Specified in White finish, and Antimicrobial additive inhibits the growth of stain and odor causing bacteria, FAST-N-LOCK mounting system takes the guess work out when tightening the hardware. The specially designed fasteners in click" when the appropriate torque is reached. The bolt and nut material shall be stainless steel, Dimensions: 25 mm (1") high, 473 mm (18-5/8") long, 371 mm (14-5/8") wide

- .3 Sloan SL-ROYAL 152-1.28-ESS-SWB Flush Valve - ROYAL® Automatic no-touch Concealed Water closet flushometer, High Efficiency 4.8 LPF (1.28 GPF), 38 mm (1-1/2") spud coupling For concealed back spud toilet, Hardwired, constructed from Semi-red brass, Rough brass finish, Chloramine resistant PERMEX® synthetic rubber diaphragm, OPTIMA® EL-1500 self-adaptive infrared sensor, Sensor located on wall box cover plate, 343 x 343 mm (13-1/2" x 13-1/2") small wall box with stainless steel front access panel and vandal-resistant screws, Courtesy Flush® electrical override button, Flush tube for 368 mm (14-1/2") rough-in, 51 - 273 mm (2" - 10-3/4") c.c. "L" dimension range, 25 mm (1") I.P.S. wheel handle Bak-Chek® angle control stop, High back pressure vacuum breaker, 25 mm (1") supply pipe, 24 VAC input/output, With indicator light, Requires transformers 0345154 or 0345999, Compliances:
- .4 Sloan SL-EL-154 Faucet and Flush Valve Power Kit - For flush valve
- .5 Watts ISCA-101-L/R-M20 Carrier - Closet Carrier, Industry Standard single Horizontal adjustable Closet Carrier, Adjustable for standard and wheelchair height, 102 mm (4") no hub waste, 51 mm (2") no hub vent connections, patented compression seal faceplate assembly, epoxy coated cast iron, with incremental measurements embossed onto legs to easily adjust height of carrier to most commonly used fixture requirements, epoxy coated cast iron foot support, neoprene bowl gasket, epoxy coated cast iron, integral test cap, chrome cap nuts, Plated hardware, Adjustable ABS nipple, Flush valve support, Codes and Compliances: Carrier complies with requirements of ASME A112.6.1M up to a 500 lb (227 kg) static load.
- .6 Mission NO HUB Series Coupling - shielded No-hub (MJ) coupling, For non-pressure gravity flow applications only, Recommended for above ground installations, (2 or 4) Type 301 stainless steel worm drive clamps, Type 301 corrugated stainless steel shield, One-piece molded elastomeric sealing gasket, Tightened to 69 kgf.cm (60 lbf.in) max. torque, Stainless steel conforms to ASTM A240/A240M, Meets & exceeds performance standard ASTM C1277, Rubber conforms to ASTM C564, Meets or exceeds all CISPI® 310 specifications, Conforms to CSA CLASS 7021 (B602), IAPMO FILE 0743 listed.

2.4.2 Water Closet Type WC-2, BARRIER FREE:

- .1 American Standard 3353101.020 Toilet - AFWALL® MILLENNIUM™ FloWise®, Toilet, Wall-hung with wall outlet, Toilet operates in the range of 4.2 to 6.0 LPF (1.1 - 1.6 GPF), White finish Vitreous china, EverClean® antimicrobial surface, Elongated bowl, Concealed trapway design, Direct-fed siphon jet flush action, 38 mm (1-1/2") back spud, Flush valve by others, 254 x 305 mm (10" x 12") water surface area, Fully-glazed 54 mm (2-1/8") trapway, Static load rating of 454 kg (1000 lb), this product is not recommended for bariatric use, Condensation channel, Toilet seat not included, 356 mm (14") wide, 660 mm (26") from finished wall, ASME A112.19.2 compliant, CSA B45.1 compliant.
- .2 Centoco AM500STSCCFE-001 Seat - FAST-N-LOCK, For elongated bowl, Open front, Heavy-duty, For commercial applications, Polypropylene, Toilet seat, Less seat cover, Plastic commercial check hinges, and Stainless steel hinge pin, Specified in White finish, and Antimicrobial additive inhibits the growth of stain and odor causing bacteria, FAST-N-LOCK mounting system takes the guess work out when tightening the hardware. The specially designed fasteners in

click" when the appropriate torque is reached. The bolt and nut material shall be stainless steel, Dimensions: 25 mm (1") high, 473 mm (18-5/8") long, 371 mm (14-5/8") wide

- .3 Franke Commercial CM-16104-WM Backrest - wall mounting, back rest, solid core plastic laminate panel back, Antique white, 305 mm (12") wide, 102 mm (4") high, 137 mm (5-3/8"), 18 gauge stainless steel bar with #4 gloss with flanges and covers, concealed snap flanges and mounting hardware included, Provide adequate backing in wall for support and comply to local codes for barrier free requirements
- .4 Sloan SL-ROYAL 152-1.28-ESS-SWB Flush Valve - ROYAL® Automatic no-touch Concealed Water closet flushometer, High Efficiency 4.8 LPF (1.28 GPF), 38 mm (1-1/2") spud coupling For concealed back spud toilet, Hardwired, constructed from Semi-red brass, Rough brass finish, Chloramine resistant PERMEX® synthetic rubber diaphragm, OPTIMA® EL-1500 self-adaptive infrared sensor, Sensor located on wall box cover plate, 343 x 343 mm (13-1/2" x 13-1/2") small wall box with stainless steel front access panel and vandal-resistant screws, Courtesy Flush® electrical override button, Flush tube for 368 mm (14-1/2") rough-in, 51 - 273 mm (2" - 10-3/4") c.c. "L" dimension range, 25 mm (1") I.P.S. wheel handle Bak-Chek® angle control stop, High back pressure vacuum breaker, 25 mm (1") supply pipe, 24 VAC input/output, With indicator light, Requires transformers 0345154 or 0345999, Compliances:
- .5 Sloan SL-EL-154 Faucet and Flush Valve Power Kit - For flush valve
- .6 Watts ISCA-101-L/R-M20 Carrier - Closet Carrier, Industry Standard single Horizontal adjustable Closet Carrier, Adjustable for standard and wheelchair height, 102 mm (4") no hub waste, 51 mm (2") no hub vent connections, patented compression seal faceplate assembly, epoxy coated cast iron, with incremental measurements embossed onto legs to easily adjust height of carrier to most commonly used fixture requirements, epoxy coated cast iron foot support, neoprene bowl gasket, epoxy coated cast iron, integral test cap, chrome cap nuts, Plated hardware, Adjustable ABS nipple, Flush valve support, Codes and Compliances: Carrier complies with requirements of ASME A112.6.1M up to a 500 lb (227 kg) static load.
- .7 Mission NO HUB Series Coupling - shielded No-hub (MJ) coupling, For non-pressure gravity flow applications only, Recommended for above ground installations, (2 or 4) Type 301 stainless steel worm drive clamps, Type 301 corrugated stainless steel shield, One-piece molded elastomeric sealing gasket, Tightened to 69 kgf.cm (60 lbf.in) max. torque, Stainless steel conforms to ASTM A240/A240M, Meets & exceeds performance standard ASTM C1277, Rubber conforms to ASTM C564, Meets or exceeds all CISPI® 310 specifications, Conforms to CSA CLASS 7021 (B602), IAPMO FILE 0743 listed.

2.5 LAVATORY

2.5.1 Basin L-1 WALL HUNG LAVATORY:

- .1 American Standard 0955001EC.020 0062000EC.020 Basin - MURRO, Wall-hung Lavatory, Vitreous china, EverClean® antimicrobial surface, White finish, Single hole centerset, Rear overflow, Faucet ledge with recessed self-draining

deck, For concealed arm or wall support, Acrylic shroud/knee contact guard less EverClean (0062000), Soap dispenser, When installed with a below deck electronics faucet which has the control box, the accessories will not fit under the shroud and will need to be installed outside the shroud, Overall Dimensions: 545 mm (21-7/16") long, 540 mm (21-1/4") wide, 152 mm (6") high, Bowl Dimensions: 343 mm (13-1/2") long, 394mm (15-1/2") wide, 127 mm (5") deep

- .2 Chicago Faucets 116.102.AB.1 Faucet - HYTRONIC®, Counter mounted, Automatic no-touch, Hardwired, Lavatory faucet, Polished chrome finish, Single hole centerset, Lead Free ANSI/NSF 61 compliant, ECAST® brass construction, Stainless steel hose included, 1.9 LPM (0.5 GPM) maximum flowrate, Vandal-resistant pressure compensating Econo-Flo™ non-aerated laminar spray outlet, includes optional 5.7 LPM (1.5 GPM) insert, Fixed Integral spout, 130 mm (5-1/8") spout reach, 168 mm (6-5/8") high, Dual infrared sensor, 12 volt AC transformer required (to be ordered separately).
- .3 McGuire 155WC Fixture Drain - Offset drain, offset lavatory strainer, Lavatory, Cast brass, Chrome-plated finish, Inorganic microbial compound, 7/32" (5.5 mm) Ø holes size, Polished chrome, Cast brass elbow, 17 gauge 32 mm (1-1/4") Ø tailpiece, 146 mm (5-3/4") offset, Brass locknut, Heavy rubber basin washer Fiber friction washer, ADA compliant, ASME A112.18.2 CSA B125.2, CSA compliant
- .4 McGuire LFBV170 Supply - CONVERTIBLE™ Commercial Faucet Supply kit, consisting of (2) stop valves, (2) risers, (2) flanges (standard), Lead Free Chrome-plated finish Brass body, 138 - 862 kPa (20 - 125 PSI) operating pressure, 4 to 60 °C (40 to 140 °F) operating temperature, Convertible loose key/triangle handle, Quarter turn ball valve, Angle stop, C.P. wrought steel deep bell wall flange (standard), C.P. prefabricated 127 mm (5") copper sweat tube extension nipple, 305 mm (12") C.P. lavatory flexible copper riser tubes (standard), 13 mm (1/2") Sweat inlet x 10 mm (3/8") O.D. outlet, 82 °C (180 °F) maximum during high-temperature system flush, AB 100 compliant, ASME A112.18.1 compliant, ASME A112.18.2-2 (risers), CSA B125.2 compliant (risers), Certified to NSF/ANSI 372, Certified to NSF/ANSI 61, UPC compliant.
- .5 McGuire 8872CB P-Trap - Heavy cast brass, 292 mm (11-1/2") distance, With cleanout plug, Steel box flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant
- .6 Watts CA-411-CA-481 Carrier - Lavatory carrier, Floor mounted concealed arm lavatory carrier, Epoxy coated cast iron concealed arms, Integral welded feet, Foot supports should be securely anchored to floor with 1/2" bolts and anchors by others, Heavy gauge steel uprights, Leveling screws and basin locking device, upper tie rod, and plated hardware., Wall mounted steel support plate with plated hardware.
- .7 Chicago Faucets 243.260.00.1/242.340.00.1 Faucet and Flush Valve Power Kit - Hardwired AC transformer, Transformer and wire
- .8 Lawler 570-86820 Mixing Valve - Point of Use and Master controlled fixtures, Thermostatic master water mixing control valve, The temperature is adjusted with the help of Spindle.

