

TENDER ADDENDUM

ADDENDUM No. M05

Project: **Parks Canada**

Date: September 1 2020

Project No.: R.089317.002

This document shall be read with and forms an integral part of the Contract Documents. It modifies and clarifies the drawings and the specifications of the above-mentioned project. The modifications described herein come into force immediately.

1.0 MECHANICAL

1.1 MODIFICATIONS TO MECHANICAL SPECIFICATIONS

1.1.1 SECTION 21 13 13:

- 1.1.1.1 Article 2.14.1.3 is modified.
- 1.1.1.2 Article 2.14.4 Flexible connections is added.
 - 1.1.1.2.1 Subsequent article numbers are shifted.

1.1.2 SECTION 23 31 13.01:

- 1.1.2.1 Article 2.5.2 Radiused elbows is modified.

1.1.3 SECTION 23 51 00:

- 1.1.3.1 Article 2.1.2.1.3 is modified.

1.2 MODIFICATIONS TO MECHANICAL DRAWINGS

1.2.1 M-010: MÉCANIQUE TABLEAUX 1 / MECHANICAL SCHEDULES 1

- 1.2.1.1 The Chillers schedule is modified.

1.2.2 M-101 : PROTECTION INCENDIE NIVEAU 1 ZONE 1 / FIRE PROTECTION LEVEL 1 ZONE 1

- 1.2.2.1 Identifications 4 and 5 are cancelled.
- 1.2.2.2 A detail for freestanding directional signs is added.

1.2.3 M-102 : PROTECTION INCENDIE NIVEAU 1 ZONE 2 / FIRE PROTECTION LEVEL 1 ZONE 2

- 1.2.3.1 Flexible connections are added at the outlet of the underground storage tanks.
- 1.2.3.2 Identification 3 is cancelled.
- 1.2.3.3 Identification 5 is added.

1.2.4 M-152 : PROTECTION INCENDIE DIAGRAMME / FIRE PROTECTION DIAGRAM

- 1.2.4.1 Flexible connections are added at the outlet of the underground storage tanks.
- 1.2.4.2 Identification 16 is added.

1.2.5 M-402 : VENTILATION NIVEAU 1 ZONE 2 / VENTILATION LEVEL 1 ZONE 2

- 1.2.5.1 The dimensions of the return grilles connected to systems 005 to 008 is modified.
- 1.2.5.2 Specific Note 6 is added.

END OF ADDENDUM No. M05

LISTE DES DESSINS

Drawing list

ÉMISSION / Issue	
DATE	2020-09-01
RAISON / Reason	Addenda M-5 Addendum M-5

PAGE	NUMÉRO / Number	TITRE DU DESSIN / Drawings title	RÉVISION / Revision	DESCRIPTION
1	M000	Page Frontispiece Frontispiece Page	0	
2	M001	Légende Mécanique Mechanical Legend	2	
3	M010	Mécanique Tableaux Mechanical Schedules	2	Issued / Émis
4	M011	Mécanique Tableaux Mechanical Schedules	2	
5	M012	Mécanique Tableaux Mechanical Schedules	2	
6	M020	Base de Propreté Housekeeping Pad	0	
7	M050	Toiture Mécanique Mechanical Roof	1	
8	M100	Protection Incendie - Information Type d'Entreposage Fire Protection - Storage Type Information	0	
9	M101	Protection Incendie - Niveau 1 - Zone 1 Fire Protection - Level 1 - Zone 1	1	Issued / Émis
10	M102	Protection Incendie - Niveau 1 - Zone 2 Fire Protection - Level 1 - Zone 2	3	Issued / Émis
11	M103	Protection Incendie - Salle Mécanique - Partie Basse Fire Protection - Mechanical Room - Low Level	0	
12	M104	Protection Incendie - Salle Mécanique - Partie Haute Fire Protection - Mechanical Room - High Level	0	
13	M105	Protection Incendie - Gicleurs d'Étagère - Niveau 1 - Zone 1 Fire Protection - In-Rack Sprinklers - Level 1 - Zone 1	0	
14	M106	Protection Incendie - Gicleurs d'Étagère - Niveau 1 - Zone 2 Fire Protection - In-Rack Sprinklers - Level 1 - Zone 2	0	
15	M107	Protection Incendie - Salle des Gicleurs Fire Protection - Sprinkler Room	1	
16	M108	Protection Incendie - Coupes Niveau 1 Fire Protection - Sections Level 1	1	
17	M109	Protection Incendie - Niveau 1 - Zone 1 Fire Protection - Level 1 - Zone 1	0	
18	M110	Protection Incendie - Niveau 1 - Zone 2 Fire Protection - Level 1 - Zone 2	0	
19	M151	Protection Incendie - Diagramme Fire Protection - Diagram	1	
20	M152	Protection Incendie - Diagramme Fire Protection - Diagram	3	Issued / Émis

21	M161	Protection Incendie - Détails Fire Protection - Details	0	
22	M201	Plomberie - Eau Domestique - Niveau 1 - Zone 1 Plumbing - Domestic Water - Level 1 - Zone 1	1	
23	M202	Plomberie - Eau Domestique - Niveau 1 - Zone 2 Plumbing - Domestic Water - Level 1 - Zone 2	1	
24	M203	Plomberie - Eau Domestique - Salle Mécanique Plumbing - Domestic Water - Mechanical Room	1	