- .9 Watts CA-411-CA-481 Carrier - Lavatory carrier, Floor mounted concealed arm lavatory carrier, Epoxy coated cast iron concealed arms, Integral welded feet, Foot supports should be securely anchored to floor with 1/2" bolts and anchors by others, Heavy gauge steel uprights, Leveling screws and basin locking device, upper tie rod, and plated hardware., Wall mounted steel support plate with plated hardware

2.5.2 Basin L-2 SEMI COUNTER TOP LAV:

- .1 American Standard 9960403.020 Basin - MEZZO, Semi-countertop Lavatory, Fine fire clay, White finish, 102 mm (4") centerset, Rear overflow, With faucet ledge, Mounting kit supplied, Overall Dimensions: 559 mm (22") long, 546 mm (21-1/2") wide, 172 mm (6-25/32") high, Bowl Dimensions: 483 mm (19") long, 381 mm (15") wide, 175 mm (6-7/8") deep
- .2 Sloan Faucet EBF-650-BAT-TEE-CP-0.5GPM-MLM-IR-BT-FCT Faucet - Counter mounted, Hands free battery power supply, back check tee, polished chrome finish, 0.5 gpm, multi laminar spray, infrared sensor, smart faucet, optimal battery powered deck mounted low integrated base body faucet.
- .3 McGuire 155WC Fixture Drain - offset drain, offset lavatory strainer, Lavatory, Cast brass, Chrome-plated finish, Inorganic microbial compound, 7/32" (5.5 mm) Ø holes size, Polished chrome, Cast brass elbow, 17 gauge 32 mm (1-1/4") Ø tailpiece diameter, 146 mm (5-3/4") offset, Brass locknut, Heavy rubber basin washer Fiber friction washer, ADA compliant, ASME A112.18.2 CSA B125.2, CSA compliant.
- .4 McGuire LFBV170 Supply - Lead free, 127 mm (5") length, Convertible quarter-turn supply, Chrome-plated finish, 13 mm (1/2") copper sweat x 10 mm (3/8") outer Ø brass ball valve, 304 mm (12") copper flexible risers, Convertible loose key handle, Lavatory, One deep bell flange
- .5 McGuire 8872CB P-Trap - Heavy cast brass, 292 mm (11-1/2") distance, With cleanout plug, Steel box flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant.

2.6 SHOWER

2.6.1 SH-1 PRESSURE BALANCING SHOWER

- .1 American Standard TU075508 Coly Pro Bath/Shower trim kit with pressure balancing valve. Polished chrome finish, Pressure balancing tub and shower system with valve trim, Cold to hot cycle, Wall mounted, Round, 190 mm (7-1/2") Ø trim size, Lever handle, Pressure balancing valve, Built-in integral check stops, Pressure balancing valve cartridge, 13 mm (1/2") nominal Ø copper sweat inlet, 13 mm (1/2") nominal Ø copper sweat outlet, 138 - 862 kPa (20 - 125 PSI) operating pressure range, 4 °C - 60 °C (40 °F - 140 °F) operating temperature range, ADA compliant, ANSI/ICC A117.1/ASSE 1016/ASME A112.1016/CSA B125.16
- .2 American Standard rough valve body RU101SS Flash Rough Valve Body with Flash connections with screw driver stops.

- .3 American Standard water saving shower head 1660.711 Vandal Resistant Water saving shower head only. 1660.240.002 Standard Shower Arm brass construction ½" NPT polished chrome.
- .4 American Standard 3 function hand shower 1660.766 with Pause control, 1.5 GPM (5.5 LPM) flowrate, 13 mm (1/2") Ø NPT female thread inlet, 80 PSI max operating pressure, A112.18.1, ASME codes, CSA B125.16, WaterSense listed
- .5 American Standard 8888.035 Shower Hose - Flexible shower hose, 69" (1801 mm) long stainless steel hose with pause control, 13 mm (1/2") Ø NPSM female inlet, 13 mm (1/2") Ø NPSM Male outlet, A112.18.1, ASME codes, CSA B125.16 complete with 8888.037 Wall Supply polished chrome.
- .6 American Standard 1662.236 Slide/ Grab Bar-Stainless steel construction, Grab bar with hand spray holder, Polished chrome finish, 38 mm (1-1/2") Ø bar diameter, 914 mm (36") long slidebar, 1-1/2" diameter stainless steel bar, Locking wall flange, ADA, ICC A117.1; ASME A112.18.1; CSA B125.1, Wood screws and anchors
- .7 American Standard in wall diverter valves T064.430 valve trim.
- .8 American Standard in wall two way diverter valve R422S.
- .9 American Standard Vacuum Breaker - Vacuum breaker, for Inline with 13 mm (1/2") NPSM Female inlet/NPSM Male outlet size, 140 °F max temperature, 120 PSI max operating pressure, Certification and Compliances include: ASSE 1014 compliant.

2.7 SINKS

2.7.1 S-1 STAINLESS STEEL WALL HUNG SINK

- .1 Franke Commercial WHB1819-3-3 Basin - Wall-hung Lavatory, Type 304 18 gauge Stainless steel, Polished to #4 satin finish, 102 mm (4") centerset, Single compartment, Less overflow, With faucet ledge, Radius coved bowl corners, 95 mm (3-3/4") high backsplash, 38 mm (1-1/2") duplex waste with rubber stopper, 38 mm (1-1/2") (DN40) brass tailpiece, Center back waste location, For Wall Plate Carrier, 16 gauge side wall brackets, one piece wall hanger, Overall Dimensions: 470 mm (18-1/2") long, 483 mm (19") wide, 273 mm (10-3/4") high, Bowl Dimensions: 406 mm (16") long, 356 mm (14") wide, 178 mm (7") deep
- .2 Chicago Faucets 895-317GN2FCAB Faucet - Counter mounted, Manual, Two handles, Sink/lavatory faucet, Polished chrome finish, 102 mm (4") centerset, Lead Free ANSI/NSF 61 compliant, ECAST® brass construction, 1/4 turn compression cartridge, 5.7 LPM (1.5 GPM) maximum flowrate, Plain end outlet with laminar flow control insert in spout inlet, Rigid/swing Gooseneck spout, 133 mm (5-1/4") spout reach, 283 mm (11-1/8") high, 102 mm (4") wrist blade handle with indexed buttons, 13 mm (1/2") NPSM supply inlet for 10 mm (3/8") or 13 mm (1/2") flexible riser.

- .3 Lawler 570-86820 Mixing Valve - Point of Use and Master controlled fixtures, Thermostatic master water mixing control valve, The temperature is adjusted with the help of Spindle.
- .4 McGuire LFCK170LK Supply - ICV DEFENDER Faucet Supply kit, consisting of (2) stop valves, (2) risers, (2) flanges (standard), Lead Free Chrome-plated finish Brass body, 138 - 862 kPa (20 - 125 PSI) operating pressure, 4 to 60 °C (40 to 140 °F) operating temperature, Loose key handle, Full turn, Angle stop, Spring actuated integral check valve, C.P. wrought steel deep bell wall flange (standard), C.P. prefabricated 127 mm (5") copper sweat tube extension nipple, 305 mm (12") C.P. lavatory flexible copper riser tubes (standard), 13 mm (1/2") Sweat inlet x 10 mm (3/8") O.D. outlet, 82 °C (180 °F) maximum during high-temperature system flush, AB 100 compliant, ASME A112.18.3, ASME A112.18.2-2 (risers), CSA B125.2 compliant (risers), Certified to NSF/ANSI 372, Certified to NSF/ANSI 61, UPC compliant.
- .5 McGuire 8872CB P-Trap - Heavy cast brass, 292 mm (11-1/2") distance, With cleanout plug, Steel box flange, Neoprene gasket, Slipnuts, 17 gauge seamless tubular wall bend, ASME A112.18.2 CSA B125.2, CSA compliant
- .6 Watts CA-421 Carrier - Lavatory support, Single, Wall Plate, Integral welded feet, Universal steel hangar support plate, Heavy gauge steel offset uprights, Plated hardware.

2.8 BATH TUB

2.8.1 BT-1 HYDROTHERAPY BATH TUB

- .1 Acceptable Manufacturer (or approved equal): Arjo Rhapsody – System 23, Colour White
- .2 Free Standing. Tub length = 1900mm (75"). Tub width = 970mm (38"), Tub height = 460mm (18-1/8"), Total Weight (tub+panel+water) = 470 kg (1037 lb).
- .3 Complete with disinfection unit, spray handle, bottles.
- .4 Water, Drain, requirements:
 - .1 Hot/Cold water connection: ¾" B.S.P. male.
 - .2 Maximum static pressure: 6 bar (600 kPa, 87psi).
 - .3 Minimum operating pressure: 2 bar (200 kPa, 29 psi).
 - .4 Required cold water temperature: 2-20 degrees Celsius.
 - .5 Required warm water temperature: 60-80 degrees Celsius.
 - .6 Connect with shut off valves between unit and supply net, minimum through 16mm diameter.
 - .7 Drainage capacity: 100 l/minute.

.5 Main disconnection device:

- .1 Permanently installed in wall & visible at all times.
- .2 Mains transient voltage: 4 kV
- .3 Creepage distance: 3mm
- .4 Air clearance: 1.8mm
- .5 Direction of movement: up and down, right and left, clockwise and counterclockwise.

.6 Electrical supply requirements:

- .1 120V, Single Phase AC, 60Hz, 1100 VA, Fuse: 10A.
- .2 Protective earth: Yes.
- .3 Potential equalization: Yes.
- .4 The unit shall be electrically connection to a separate fuse, ground fault circuit interrupter (10mA), safety switch, emergency switch, mains cable (3x16 AWG / 3x1.5 mm²).
- .5 IP Class: IP X4. IP Class Hand Control: IP X7.

.7 Standards and Certificates

- .1 WRAS 0509066.
- .2 UL E180493.
- .3 EN/ISO 60601-1, UL 2601-1.
- .4 CAN/CSA-C22.2 No. 601.1.
- .5 ENMC 99212. EN 60601-1-2.
- .6 UL SA12041.
- .7 CSA B45.5-02.
- .8 ANSI Z124.1.2-2005.
- .9 ANSI/ASME A112.19.7-1995.
- .10 ANSI/ASME A112.19.8-1987.
- .11 ASSE 1001-1988, CSA B64.1.1.
- .12 ASSE 1056, CSA B64.1.2.

.13 ANSI/ASSE 1014-1989.

.14 ANSI/ASSE 1016-1996.

.15 EN 1717: 2001.

.8 Provide the following accessories:

.1 Grey Pillow: 8331457-03.

.2 Foot Support: 8154647-04.

.3 Bottles of each:

.1 Disinfectant. (2 – 2 litre bottles).

.2 Bath Oil. (2 – 2 litre bottles).

.3 Shampoo, body wash. (4 - 2 litre bottles).

.4 Provide rough-ed in sanitary and water connection compatible with the machine.

.4 Install the machine in accordance with manufacturer written instructions.

.5 Fully commission and test the machine prior to substantial completion.

.6 Provide user demonstration on operation of the machine, including features and options.

.7 Provide O&M manual data, including shop drawings, maintenance requirements, suggested cleaning products, etc.

2.9 WASHBOX

2.9.1 Wash box - WB-1: For Indirect Drain connection and For Clothes Washers

.1 Flush with wall, with single lever operated valve, hose end outlets, copper liner, service stops, ½" (12.7mm), hot and cold water connection, 1 ½" (38mm) drain outlet. "p" trap cast brass, 1 ½" (38mm) concealed in wall.

.2 Standard of Acceptance: Symmons " Eliminator" #W-600-X Laundry Mate Washer Box, Powers, Leonard.

PART 3 - EXECUTION

3.1 INSTALLATION

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

3.1.2 Conform to water conservation requirements specified this section.

3.1.3 Connect fixtures complete with supplies and drains, traps and cleanouts, supported level and square. Hot water faucets shall be on left.

- 3.1.4 Provide venting for all plumbing fixtures as required by codes.
- 3.1.5 All handicap fixtures to be mounted at heights to be in accordance with Ontario Building Code requirements and shall be in accordance with requirements of local authorities having jurisdiction.
- 3.1.6 Provide chrome plated flexible supplies to fixtures with screw driver stops, reducers and escutcheons.
- 3.1.7 All piping shall be recessed unless otherwise approved. Piping to be installed in areas shall be run in neat parallel lines as tight as possible to walls and ceilings.
- 3.1.8 Division 22 shall provide all wiring for the electronic urinals, lavatories, bath tub and other hands free electrical and electronic fixtures from the connections within the room provided by Division 26.
- 3.1.9 Install combination eyewash safety showers in accordance with manufacturer's recommendations.
- 3.1.10 Install bath tub as per manufacturer's requirements including P&D and electrical connection requirements.
- 3.1.11 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.
 - .4 Adjust urinal flush timing mechanisms.
 - .5 Set controls of automatic flush valves for WCs and urinals to prevent unnecessary flush cycles.
- 3.1.12 Checks:
 - .1 Water closets, urinals: flushing action.
 - .2 Aerators: operation, cleanliness.
 - .3 Vacuum breakers, backflow preventers: operation under all conditions.
- 3.1.13 Thermostatic controls:
 - .1 Verify temperature settings, operation of control, limit and safety controls.
- 3.2 CLEANING
- 3.2.1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.2 SUMMARY

1.2.1 Section Includes:

- .1 Use of mechanical systems during construction.
- .2 Use of permanent heating and or ventilating systems for supplying temporary heat or ventilation is permitted only under the following conditions.

1.3 USE OF SYSTEMS

- 1.3.1 Use of new and or existing permanent heating and or ventilating systems for supplying temporary heat or ventilation is not permitted. It is permitted only under following conditions:

- .1 Entire system is complete, pressure tested, cleaned, flushed out.
- .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
- .3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
- .4 There is no possibility of damage.
- .5 Supply ventilation systems are protected by Merv 11 filters, inspected daily, changed every week or more frequently as required.
- .6 Return systems have a minimum of Merv 11 filters over openings, inlets, outlets.
- .7 Systems will be:
 - .1 Operated by Contractor.
 - .2 The condition of the filters shall be inspected and documented daily. Written report of filter condition to be submitted on a weekly basis to the Consultant.
 - .3 Warranties and guarantees are not relaxed.
 - .4 Regular preventive and other manufacturers recommended maintenance routines are performed by Contractor at own expense and under supervision of Consultant.

.8 Refurbish entire system before static completion; clean internally and externally, restore to "as- new" condition, replace filters in air systems.

1.3.2 Filters specified in this Section are over and above those specified in other Sections of this project.

1.3.3 Exhaust systems are not included in approvals for temporary heating ventilation.

PART 2 - PRODUCTS

2.1 NOT USED

2.1.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

3.1.1 Not Used.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.2 SUMMARY

1.2.1 Section Includes:

- .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
- .2 Sustainable requirements for construction and verification.

1.3 REFERENCES

1.3.1 Canadian Gas Association (CGA)

- .1 CSA/CGA B149.1-2020 Natural Gas and Propane Installation Code.

1.3.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-1.60 -1997 Interior Alkyd Gloss Enamel.
- .2 CAN/CGSB-24.3 - 1992 Identification of Piping Systems.

1.3.3 National Fire Protection Association (NFPA)

- .1 NFPA 13-2022, Standard for the Installation of Sprinkler Systems.

1.4 SUBMITTALS

- .1 Provide in accordance with Front End Documents and Section 22 05 01.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Front End Documents and manufacturer's written instructions.

1.5.2 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: Provide in accordance with Front End Documents

1.6 MOCK UPS

- 1.6.1 Provide a mock-up of the identification and labelling system for review and approval prior to proceeding with the installation of the labelling for the project.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

- 2.1.1 Metal nameplate mechanically fastened to each piece of equipment by manufacturer.
- 2.1.2 Lettering and numbers raised or recessed.
- 2.1.3 Information to include, as appropriate:
 - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
 - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.
- 2.1.4 Locate nameplates so that they are easily read. Do not insulate or paint over plates.

2.2 SYSTEM NAMEPLATES

- 2.2.1 Colours:
 - .1 Hazardous: red letters, white background.
 - .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- 2.2.2 Construction:
 - .1 3 mm thick laminated plastic matte finish, with square corners, letters accurately aligned and machine engraved into core.
- 2.2.3 Sizes:
 - .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- 2.2.4 Locations:
 - .1 Terminal cabinets, control panels: use size # 5.
 - .2 Equipment in Mechanical Rooms: use size # 9.

2.2.5 Identify equipment type and number (e.g. Pump No. 2) and service or areas or zone of building served e.g. " Outer Lobby AHU No. 3 ".

2.2.6 All plates shall be pop riveted in place.

2.2.7 Fasten nameplates securely in conspicuous place.

2.2.8 Submit list of nameplates for review prior to engraving.

2.3 EXISTING IDENTIFICATION SYSTEMS

2.3.1 Apply existing identification system to new work.

2.3.2 Where existing identification system does not cover for new work, use identification system specified this section.

2.3.3 Before starting work, obtain written approval of identification system from the Consultant.

2.4 PIPING SYSTEMS GOVERNED BY CODES

2.4.1 Identification:

.1 Natural gas: to CSA/CGA B149.1 and TSSA.

.2 Propane gas: to CSA/CGA B149.1 and TSSA.

.3 Sprinklers: to NFPA 13.

.4 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

2.5.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

2.5.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

2.5.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

2.5.4 Manufactured pipe markers and color bands:

2.5.5 All identification shall incorporate direction of flow arrows.

2.5.6 Markers shall be manufactured from semi rigid plastic vinyl, with subsurface printing using quality indoor/outdoor vinyl inks and a UV vinyl inhibitor.

2.5.7 For outside diameters up to 6" the markers shall be coiled and wrap completely around the pipe with six rows of wording in alternate directions.

2.5.8 For outside diameters greater than 6" the markers shall be saddle style with two (2) rows of wording and shall be installed utilizing nylon cable ties provided with the marker.

2.5.9 Standard of Acceptance: SMS Coil-Mark, Brady Wrap Around, Seton Setmark

2.5.10 Table: pipe and valve identification.

.1 Coding shall be in accordance with the following schedule with approved plastic bands:

PIPE MARKER LEGEND	LETTERING ON BAND	BAND COLOR	LETTERING COLOR
Cold water	Cold Water	Green	White
Domestic Hot Water DHW	Dom. Hot Water	Yellow	Black
Domestic Hot Water Recirc.	Dom. H.W. Recirc	Yellow	Dark Green
San sewer	Sanitary Drain	Green	White
Sprinkler water	Sprinkler Water	Red	White
Storm Water	Storm Drain	Green	White
Vent	Vent	Green	White

2.6 IDENTIFICATION DUCTWORK SYSTEMS

2.6.1 Use 50mm (2") high black stenciled letters, e.g. "Supply AH-1", "Return AH-1", "Sanitary Exhaust EF-1" with directional flow arrow. Lettering must identify the system that the ductwork serves.

2.6.2 Maintain maximum 15m (50 ft) distance between markings.

2.6.3 Identify ducts each side of dividing walls or partitions and beside each access door.

2.6.4 Stencil over final finish only.

2.7 VALVES, CONTROLLERS

2.7.1 Provide two-ply engraved laminated plastic tags equal to SMS Series LS-1500 color coding.

2.7.2 Provide Consultant with six (6) identification flow diagrams of approved size for each system. Include tag schedule, designating number, service, function, and location of each tagged item and normal operating position of valves.

2.7.3 Install where directed one (1) copy of flow diagram and valve schedule mounted in glazed frame. Provide one (1) copy in each operating and maintenance instruction manual.

2.7.4 Consecutively number valves in systems.

2.7.5 Mechanical Contractor shall coordinate the valve numbering system utilized for the new building with the Owner's current valve numbering system.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

3.2.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.2.2 Provide ULC and CSA registration plates as required by respective agency.

3.3 NAMEPLATES

3.3.1 Locations:

.1 In conspicuous location to facilitate easy reading and identification from operating floor.

3.3.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

3.3.3 Protection:

.1 Do not paint, insulate or cover.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

3.4.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 15 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

3.4.2 Adjacent to each change in direction.

3.4.3 At least once in each small room through which piping or ductwork passes.

3.4.4 On both sides of visual obstruction or where run is difficult to follow.

3.4.5 On both sides of separations such as walls, floors, partitions.

3.4.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

3.4.7 At beginning and end points of each run and at each piece of equipment in run.

- 3.4.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- 3.4.9 Identification easily and accurately readable from usual operating areas and from access points.
 - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.
- 3.5 VALVES, CONTROLLERS
 - 3.5.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.
 - 3.5.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass in the Mechanical Room. Provide one copy (reduced in size if required) in each operating and maintenance manual.
 - 3.5.3 Provide an electronic version in the Maintenance Manual in accordance with Section 22 05 02.
 - 3.5.4 Number valves in each system consecutively.
- 3.6 CLEANING
 - 3.6.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01.

1.1.2 Follow start-up procedures as recommended by manufacturer and their warranty requirements.

1.1.3 Special start-up procedures may be specified elsewhere.

1.2 PREQUALIFIED CONTRACTORS

1.2.1 The Air and Hydronic Balancing Contractor shall be one of the following:

.1 Dasstab.

.2 Design Test and Balance.

.3 VPG.

.4 Flowset.

.5 Pro-Air.

.6 Verify

1.3 REFERENCE STANDARDS:

1.3.1 Do TAB of complete mechanical systems over entire operating range in accordance with most stringent conditions of selected standard:

1.3.2 AABC (Associated Air Balance Council).

1.3.3 ASHRAE (American Society of Heating Refrigerating & Air Conditioning Engineers).

1.3.4 NABC (National Air Balance Council).

1.3.5 SMACNA (Sheet Metal & Air Conditioning Contractors National Association).

1.3.6 Specifications herein or elsewhere in contract documents.

1.4 SUMMARY

1.4.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

1.4.2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.5 QUALIFICATIONS OF TAB PERSONNEL

- 1.5.1 Submit names of personnel to perform TAB to the Consultant within 90 days of award of contract.
- 1.5.2 Provide documentation confirming qualifications and relevant experience.
- 1.5.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-[2015]
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing
- 1.5.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- 1.5.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- 1.5.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- 1.5.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- 1.5.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.
- 1.6 PURPOSE OF TAB
 - 1.6.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
 - 1.6.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
 - 1.6.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.
- 1.7 EXCEPTIONS

- 1.7.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.
- 1.8 CO-ORDINATION
 - 1.8.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
 - 1.8.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.
- 1.9 SHOP DRAWINGS
 - 1.9.1 Prior to commencing work, shop drawings shall be submitted showing equipment, proof of calibration, testing methods to be used with each different style of diffuser and measuring point, and forms and diagrams to be used for the air and hydronic balance.
- 1.10 PRE-TAB REVIEW
 - 1.10.1 Review contract documents before project construction is started and confirm in writing to The Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
 - 1.10.2 Review specified standards and report to the Consultant in writing proposed procedures which vary from standard.
 - 1.10.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.
- 1.11 SITE INSPECTIONS AND SUBSEQUENT MEETINGS:
 - 1.11.1 Schedule once a month, site visits to correspond with the weekly site meeting. After each site visit submit a written report to the Construction Manager and Mechanical Consultant. Site visits shall commence at the start of the air and hydronic distribution work and be spread over the construction period up to the start of the balance of the work. If work requiring correction is discovered during an inspection, be sure that the required correction work is clearly indicated in the report. In addition to site meetings and inspections specified above, attend, when requested by the Consultant, at the TAB Contractor's expense any other meetings where the TAB Contractor's presence is required.
 - 1.11.2 Prior to the start of the balancing work convene pre installation meeting two weeks prior to the start of the balancing work in accordance with section 01 32 16.06 Construction progress schedule – Critical Path method.
 - 1.11.3 To be beneficial these reports are required to be submitted on the last day of each month and as a result, a cash allowance shall be carried to ensure that the reports are submitted.
 - 1.11.4 The Mechanical Contractor shall include a cash allowance within the mechanical contract value equal to the following:

- .1 No. of Months of Construction x \$1,000.
 - .2 The number of months of construction shall be considered the date where air and hydronic distribution commences on site to the date of project completion.
- 1.11.5 The cash allowance shall be distributed as the reports are submitted. Failure to submit the report on time will result in the cash allowance for the project being reduced by \$1,000 per late report.
- 1.12 START-UP
 - 1.12.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
 - 1.12.2 Follow special start-up procedures specified elsewhere in Division 22 and 23.
- 1.13 OPERATION OF SYSTEMS DURING TAB
 - 1.13.1 Operate systems for length of time required for TAB and as required by the Consultant for verification of TAB reports.
- 1.14 START OF TAB
 - 1.14.1 Notify the Consultant 14 days prior to start of TAB.
 - 1.14.2 Start TAB when building is essentially completed, including:
 - 1.14.3 Installation of ceilings, doors, windows and other construction affecting TAB.
 - 1.14.4 Application of weatherstripping, sealing, and caulking.
 - 1.14.5 Pressure, leakage, and other tests are complete specified elsewhere Division 23.
 - 1.14.6 Provisions for TAB installed and operational.
 - 1.14.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Construction filters removed.
 - .4 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .5 Correct fan rotation.
 - .6 Fire and volume control dampers installed and open.

- .7 Coil fins combed, clean.
- .8 Access doors, installed, closed.
- .9 Outlets installed; volume control dampers open.

1.15 SYSTEMS TO BE TESTED

1.15.1 TAB to apply to following systems, equipment and related controls:

- .1 Air supply to the space.
- .2 Exhaust air from the space.

1.16 FINAL BALANCING

1.16.1 Start final TAB only when building is essentially completed, including:

- .1 Installation of ceilings, doors, windows, light fixtures and other construction affecting TAB.
- .2 Application of sealing, caulking and weather stripping.
- .3 Normal operation of mechanical systems affecting TAB.

1.17 APPLICATION TOLERANCES

1.17.1 Do TAB to following tolerances of design values:

- .1 Diffusers: plus 10 %, minus 10 %.
- .2 Exhaust Systems: plus 10% , minus 10%
- .3 Air Handling Units: plus 5% minus 5%.
- .4 Hydronic systems: plus 5% or minus 5 %.

1.18 ACCURACY TOLERANCES

1.18.1 Measured values accurate to within plus or minus 2 % of actual values.

1.19 INSTRUMENTS

1.19.1 Prior to TAB, submit to The Consultant list of instruments used together with serial numbers.

1.19.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

1.19.3 Calibrate within three (3) months of using instruments for TAB activity. Provide certificate of calibration to The Consultant.

1.20 SUBMITTALS

- 1.20.1 Submit, prior to commencement of TAB:
- 1.20.2 Proposed methodology and procedures for performing TAB if different from referenced standard.
- 1.21 PRELIMINARY TAB REPORT
 - 1.21.1 Submit for checking and approval of the Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.
 - .5 TAB air reports
- 1.22 VERIFICATION
 - 1.22.1 Reported results subject to verification by the Consultant
 - 1.22.2 Provide personnel and instrumentation to verify up to 30% of reported results.
 - 1.22.3 A measured flow deviation of more than 10 percent between the verification reading and the reported data shall be considered a failure of the verification procedure.
 - 1.22.4 A failure of more than 10-percent of the selected verification readings shall result in the rejection of the report as unacceptable.
 - 1.22.5 Should the report be rejected, the TAB Contractor shall rebalance all systems, submit new certified reports and make a re-inspection at no additional cost to the Owner.
 - 1.22.6 Number and location of verified results as directed by the Consultant
 - 1.22.7 Pay costs to repeat TAB as required to satisfaction of the Consultant.
- 1.23 SETTINGS
 - 1.23.1 After TAB is completed to satisfaction of the Consultant replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
 - 1.23.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.
 - 1.23.3 Equipment with ECM Motors
 - .1 TAB contractor shall program the ECM motors to deliver the specified air flow.
- 1.24 COMPLETION OF TAB

1.24.1 TAB considered complete when final TAB Report received and approved by the Consultant.

1.25 AIR SYSTEMS

1.25.1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA and ASHRAE.

1.25.2 Measurements:

.1 Air velocity.

.2 Static pressure.

.3 Velocity pressure.

1.25.3 Location of System Measurements at:

.1 Main branch ducts.

.2 Sub branch ducts.

.3 Each supply, exhaust and return air inlet and outlet.

.4 All areas served by system.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Balancing shall be carried out by an independent qualified balancing company. Balancing company must be one of the approved balancing companies.

3.1.2 The TAB contractor shall visit the site in accordance with Item 1.3 above.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.2 WET INSULATION

- 1.2.1 Insulation that has become wet or contaminated shall not be installed.
- 1.2.2 Insulation that becomes wet on the job site shall be remediated in accordance with CCA 82 – 2004 "Mould Guidelines for the Canadian Construction Industry".

1.3 REFERENCES

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-2015, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 NFPA
 - .1 NFPA 90A 2024 Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B 2024 Warm Air Heating and Air Conditioning Systems.
- .3 ASTM International Inc.
 - .1 ASTM A167-99(2004) Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet and Strip.
 - .2 ASTM E84-23d.
 - .3 ASTM B209M-2014, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .4 ASTM C335-2023, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .5 ASTM C411-2019, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .6 ASTM C449/C449M-07 (2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .7 ASTM C547-22a, Standard Specification for Mineral Fiber Pipe Insulation.
 - .8 ASTM C553-2013 (2019), Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

- .9 ASTM C612 2014 (2019), Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- .10 ASTM C795-08 (2023), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .11 ASTM C921-2010 (2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.4 Canadian General Standards Board (CGSB)

- .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .2 CAN/CGSB 51.2M Type 2, Thermal Insulation, Polystyrene, Boards and Pipe Coverings
- .3 CAN/CGSB 51.12 Cement, Thermal Insulating and Finishing
- .4 CAN/CGSB 51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering
- .5 CAN/ULC S102-10 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- .6 CGSB 51 GP 9M Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting
- .7 CGSB 51 11M Thermal insulation, Mineral Fibre, Blanket for Piping, Ducting, Machinery and Boilers
- .8 CGSB 51 GP 53M Jacketing, Polyvinyl Chloride Sheet for Insulating Pipes, Vessels and Round Ducts.

.5 Green Seal Environmental Standards (GSES)

- .1 Standard GS-36-13, Commercial Adhesives.

.6 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (current).

.7 Underwriters Laboratories of Canada (ULC)

- .1 CAN/ULC-S102-10, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-17, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- 1.4.1 Provide submittals in accordance with Front End Documents and Section 22 05 01.

1.4.2 Shop Drawings

- .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.

1.4.3 Samples:

- .1 Prior to ordering any insulation materials, prepare a sample board, with a cross section sample of all types of insulation, including exterior jacket and adhesive, properly identified for the various services and equipment on the project and state types of adhesives used. Submit the sample board to the Consultant for review. After review and acceptance, the sample board shall be kept on site for the duration of the project for reference. Deviation from the accepted samples will not be permitted.
- .2 Affix typewritten label beneath sample indicating service.

1.4.4 Manufacturers' Instructions:

- .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence and cleaning procedures.

1.5 QUALITY ASSURANCE

- 1.5.1 Engage a licensed Insulation Application Contractor, specializing in, possessing an established reputation for this type of work.

1.6 DELIVERY, STORAGE AND HANDLING

- 1.6.1 Deliver, store and handle in accordance with Front End Documents.
- 1.6.2 Insulation, coverings, cements, adhesives, coatings etc., shall be shipped to the site in factory fabricated containers with manufacturer's stamp or label affixed indicating the fire hazard ratings of the products, name of manufacturer and brand.
- 1.6.3 Retain insulation materials in their original containers, until immediately prior to application. Keep all materials dry during shipping and storage.
- 1.6.4 Retain adhesives in their original cartons or containers with the manufacturer's name and catalogue number clearly identified on same.
- 1.6.5 Protect the insulation against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged insulation. The Contractor shall remove all damaged insulation from the job site at no additional cost to the Owner/Architect.
- 1.6.6 Installed insulation, which has not been weatherproofed, shall be protected from inclement weather by an approved waterproof sheeting installed by the Contractor.

The Contractor shall remove all wet or damaged insulation from the job site at no additional cost to the Owner/Architect.

- 1.6.7 Comply with all requirements of Local and Provincial Authorities having jurisdiction, the National Building Code and the Underwriters' Laboratory of Canada (ULC).
- 1.6.8 Fire retardant type insulation materials, coverings and adhesives with maximum 25 Flame Spread and maximum 50 Smoke Developed rating when tested shall be in accordance with CAN/ULC-S102. Materials tested in accordance with ASTM C411 11 shall not flame, smoulder, glow or smoke at temperature(s) to which exposed in service.
- 1.6.9 Properly identify insulation materials, coverings and adhesives when required by Federal and/or Provincial Health and Safety WHMIS Legislation.

PART 2 - PRODUCTS

2.1 PERFORMANCE

- 2.1.1 Perform Thermal Insulation work in accordance with ASHRAE 90.1 - 2013 Standards and OBC Standard SB-10.

2.2 FIRE AND SMOKE RATING

- 2.2.1 Comply with NFPA 90A 2009 Standards. Maximum flame spread rating of 25 and maximum smoke developed rating of 50 shall be in accordance with CAN4-S102, ASTM E84 and UL723.
- 2.2.2 Material(s) tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature(s) to which exposed in service.
- 2.2.3 To CAN/ULC-S102, NFPA 90A 2009 and CAN4-S102..
 - .1 Maximum flame spread rating: 25
 - .2 Maximum smoke developed rating: 50.

2.3 INSULATION

- 2.3.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- 2.3.2 Thermal conductivity ("k" factor) not to exceed specified values at 24C mean temperature when tested in accordance with ASTM C335.

2.4 C2 MINERAL FIBRE BLANKET WITH VAPOUR BARRIER

- 2.4.1 Application:
 - .1 Apply on round or oval ducting or concealed rectangular ductwork less than 32" (850 mm) wide, either cold or dual temperature, where such ducts would otherwise be insulated as described for D 4.
- 2.4.2 Material(s):

- .1 duct wrap insulation shall comply with facing and shall meet ASTM C 533.
- .2 "k" @ 75 F. mean temperature 0.27 max. ("k" @ 24°C mean temperature 0.039.) when material compressed 25%; The density of the material shall be a minimum of 1.0 lb/ft³ (16 kg/m³).
- .3 maximum service temperature 450 F.(232 C.);
- .4 rated at 25/50 per ASTM E84, UL 723;
- .5 product must comply with requirements of ASTM C 795 when used over stainless steel;
- .6 material(s) faced with "FSK" shall have a permeance of 0.02 or less.
- .7 material(s) must conform to ASHRAE 90.1 - 2013;
- .8 Fiberglas Flexible Reinforced Foil and Flame Retardant "KRAFT".

2.4.3 Standard of Acceptance: Knauf, Manson, Johns Manville.

2.5 JACKETS

2.5.1 Canvas:

- .1 Cotton, heavy plain weave at 6 oz/sq yd (220g/m²), treated with dilute fire retardant lagging adhesive to ASTM C921. ULC listed.
- .2 Lagging adhesive: compatible with insulation.
- .3 Standard of Acceptance: S. Fattal, Thermocanvas, Johns Manville.

2.6 ACCESSORIES

2.6.1 Tape: Self adhesive, 100mm (4") wide under 25 Flame Spread and under 50 Smoke Developed rating.

2.6.2 Contact Adhesive: Quick-setting, non-flammable fire resistive adhesive to adhere fibrous glass to ducts. 15 Flame Spread and 0 Smoke Developed ratings.

- .1 Acceptable Products: Foster: 85-20 Asbestos Free, Armstrong: 520.

2.6.3 Lap Seal Adhesive: Quick-setting adhesive for joints and lap sealing of vapour barriers. 10 Flame Spread and 0 Smoke Developed ratings.

- .1 Acceptable Products: Foster: 85-75, Asbestos Free, Drion.

2.6.4 Canvas: Washable adhesive for cementing canvas lagging cloth to duct insulation.

- .1 Acceptable Products: Foster: 30-36 Asbestos Free.

2.6.5 Pins:

- .1 Weld pins 4mm (1/8") diameter with 35mm (1-1/2") diameter head for

installation through the insulation. Length to suit thickness of insulation.

.2 Weld Pins: If duct is over 600 mm (24") wide, use on bottom of duct.

.1 Acceptable Products: Duro Dyne: clip-pin.

.3 Weld pins 1/8" (2.0 mm) for installation prior to applying insulation. Length to suit thickness of insulation. Nylon retaining clips 1-1/4" (32 mm) square.

.1 Acceptable Products: Duro Dyne: spotter clips or stop clips as required.

.4 Pin Spacing

.1 For all systems pins shall be spaced at 18" (450mm) spacing.

2.6.6 Outdoor Vapour Retarder Mastic:

.1 Vinyl emulsion type acrylic, compatible with insulation.

.2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

2.7 DUCTWORK INSULATION SCHEDULE

APPLICATION	EXTENT	THICKNESS	AIR TEMPERATURE RANGE
Supply Air	From supply fan discharge to diffuser/grille. Exceptions .1 Do not insulate ductwork that is exposed in the room that it serves where ducts continue to another room ductwork is required to be insulated. This includes all supply air ductwork from outside air make up units to other air handling units.	1" (25 mm)	50°F to 149°F 10 C to 65 C
Silencers	Insulate all supply air silencers.	1" 25 mm	50°F to 149°F 10 C to 65 C
Return Air	Required for ductwork exterior to the building and ductwork passing through unheated spaces where the temperature will be below 40°F (4.4 C). All other return air ductwork does not require insulation.	2" 50 mm	65°F to 90°F 18 C to 32 C

APPLICATION	EXTENT	THICKNESS	AIR TEMPERATURE RANGE
<p>Where insulation is installed on ductwork having flanged connections, increase duct insulation as required to provide a 1/2" (12 mm) cover on flanges and duct angles.</p> <p>For duct sizes 20" (500 mm) to 34" (850 mm) utilize either 1-1/2" (40 mm) flexible wrap or 1" (25 mm) rigid board insulation where 1" (25 mm) insulation is called for. For thicknesses greater than 1" utilize rigid board insulation.</p> <p>Return ductwork that is not running through unheated spaces does not require insulation.</p> <p>Ductwork that is internally lined with the required thickness of insulation is not required to be externally insulated.</p>			

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

- 3.2.1 Pressure test ductwork systems complete, witness and certify.
- 3.2.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- 3.3.1 Apply insulation after required tests are completed and approved by the Engineer. Ensure surfaces are clean and dry when insulation is installed and during application of any finish.
- 3.3.2 Apply insulation as close as possible to equipment by grooving, scoring and bevelling insulation if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires or bands.
- 3.3.3 Fill joints, cracks, seams and depressions with bedding compound to form a smooth surface. Use a vapour retardant cement on cold equipment.
- 3.3.4 Provide vapour retardant jacket. Seal all vapour retardant jacket seams and penetrations with UL listed tapes or vapour retardant adhesive. Where service access is required bevel and seal ends of insulation.
- 3.3.5 Continue insulation through walls, sleeves, hangers and other duct penetrations except where prohibited by Code.
- 3.3.6 Work shall be performed by a qualified Insulation Journeymen.

- 3.3.7 Apply insulation and coverings at ambient conditions as required by manufacturers of insulations, adhesives and mastics.
- 3.3.8 Install insulation with smooth and even surfaces.
- 3.3.9 Replace removed insulation from existing ductwork to make tie in connections with new insulation. Cut back existing insulation a sufficient distance to make/form a neat and firm butt joint between the old and new insulation.
- 3.3.10 Secure insulation on exposed rectangular ductwork with welded impaling pins and speed washer type fasteners at 300mm (12") on centre. Provide a minimum of two (2) rows of fasteners on each side of the duct.
- 3.3.11 In addition to the mechanical fasteners, adhere insulation to the duct with fire resistive adhesive applied to the duct in 150mm (6") wide strips at 450mm (18") centres. Tightly butt all joints and breaks in the insulation and seal with fire resistive mastic and 75mm (3") wide scrim foil pressure sensitive tape. Cut off protruding ends of welded pins and cover speed washers with same tape to ensure a smooth application of exterior jacket.
- 3.3.12 Fasten insulation to rectangular ductwork less than 787mm (31") wide and round ductwork with adhesive applied in 150mm (6") wide strips at 450mm (18") centres. Tightly butt all joints and breaks in the insulation. Seal with fire resistive mastic and 75mm (3") wide scrim foil pressure sensitive tape. Use tying cord only to temporarily secure insulation until adhesive has set. Remove prior to application of exterior jacket.
- 3.3.13 Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to the adjoining insulation.

3.4 FINISHES

- 3.4.1 Finishes: conform to following table:

	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	PVC	PVC
Indoor, exposed elsewhere	PVC Canvas where it is intended to be painted.	PVC Canvas where it is intended to be painted.

3.5 CLEANING

- 3.5.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

1.1.1 This section shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.1.2 Perform Thermal Insulation work in accordance with ASHRAE 90.1 - 2013 Standards.

1.1.3 Section Includes:

- .1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 WET INSULATION

1.2.1 Insulation that has become wet or contaminated shall not be installed.

1.2.2 Insulation that becomes wet on the job site shall be remediated in accordance with CCA 82 – 2004 “Mould Guidelines for the Canadian Construction Industry”.

1.3 REFERENCES

1.3.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

- .1 ASHRAE Standard 90.1-13, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).

1.3.2 American Society for Testing and Materials International (ASTM)

- .1 ASTM B209M-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate Metric.
- .2 ASTM C335-23, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .3 ASTM C411-19, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
- .4 ASTM C449/C449M-07 (2019), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .5 ASTM C533-17(2023), Calcium Silicate Block and Pipe Thermal Insulation.
- .6 ASTM C547-22a, Mineral Fiber Pipe Insulation.
- .7 ASTM C585-22
- .8 ASTM C795-08 (2023), Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- .9 ASTM C921-2015, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.10 ASTM C1136-23 Standard Specification For Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

.11 ASTM E84–23d Standard Test Method For Surface Burning Characteristics Of Building Materials

1.3.3 ANSI

.1 ANSI/NFPA 90A-2024 Installation of Air Conditioning and Ventilating Systems

.2 ANSI/NFPA 90B-2024 Installation of Warm Air Heating and Air Conditioning Systems

1.3.4 Canadian General Standards Board (CGSB)

.1 CGSB 51-GP-52Ma Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

.2 CAN/CGSB-51.53 Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts

.3 CAN/CGSB-51.20M Type 2: Thermal Insulation, Polystyrene, Boards and Pipe Coverings

.4 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing

.5 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering

.6 CGSB 51-GP-9M Thermal Insulation, Mineral Fibre, Sleeving for Piping and Round Ducting

.7 CGSB51-GP-11M Thermal Insulation, Mineral Fibre, Blanket for Piping, Ducting, Machinery and Boilers

.8 CGSB51-GP-52M Vapour Barrier Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

.9 CGSB51-GP-53M Jacketing Polyvinyl Chloride Sheet for Insulating Pipes, Vessels and Round Ducts

1.3.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Assessment Act (CEAA), 2012

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.3 Ministry of the Environment, Ontario.

1.3.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3.7 Manufacturer's Trade Associations

- .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Current)

1.3.8 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S102-2019(R2024), Surface Burning Characteristics of Building Materials and Assemblies.
- .2 CAN/ULC-S701-11, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .3 CAN/ULC-S702.1- 21 Thermal Insulation, Mineral Fibre, for Buildings
- .4 CAN/ULC-S702.2-15-(R2023), Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.4 DEFINITIONS

1.4.1 For purposes of this section:

- .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
- .2 "EXPOSED" - Means: "not concealed" as defined herein. This shall also include but not be limited to areas where the ceiling is not continuous from wall to wall and the gap between the wall and the ceiling is a minimum of 12" (300 mm) "floating ceilings" or as indicated on the drawings, the space above the floating ceiling shall be considered exposed.
- .3 "RUNOUTS" Means: Piping to individual terminal units not exceeding 12' (3650 mm).

1.5 SUBMITTALS

1.5.1 Submittals: in accordance with Front End Documents and Section 22 05 01.

1.5.2 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Front End Documents and Section 22 05 01. Include product characteristics, performance criteria, and limitations.
- .2 Submit a list of insulation material and thickness to be used for each service. Include installation details for valves, fittings, pipe and all other items to be insulated.
- .3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Front End Documents prepared by the Construction Manager. Shop Drawings:
- .4 Submit shop drawings in accordance with Front End Documents and Section 22 05 01.

1.5.3 Samples:

- .1 Prior to ordering insulation materials, submit a sample board demonstrating the cross section of each type of insulation to be utilized on the project for approval. Submission shall include insulating material, exterior jackets and adhesive for each type of insulation. After review and acceptance, the sample board shall be kept on site for the duration of the project for reference purposes. Deviation from the accepted samples will not be permitted.

1.5.4 Quality assurance submittals: submit the following in accordance with Front End Documents.

- .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .2 Instructions: submit manufacturer's installation instructions.

1.6 REGULATORY REQUIREMENTS

- 1.6.1 Comply with all requirements of Local and Provincial Authorities having jurisdiction, the Ontario Building Code and the Underwriters' Laboratory of Canada (ULC).
- 1.6.2 Properly identify insulation materials, coverings and adhesives when required by Federal and/or Provincial Health and Safety WHMIS Legislation.

1.7 QUALITY ASSURANCE

- 1.7.1 Insulating material(s) shall be new, undamaged and of the respective type(s) specified for each specific application.
- 1.7.2 Pipe insulation shall be pre-formed and furnished in standard lengths with ends cut square, and conforming with the dimensional requirements of ASTM C 585.
- 1.7.3 Insulation shall be installed by a licensed Insulation Application Contractor, specializing in, and possessing an established reputation for this type of work.

1.8 DELIVERY, STORAGE AND HANDLING

1.8.1 Packing, shipping, handling and unloading:

- .1 Insulation, coverings, cements, adhesives coatings etc., shall be shipped to the site in factory fabricated containers, with the manufacturer's stamp or label affixed, indicating the fire hazard ratings of the products, name of the manufacturer and brand.
- .2 Retain insulation materials in their original containers, until immediately prior to application. Keep all materials dry during shipping and storage.
- .3 Retain adhesives in their original cartons or containers with the manufacturer's name and catalogue number clearly identified on same. Protect contents against freezing.

- .4 Protect insulation against dirt, water, chemical and mechanical damage before, during and after installation. Do not install damaged insulation.
- .5 The Contractor shall remove all wet or damaged insulation from the job site, at no additional cost to the Owner/Architect.

1.8.2 Storage and Protection:

- .1 Protect from weather, construction traffic.
- .2 Protect against damage.
- .3 Store at temperatures and conditions required by manufacturer.
- .4 Installed, non-weatherproofed, insulation shall be protected from inclement weather with an approved waterproof sheeting as installed by the Contractor.
- .5 The Contractor shall remove and replace any wet or damaged insulation, at no additional cost to the Owner/Architect.

1.8.3 VOC Requirements

- .1 All adhesives, sealants, paints and coatings used on or inside of building weatherproofing layer shall have a VOC content that is less than stated in SCAQMD Rule #1168.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

2.1.1 In accordance with CAN/ULC-S102, NFPA 255-2006 and ASTM E84.

- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.
- .3 Product shall be a limited combustible as defined in NFPA 90A with a potential heat value not exceeding 8141 KJ/Kg (3500 Btu/lb) when tested in accordance with NFPA 259.
- .4 Materials shall be tested in accordance with ASTM C411 and shall not flame, smoulder, glow or smoke at temperatures to which exposed in service.

2.2 INSULATION

2.2.1 Mineral fibre specified includes glass fibre, rock wool, slag wool. Furnished in standard lengths with ends cut square conforming with the dimension requirements of ASTM C547

2.2.2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.

2.3 TYPE P-1: FORMED FIBROUS GLASS INSULATION ON WARM SURFACES

2.3.1 Rigid moulded mineral fibre without factory applied vapour retarder jacket.

- .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547 Type 1.
- .2 Maximum "k" factor: 0.033 W/m C at 24 C (0.23 Btu in / (hr ft² F) at 75 F) max to ASTM C518 and CAN/ULC-S702.
- .3 Maximum service temperature 454°C (850°F);
- .4 When used over stainless steel the product must comply with the requirements of ASTM C 795.
- .5 White All Service Jacket with SSL vapour retarder jacket, a white Kraft paper, reinforced with a glass fibre yarn and bonded to an aluminum foil, with self sealing longitudinal closure laps and butt strips complying with ASTM C1136.
- .6 Fittings, valves, tees, etc shall be insulated with Hi-Lo Temp fibre glass insulation inserts covered with insulated fitting covers.
- .7 Standard of Acceptance: Fiberglass Canada: 850 with ASJ-SSL Jacket, Manson: Alley K with all purpose APT Jacket, Knauf, Johns Manville.
- .8 Thickness:

- .1 Table 1 - Insulation Thicknesses follows:

TABLE 1- HOT SYSTEMS INSULATION THICKNESSES						
Service	Fluid Design Operating Temperature Range C (F)	Nominal Pipe Size Insulation Thickness				
		Less than 1"	1"	1 1/2" to 3"	4" to 6"	8" and over
Dom. Hot Water & Recirc Piping & Tempered Water	Up to 60 C (140° F).	1.0" 25mm	1.0" 25mm	1.5" 40mm	1.5" 40mm	1.5" 40mm
Hot water Heating, Glycol and Reheat	Up to 93 C (200° F)	1.5" 40mm	1.5" 40mm	2" 50mm	2" 50mm	2" 50mm
Equipment Drain Lines, Safety Valve Vents, etc.	Up to 93 C (200° F)	1.5" 40mm	1.5" 40mm	2" 50mm	2" 50mm	2" 50mm

- .9 Application

- .1 Insulate all piping for the systems described above.

2.4 TYPE P-2: FORMED FIBROUS GLASS WITH VAPOUR BARRIER INSULATION ON COLD SURFACES

2.4.1 Rigid moulded mineral fibre with factory applied vapour retarder jacket.

- .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 maximum service temperature 850°F.(454°C.);
- .4 product must comply with ASTM C795 when used over stainless steel.
- .5 Maximum "k" factor: 0.23 max to CAN/ULC-S702 and ASTM C547.
- .6 White "KRAFT" paper reinforced with a glass fibre yarn and bonded to an aluminum foil, with self sealing longitudinal laps and butt strips.
- .7 Standard of Acceptance: Fibreglass Canada: 850 with ASJ-SSL Jacket, Manson: Alley K with all purpose APT Jacket, Knauf, Johns Manville
- .8 Thickness:

TABLE 1- COLD SYSTEMS INSULATION THICKNESSES						
Service	Fluid Design Operating Temperature Range °F	Nominal Pipe Size Insulation Thickness				
		Less than 1"	1" to 1 ¼"	1 ½" to 3"	4 to 6"	8 & Up
Domestic Cold Water	40 to 50	1" (25mm)	1" (25mm)	1" (25mm)	1.5" (40mm)	1.5" (40mm)
Storm Water		1" (25mm)	1" (25mm)	1" (25mm)	1" (25mm)	1" (25mm)

.9 Application

- .1 Insulate all piping for the systems described above with the following exceptions.
- .2 For storm drainage piping provide insulation as follows:
 - .1 Horizontal and vertical runs of storm piping for 33' (10 m) from roof drain.
 - .2 Where multiple storm drain runouts are shorter than 33' (10 m) connect into a storm main. Insulate entire length of storm main up to 33' (10 m) beyond the last runout;
 - .3 Entire length of horizontal storm piping above hard ceilings.

2.5 INSULATION SECUREMENT

2.5.1 Insulation Type P-1, P-2.

- .1 Tape: Colour matching, pressure sensitive, self adhesive vinyl tape. Under 25 for Flame Spread and under 50 for Smoke Developed ratings.
- .2 Lap Seal Adhesive: Quick-setting adhesive for joints and lap sealing of vapour barriers. 10 Flame Spread and 0 Smoke Developed ratings.
- .3 Standard of Acceptance: Foster: 85-75 Drion.
- .4 Lagging Adhesive: Fire retardant coating approved by CFFM and Authorities having jurisdiction prior to application.
- .5 Canvas adhesive: washable.
- .6 Tie wire: 1.5 mm diameter stainless steel.
- .7 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.6 VAPOUR RETARDER LAP ADHESIVE

2.6.1 Water based, fire retardant type, compatible with insulation.

2.7 INDOOR VAPOUR RETARDER FINISH

2.7.1 Vinyl emulsion type acrylic, compatible with insulation.

2.8 JACKETS

2.8.1 Polyvinyl Chloride (PVC):

- .1 Piping: ULC listed PVC moulded type jacketing material, gloss white complying with 25 Flame Spread and 50 Smoke Developed ratings.
- .2 Fittings: ULC listed PVC, gloss white, 1-piece, pre-moulded fittings complying with 25 Flame Spread and 50 Smoke Developed ratings.
- .3 Jackets shall be a minimum of 0.8 mm (30mil) stock thickness.
- .4 PVC Application: strictly in accordance with the requirements of Authorities having jurisdiction.
- .5 Ultraviolet resistant.
- .6 Fastenings: To manufacturers standard(s).
- .7 Minimum service temperatures: -20 degrees C.
- .8 Maximum service temperature: 65 degrees C.
- .9 Moisture vapour transmission: 0.02 perm.

.10 Fastenings:

- .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
- .2 Tacks.
- .3 Pressure sensitive vinyl tape of matching colour.

.11 Special requirements:

- .1 Outdoor: UV rated material at least 0.5 mm thick.

2.8.2 Canvas:

- .1 Apply in exposed areas: compacted firm, ULC listed, heavy plain weave, cotton fabric at 6 oz. per sq. yd (220g/m²) treated with diluted fire retardant lagging adhesive.
- .2 On concealed valves and fittings use ULC listed plain weave cotton fabric at 3 oz. per sq. yd(120 g/m²).
- .3 Standard of Acceptance: S. Fattal, Thermocanvas, Johns Manville.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- 3.1.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

- 3.3.1 Install in accordance with TIAC National Standards.
- 3.3.2 Apply insulation once required tests are complete and approved by the Consultant. Surfaces shall be clean and dry when insulation is installed and during application of any finish.
- 3.3.3 Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.
- 3.3.4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm (3").

- 3.3.5 For all services apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted or engaged together. Pipe insulation shall be continuous with no interruption for sleeves, pipe and fitting. For warm/hot systems the pipe hanger shall be allowed to penetrate the insulation. For cold systems the hanger shall be oversized and not penetrate the insulation.
- 3.3.6 The butt end of every fourth pipe insulation section and the ends or raw edges of insulation terminations at equipment connections, fittings and fire stop systems shall be sealed with vapour retarder mastic.
- 3.3.7 For warm/hot systems provide canvas or wrap as indicated in the finishes section below.
- 3.3.8 For domestic cold water, chilled water and other cold systems maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Insulation shall be tightly fitting to eliminate voids. Lap canvas or other specified wrapping over all joints and thoroughly cement down with adhesive. Vapour barriers and insulation shall be complete over the full length of pipe or surface, without penetration for hangers.
- 3.3.9 Supports, Hangers:
- .1 Install hangers, supports outside vapour retarder jacket.
 - .2 Insulation on all surfaces must be applied with a continuous, unbroken vapour seal. Hangers, supports, anchors etc, that are secured directly to cold surfaces must be adequately insulated and vapour sealed to prevent condensation.
 - .3 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- 3.3.10 Extend insulation through sleeves in walls (except fire walls) or other openings in the building for a continual insulation and vapour barrier of uniform diameter.
- 3.3.11 Terminate insulation at each side of the fire walls and pack the space between the wall sleeve and pipe as specified.
- 3.3.12 Replace removed insulation from existing piping to make tie-in connections with new insulation. Cut back existing insulation a sufficient distance to make/form a neat and firm butt joint between old and new insulation.
- 3.3.13 Protect insulation on domestic cold water with insulation shields consisting of high density insulation and sheet steel support. The thickness of the inserts shall be equal to the thickness of the adjoining insulation and shall be provided with vapour retarder seals. Insulation inserts shall be sized as follows:

INSULATION INSERTS - SIZES			
Pipe Size		Length	
Inches	mm	Inches	mm
1-1/2" to 2-1/2"	40mm to 65mm	10"	250mm
3" to 6"	75mm to 150mm	12"	300mm
8" to 10"	200mm to 250mm	16"	400mm
12" and up	300mm and up	22"	550mm

- 3.3.14 Galvanized metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and shall be of the length specified for the insulation hanger inserts less 100mm (4") to allow for vapour retarding butt joints on each side of the shields.
- 3.3.15 Apply specified adhesives, mastics and coatings to manufacturer's recommended minimum coverage per gallon.
- 3.3.16 Install insulation with smooth and even surfaces.
- 3.3.17 Where piping is indicated to be heat traced, provide oversized insulation to accommodate heat tracing cable.
- 3.3.18 Multi-Layered Insulation: Use staggered butt joint construction.
- 3.3.19 Vertical Pipe over NPS 3: Use insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter, locate on 4.5 m (15') centres and at each valve and flange.
- 3.3.20 At expansion joints in piping, apply insulation over a 16 gauge sleeve fabricated to fit around expansion joint without restricting its movement. Fabricate sleeve(s) so it may be removed to allow for the repacking and lubrication of the expansion joint without damaging adjoining insulation. Extend sleeves a minimum of 75mm (3") longer than the expansion joint, fit with insulation retaining flanges and with a means of maintaining the position of the sleeve over the expansion joint.
- 3.3.21 Terminate insulation at each end of unions and flanges on hot lines, and at other points where indicated, with insulation cement, to CGSB 51-GP-6M, troweled on bevel.
- 3.3.22 Gouge out insulation for a proper fit where there is interference between the weld bead and the insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles, supports, hangers, and clamp guides and seal with insulating cement.
- 3.3.23 Insulation is not required on chrome plated piping and fittings.
- 3.3.24 Surface temperature on the outside of insulation shall not exceed 66 C (150°F).

3.3.25 Insulate flanges, valves and fittings with segments of insulation of the same type and thickness as the insulation on the pipe, secured in place with soft annealed galvanized wire. Finish with cement and canvas while the cement is still wet.

3.4 FINISHES:

3.4.1 Canvas:

- .1 Apply in exposed areas on piping with operating temperatures 80 C (180 F) and above.
- .2 Compacted firm, ULC listed, heavy plain weave, cotton fabric at 220g/m² (6 oz. per sq. yd) treated with diluted fire retardant lagging adhesive.
- .3 On concealed valves and fittings use ULC listed plain weave cotton fabric at 120 g/m² (3 oz. per sq. yd)
- .4 Standard of Acceptance: S. Fattal, Thermocanvas, Johns Manville.

3.4.2 PVC:

- .1 Apply in exposed areas on piping with operating temperatures less than 80 C (180°F).
- .2 Piping: ULC listed PVC moulded type jacketing material, gloss white complying with 25 Flame Spread and 50 Smoke Developed ratings.
- .3 Fittings: ULC listed PVC, gloss white, 1-piece, pre-moulded fittings complying with 25 Flame Spread and 50 Smoke Developed ratings.
- .4 PVC Application: strictly in accordance with the requirements of Authorities having jurisdiction.
- .5 Ultraviolet resistant.
- .6 Fastenings: To manufacturers standard(s).

3.5 SIZING

3.5.1 Provide fire retardant coating on canvas jackets.

3.5.2 Fire retardant coating shall be approved by Authorities having jurisdiction and CFFM prior to application.

3.5.3 Priming:

- .1 Coat canvas covering exposed in finished spaces with diluted coat of lagging adhesive, as recommended by the insulation manufacturer.

3.6 CLEANING

3.6.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This Section of the Specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01 - Mechanical General Provisions.

1.1.2 Ductwork and piping shall be installed in accordance with the proposed sections and layouts shown on the Mechanical Drawings. In accordance with Good Installation Practices all hydronic piping shall be installed below the ductwork. Where it is not possible for pipes running perpendicular to the ductwork to pass below the ducts it is acceptable for pipes to cross above the ducts. All pipes running parallel to ductwork shall not be run above the ductwork unless the proposed location is submitted on an interference drawing and the specific location where this is to occur is approved in writing by the Mechanical Department Representative.

1.2 SUMMARY

1.2.1 Section Includes:

- .1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.3 REFERENCES

1.3.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

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

- .1 ASTM A480/A480M-24, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
- .2 ASTM A635/A635M-22, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
- .3 ASTM A621 & A621M Specification for forming steel (FS), sheet and strip, carbon hot rolled.
- .4 ASTM A653/A653M-23, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .5 ASTM A924M-22a General requirements for sheet steel, metallic coated by hot dip process.

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

- .1 Material Safety Data Sheets (MSDS).

1.3.4 National Fire Protection Association (NFPA).

- .1 NFPA 90A-24, Standard for the Installation of Air-Conditioning and Ventilating Systems.

- .2 NFPA 90B-24, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- 1.3.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible
 - .2 SMACNA HVAC Air Duct Leakage Test Manual,
- 1.3.6 IAQ Guideline for Occupied Buildings Under Construction
- 1.4 SUBMITTALS
 - 1.4.1 Submit shop drawings and product data in accordance with Front End Documents and Section 22 05 01.
 - 1.4.2 Shop Drawings for each type of ductwork shall be submitted and include:
 - .1 Confirm that ductwork will be built in accordance with SMACNA requirements.
 - .2 Fittings
 - .3 Method of Joint
 - 1.4.3 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Front End Documents prepared by the Construction Manager for the following:
 - .1 Sealants.
 - .2 Tape.
 - .3 Proprietary Joints.
 - .4 Ductwork Cleanser.
- 1.5 DELIVERY, STORAGE AND HANDLING
 - 1.5.1 Protect on site stored or installed absorptive material from moisture damage.
 - 1.5.2 Waste Management and Disposal:
 - .1 Provide in accordance with Front End Documents.

PART 2 - PRODUCTS

- 2.1 SUSTAINABLE REQUIREMENTS
 - 2.1.1 All adhesives, sealants, paints and coatings used on or inside of building weatherproofing layer shall have a VOC content that is less than the content limits defined in Section 01 61 10 LEED Product Requirements.
- 2.2 SEAL CLASSIFICATION
 - 2.2.1 Classification as follows:

2.2.2 Sealing classifications shall be in accordance with the Sealing Classifications Table as follows:

Seal Class and Pressure Rating		
Seal Class	Sealing Requirements	Applicable Static Pressure Construction Class
B	All transverse joints and longitudinal seams and connections made airtight with sealant, tape or a combination thereof	Up to 3" w.g. (750 Pa) -3" w.g. (-750 Pa) and less
C	All transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.	Up to 2" w.g. (500 Pa) -2" w.g. (500 Pa) and less
D	Unsealed seams and joints.	Up to 1" w.g. (250 Pa)-1" w.g. (-250 Pa) and less

2.3 PRESSURE CLASSIFICATIONS

2.3.1 Ductwork material shall be constructed in accordance with SMACNA ratings for the following pressure classifications. Pressure classifications shall be in accordance with the Pressure Classifications Table as follows:

TABLE - PRESSURE CLASSIFICATIONS				
Ductwork	Operating Pressure	Seal Class	Leakage Class	
			Rectangular	Round
Supply Air Ductwork Upstream of VAV Boxes	Up to 3" wg (750 Pa)	B	8	4
Supply Air Ductwork Downstream of VAV Boxes	Up to 1" wg (250 Pa)	C	12	6
Return Air Ductwork for systems without VAV Boxes and for ductwork upstream of the VAV box.	Up to -1" wg (-250 Pa)	C	12	6
All Other Ductwork Not Listed Above	Up to 0.5" wg(125 Pa)	D	16	8

2.4 FITTINGS

2.4.1 Fabrication: to SMACNA.

2.4.2 Radiused elbows.

.1 Rectangular:

- .1 Rectangular elbows shall be standard radius. Centreline radius: 1.5 times width of duct
- .2 Short radius elbows with single thickness turning vanes shall only be utilized where shown on the drawings or agreed to by the Consultant.
- .3 Round: smooth radius . Centreline radius: 1.5 times diameter.

2.4.3 Branches:

- .1 Rectangular main and branch: with radius on branch 1.5 times width of duct. 45 degrees entry on branch and balancing damper.
- .2 Round main and branch: enter main duct at 45 degrees with conical connection and balancing damper.
- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with balancing damper.

2.4.4 Transitions:

- .1 Diverging: 20 degrees maximum included angle.
- .2 Converging: 30degrees maximum included angle.

2.4.5 Offsets:

- .1 Full, short radiused elbows as indicated.

2.4.6 Obstruction deflectors: maintain full cross-sectional area.

- .1 Maintain full cross sectional area. Maximum included angles: as for transitions.

2.5 FIRE STOPPING

- 2.5.1 Refer to Section 23 33 16 Fire and Smoke Dampers for requirements where ducts pass through fire rated walls.

2.6 GALVANIZED STEEL

- 2.6.1 Lock forming quality: G60 zinc coating to ASTM A653/A653M and A924 standards.
- 2.6.2 Minimum yield strength for steel sheet and reinforcements shall be 30,000 psi (207 kPa).
- 2.6.3 The sheet metal gauge and requirement for reinforcement shall be in accordance with Tables 1 3 1/2" W.G. Static pressure to Table 1 7 4" W.G. Static pressure of SMACNA.
- 2.6.4 Fabrication shall be to SMACNA Standards.
- 2.6.5 Joints: To SMACNA or proprietary manufactured duct joint. Proprietary manufactured flanged duct joint shall be considered to be a Class C seal.

2.6.6 Standard of Acceptance: Namasco, Ductmate, Exanno, Nexus.

2.6.7 Joint reinforcement shall be in accordance with Tables 1 10 to 1 13 of the SMACNA Standard

2.7 ROUND DUCTWORK

2.7.1 All round ductwork up to 1500mm (60") in diameter shall be of Spiro lockseam construction with an intermediate standard rib to provide the rigidity equivalent to SMACNA Standard Gauge Spiral Duct.

2.7.2 G-60 coated galvanized of lockforming grade conforming to ASTM A635 and A924 standards. Minimum yield strength for steel and reinforcements shall be 30,000 psi. (207 Kpa.) with a thickness not less than for 24 gauge for duct diameters 250 mm to 425 mm (10" to 17"), 24 gauge for 450 mm. to 600 mm. (18" to 24"), 22 gauge for 650 mm. to 800 mm. (26" to 30") and 20 gauge for 850 mm. to 1500 mm. (32" to 60") diameters.

2.7.3 For duct diameters less than 225mm (9") use 26 gauge spiro duct without ribs.

2.7.4 Fittings:

.1 Elbows 100 mm to 200 mm (4" to 8"), shall be diestamped. Diestamped elbows shall be 2 piece construction with fully welded longitudinal seam.

.2 Elbows 225 mm to 900 mm (9" to 36") shall be standing seam construction.

.3 Elbows 950 mm to 1500 mm (38" to 60") shall be standard gore construction with joints riveted and bonded.

.4 Fittings shall be 1 gauge thicker than standard ductwork.

2.7.5 All couplings shall be slipped joint construction with minimum 50mm (2") insertion length. Duct sealer shall be applied on male end connectors before insertion and afterwards to cover the entire joint and sheet metal screws. Sheet metal screws shall be installed at a maximum 300mm (12") spacing, with a minimum of three (3) screws per joint. In large diameters, flanging gasketed joints are acceptable, in lieu of slip joints.

2.8 INTERNALLY LINED ROUND DUCTWORK

2.8.1 Round ductwork indicated to be internally lined utilize spiral round insulated duct with double wall including external pressure tight metal shell, 25mm (1") fibreglass insulation and an internal perforated liner.

2.8.2 The external shell and couplings shall comply with the specification for round ductwork.

2.9 OUTSIDE AIR AND EXHAUST AIR PLENUMS

2.9.1 Panel Construction

.1 Walls and Roof shall be constructed from pre-insulated sandwich panel with galvanized steel to ASTM A653/A653 M with G90 Coating Designation.

- .2 Outer Wall Exposed to Outside Air: 1.3 mm thick galvanized steel.
- .3 Inner Wall Exposed to Mechanical Room: 0.85 mm thick galvanized steel.
- .4 Panels: tongue and groove connection type, designed for individual panel removal for equipment access without major dismantling of plenum.
- .5 Fully framed with 1.3 mm thick galvanized steel channels. 50 mm (2 in.) thick thermally insulated, 72 kg/m³ (4 lb/ft³) density, glass fibre insulation with vapour barrier on inner wall side double wall construction, ,
- .6 Horizontal stiffeners: 0.85 mm minimum galvanized steel on 800 mm centres to control media settlement.
- .7 Thermal break; between adjacent wall panels, between wall panels and plenum roof panels, and between wall/roof panels and building structure.
- .8 Deflection: not to exceed 1/240 of unsupported panel span at design pressure differential of 500 Pa.
- .9 Floor: Watertight, welded stainless steel type 304 floor panels, with upturned 50 mm (2 in) perimeter lip and drain connection in location shown on plans. Panels shall be sloped to drain.

2.9.2 Doors

- .1 Minimum one door per Plenum or as indicated on the drawings.
- .2 Access doors with minimum 510 x 1375 mm opening. Where plenum height is less than 1375 mm the door shall be sized 100 mm smaller than the total height of the plenum.
- .3 Construction same as standard panel except interiors to be solid.
- .4 Two butt-type nylon bushed hinges, two cam-type latches with inside and outside handles.
- .5 Neoprene gasket seal.
- .6 Zinc plated hardware.
- .7 Open against air pressure.
- .8 Windows:
 - .1 Inspection windows, 305 x 305 mm, double glazed with 6 mm wire reinforced glass mounted in neoprene "U" channels.

2.9.3 Access Panels (Where Noted on the Drawings)

- .1 Access panels: sized for equipment removal; two handles per panel; screw at 100 mm maximum centres; perimeter neoprene sponge gasket; materials same as standard panel.

2.10 HANGERS AND SUPPORTS

2.10.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
 - .1 Maximum size duct supported by strap hanger: 20" (500mm) width.
- .2 Hanger configuration: to SMACNA.
- .3 Hangers: Galvanized steel angle with galvanized steel rods shall be in accordance with SMACNA and the Table Hangers And Supports as follows:

TABLE - HANGERS AND SUPPORTS		
Duct Size(mm)	Angle Size (mm)	Rod Size(mm)
up to 750	25 x 25 x 3	6
751 to 1500	40 x 40 x 3	10
1501 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper Hanger Attachments:
 - .1 Concrete: after concrete pour:
 - .1 expanded concrete anchors shall be made of steel. ;
 - .2 powder actuated fasteners shall not be utilized;
 - .3 holes for expanding fasteners shall be drilled either by a carbide bit or by the teeth on the fastener itself. Expansion shield shall be "set" by driving it into the hole and expanding it with a conical plug.
 - .2 Round Ductwork: duct shall be supported as follows:
 - .1 Duct dimensions 900mm (36") single hangers are acceptable;
 - .2 Duct dimensions over 900mm (36") hanger rods shall be provided on both sides of the duct;
 - .3 Minimum hanger sizes shall be in accordance with Table 4 2 of SMACNA.
 - .4 Loading on trapeze bars shall be in accordance with Table 4 3 of SMACNA.

PART 3 - EXECUTION

3.1 GENERAL

- 3.1.1 Do work in accordance with NFPA 90A, NFPA 90B, SMACNA and as indicated.
- 3.1.2 Do not break continuity of insulation vapour barrier with hangers or rods.

- .1 Insulate strap hangers 100 mm (4") beyond insulated duct
- .2 Ensure diffuser is fully seated.
- 3.1.3 Support risers in accordance with SMACNA as indicated.
- 3.1.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- 3.1.5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- 3.2 HANGERS
 - 3.2.1 Strap hangers: install in accordance with SMACNA.
 - 3.2.2 Angle hangers: complete with locking nuts and washers.
 - .1 Horizontal ducts shall have a support within 27" (600 mm) of each elbow and within 48" (1200 mm) of each branch intersection.
 - .2 Straight runs of duct, the hanger spacing shall be in accordance with the Table - Hanger Spacing as follows:

TABLE - HANGER SPACING	
Duct Size (mm)	Spacing (mm)
up to 1500	3000
1501 and over	2500

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This Section of the Specification shall be read in conjunction with and be governed by the requirements of Section 22 05 01 - Mechanical, General Provisions.

1.2 SUMMARY

- 1.2.1 Section Includes:

- .1 Balancing dampers for mechanical forced air ventilation and air conditioning systems.

1.3 REFERENCES

- 1.3.1 Sheet Metal and Air Conditioning National Association (SMACNA)

- .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.

- 1.3.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

- .1 Material Safety Data Sheets (MSDS).

1.4 SUBMITTALS

- 1.4.1 Product Data:

- .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Front End Documents and section 22 05 01. Include product characteristics, performance criteria, and limitations.

1.5 DELIVERY, STORAGE, AND HANDLING

- 1.5.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Front End Documents and section 22 05 01

PART 2 - PRODUCTS

2.1 GENERAL

- 2.1.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- 2.2.1 Not to be used.

2.3 SINGLE BLADE DAMPERS

- 2.3.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

- 2.3.2 Individual Blade Size and configuration to recommendations of SMACNA, except maximum height 125 mm (5")
- 2.3.3 Locking quadrant with shaft extension to accommodate insulation thickness.
- 2.3.4 Inside and outside bronze end bearings.
- 2.3.5 Channel frame of same material as adjacent duct, complete with angle stop.
- 2.4 MULTI-BLADED DAMPERS
 - 2.4.1 Factory manufactured of material compatible with duct.
 - 2.4.2 Opposed blade: configuration,
 - 2.4.3 Frame and blade thickness to be 16 gauge galvanized steel.
 - 2.4.4 Damper to meet construction recommendations of SMACNA.
 - 2.4.5 Maximum individual blade height: 125 mm (5")
 - 2.4.6 Bearings: Molded synthetic.
 - 2.4.7 Maximum system pressure 1000 Pa (4" w.g).
 - 2.4.8 Linkage: shaft extension with locking quadrant.
 - 2.4.9 Channel frame of same material as adjacent duct, complete with angle stop.
- 2.5 DIVERTING DAMPERS
 - 2.5.1 Adjustable, curved vanes, mounted in supporting frame.
 - 2.5.2 All aluminum construction.

PART 3 - EXECUTION

- 3.1 MANUFACTURER'S INSTRUCTIONS
 - 3.1.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- 3.2.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- 3.2.2 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- 3.2.3 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- 3.2.4 Dampers: vibration free.
- 3.2.5 Ensure damper operators are observable and accessible.
- 3.2.6 Install balancing dampers on all open ended return air ducts.

3.3 CLEANING

- 3.3.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.2 SUMMARY

- 1.2.1 Section Includes:

.1 Materials and installation of flexible ductwork, joints and accessories.

1.3 REFERENCES

- 1.3.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

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

.1 Material Safety Data Sheets (MSDS).

- 1.3.3 National Fire Protection Association (NFPA).

.1 NFPA 90A-24, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-24, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

- 1.3.4 Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.2 SMACNA IAQ Guideline for Occupied Buildings under Construction.

- 1.3.5 Underwriters' Laboratories Inc. (UL).

.1 UL 181-11(R2021), Standard for Factory-Made Air Ducts and Air Connectors.

- 1.3.6 Underwriters' Laboratories of Canada (ULC).

.1 CAN/ULC-S110 Fire Tests for Air Ducts.

1.4 SUBMITTALS

- 1.4.1 Make submittals in accordance with Front End Documents prepared by the Construction Manager and Section 22 05 01.

1.5 QUALITY ASSURANCE

- 1.5.1 Certification of Ratings:

- .1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.6 DELIVERY, STORAGE AND HANDLING

- 1.6.1 Protect on site stored or installed absorptive material from moisture damage.
- 1.6.2 Store and manage hazardous materials in accordance with Front End Documents.

1.7 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

- 1.7.1 Develop and implement an Indoor Air Quality (IAQ) Management Plan in accordance with Front End Documents prepared by the Construction Manager.
- 1.7.2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

1.8 SUBMITTALS

- 1.8.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 22 05 01.

1.9 INDOOR AIR QUALITY (IAQ) MANAGEMENT PLAN

- 1.9.1 Develop and implement an Indoor Air Quality (IAQ) Management Plan in accordance with Section 01 47 15 - Sustainable Requirements: Construction for construction and preoccupancy phases of building.
- 1.9.2 During construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

PART 2 - PRODUCTS

2.1 GENERAL

- 2.1.1 Factory fabricated to CAN/ULC-S110.
- 2.1.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
- 2.1.3 Fire retardant type insulation materials, coverings and adhesives with maximum flame spread rating of 25 and maximum smoke developed rating of 50 when tested in accordance with CAN/ULC-S102 and NFPA 255-2006. Materials tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature to which exposed in service. Flexible duct system shall meet OBC requirements for smoke and flame spread for return air plenums.

2.2 METALLIC INSULATED

- 2.2.1 Spiral wound flexible aluminum with 25 mm (1") external insulation.
- 2.2.2 Performance:

- 2.2.3 Temperature range: 4.4 C. to 120 C. (40 F. to 250 F)
- 2.2.4 Minimum bend radius: 1.5 x diameter.
- 2.2.5 Vinyl sleeve outer covering.
- 2.2.6 Maximum working pressure: 3000 Pa (12").
- 2.2.7 Class 1 duct material.
- 2.3 ACOUSTIC FLEX
 - 2.3.1 Utilize where indicated on the drawings.
 - 2.3.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.
 - 2.3.3 Fire retardant type insulation materials, coverings and adhesives with maximum flame spread rating of 25 and maximum smoke developed rating of 50 when tested in accordance with CAN/ULC-S102 and NFPA 255-2006. Materials tested in accordance with ASTM C411-05 shall not flame, smoulder, glow or smoke at temperature to which exposed in service. Flexible duct system shall meet NBC requirements for smoke and flame spread for return air plenums.
 - 2.3.4 Acoustic flexible ducting shall be constructed of a spirally wound strip of acoustic rated CPE interlocked with an external helix
 - 2.3.5 Flexible ducting shall be wrapped in Owens Corning Greenguard Children & Schools Certified Fiberglas insulation; and sleeved by a black flame retardant low-density antistatic polyethylene vapor barrier.
 - 2.3.6 Standard of Acceptance: Peppertree Air Solutions CEH Type HPB, Thermaflex, Flexmaster.

PART 3 - EXECUTION

- 3.1 DUCT INSTALLATION
 - 3.1.1 Install where indicated and in accordance with preferred method of SMACNA and the following:
 - 3.1.2 Connections:
 - .1 Duct Sizes 300 mm (12") and Under:
 - .1 Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.
 - .2 Duct sizes above 300 mm (12"):
 - .1 Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.
 - .3 Screws shall be located at least 1/2" (12 mm) from the end of the duct.

.4 The collar to which the flexible duct is attached shall be a minimum 2" (50 mm) in length.

.5 Cover entire joint with tape and seal as specified in Section 23 33 00.

3.1.3 Supports:

.1 Support shall be in accordance with SMACNA.

.2 The maximum amount of sag for flexible duct shall not exceed 12 mm (1/2") per foot. Provide additional supports as required.

3.1.4 Length:

.1 Maximum length of flexible duct: 3000 mm (10 ft.).

.2 Minimum length of flexible duct connecting to light fixture troffers or ceiling diffusers shall be 1800 mm (72").

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

- 1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01 of the specification.

1.2 SUMMARY

1.2.1 Section Includes:

- .1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial use.

1.3 SYSTEM DESCRIPTION

1.3.1 Performance Requirements:

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.4 SUBMITTALS

1.4.1 Shop Drawings

- .1 Submit manufacturer's printed product literature in accordance with Front End Documents and Section 22 05 01.
- .2 Indicate following:
- .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.5 REFERENCE STANDARDS

- 1.5.1 ADC 1062GRD 84 Test Code for Grilles, Registers and Diffusers.

1.6 MANUFACTURED ITEMS

- 1.6.1 Grilles, registers and diffusers shall be product of one manufacturer for generic type.

1.7 DELIVERY, STORAGE, AND HANDLING

1.7.1 Packing, shipping, handling and unloading:

- .1 Deliver, store and handle in accordance with Front End Documents.

- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

1.8 CERTIFICATION OF RATINGS

- 1.8.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 GENERAL

- 2.1.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- 2.1.2 Where grilles, registers and diffusers penetrate fire walls and fire partitions, provide approved steel sleeve secured to structure in accordance with NFPA 90A 2009 and required fire damper.
- 2.1.3 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board and as specified.
 - .3 Concealed fasteners.
 - .4 Concealed manual volume control damper operators.
- 2.1.4 Colour: As indicated on the schedule

2.2 MANUFACTURED UNITS

- 2.2.1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.3 SUPPLY GRILLES AND REGISTERS

- 2.3.1 Steel: primed cold rolled steel with exposed welded joints and mitred corners.
- 2.3.2 Aluminum: extruded satin finish with mechanical fasteners and mitred corners.
- 2.3.3 Provide plaster frames as plaster stops where set into plaster or gypsum board.
- 2.3.4 Provide concealed fasteners in all finished areas.
- 2.3.5 Provide balancing dampers where grilles are installed in hard ceilings.
- 2.3.6 Final finish to be selected by Architect from standard manufacturer finishes at shop drawing stage.
- 2.3.7 Style, frame, and installation details as indicated on the schedule.
- 2.3.8 Sizes and capacities: as indicated in the schedule.

2.3.9 Standard of Acceptance: EH Price, Titus, Tuttle and Bailey, Nailor, Metalaire, Kruger.

2.4 SUPPLY GRILLES AND REGISTERS

2.4.1 32 mm (1-1/4") border double deflection with airfoil shape horizontal face and vertical rear bars, opposed blade dampers (OBD) where indicated with concealed manual operator, and gaskets.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

2.5.1 32 mm (1-1/4") border, single deflection, air foil shape, horizontal bar type 35° max turn up, when shown on the schedule opposed blade damper with concealed operator and rubber sealing strips.

2.5.2 Egg crate to be 12 x 12 x 25 (½" x ½" x 1"), type as per schedule.

2.5.3 Perforated Grilles shall consist of a perforated core with 3/16" (5) holes on 1/4" (6) centres staggered 60 degrees and an extruded aluminum border. Finish in accordance with the schedule.

2.6 DIFFUSERS

2.6.1 Diffusers shall consist of a precision formed back cone of one piece seamless construction which incorporates a round inlet collar of sufficient length for connecting rigid or flexible duct.

2.6.2 Refer to schedule for finish.

2.6.3 As indicated on the schedule, Circular, square or perforated type, having adjustable fixed pattern, and volume control dampers with flow straightening devices and blank off quadrants.

2.6.4 For plaque diffusers an inner plaque assembly shall be incorporated that drops no more than 1/4" below the ceiling plane to assure proper air distribution performance. The inner plaque assembly shall be completely removable from the diffuser face to allow full access to any dampers or other ductwork components located near the diffuser neck.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

3.2.1 Install in accordance with manufacturer's instructions.

3.2.2 Install with stainless steel screws in countersunk holes where fastenings are visible.

3.2.3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.

3.2.4 All diffusers and grilles in finished areas to have concealed mounting. In unfinished areas and where grilles or diffusers are to be installed in ductwork. For linear bar grilles and linear slot diffusers site measure for exact fit.

3.3 CLEANING

3.3.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 - GENERAL

1.1 GENERAL

1.1.1 This section of the specification shall be read in conjunction with and shall be governed by the requirements outlined in Section 22 05 01.

1.1.2 System Description: Open coil electric reheat coils designed for air heating applications using electric heat.

1.2 REFERENCE STANDARDS

1.2.1 ASTM B88-22 Specification for Seamless Copper Water Tube

1.2.2 ASTM B783-2019 Specification for Materials for Ferrous Powder Metallurgy (P/M) Structural Parts

1.2.3 UL STD 1996 -2022 UL File number E245517

1.2.4 CSA Standard C22.2 No. 46 – 2013 (R2022): Electric Air-Heaters.

1.2.5 CSA Standard C22.2 No. 236 -2015: Heating and Cooling Equipment

1.3 SHOP DRAWINGS

1.3.1 Submittals in accordance with Front End Documents and Section 22 05 01.

1.3.2 Provide maintenance information in accordance with Section 22 05 02.

PART 2 - PRODUCTS

2.1 GENERAL

2.1.1 Coils shall have the capability to be used in right-hand or left-hand applications.

2.1.2 Each coil shall be selected using a computer selection program approved by ARI Standard 410.

2.1.3 All duct heaters shall be tested and certified to UL STD 1996 UL File number E245517.

2.2 FORCED FLOW HEATERS

2.2.1 Wall mounted recessed mounted forced flow heater.

2.2.2 Convector colour to be selected from the standard colour selection chart at the shop drawing stage by the Architect.

2.2.3 Sheet metal enclosure, acid etched, primed and finished with 2 coats of enamel with colour as determined by the Consultant at the shop drawing stage.

2.2.4 Integral tamperproof thermostat, control transformer and contactors.

2.2.5 Thermal cutout.

2.2.6 Totally enclosed, shaded pole, impedance protected motor.

2.2.7 Factory wired to one junction box.

2.2.8 Standard of Acceptance: Dimplex Model # LC6025W31

PART 3 - EXECUTION

3.1 GENERAL

3.1.1 Install all equipment in accordance to manufacturer's recommendations and as shown on the drawings.

3.1.2 Provide an access door upstream of all reheat coils.

3.2 CLEANING

3.2.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION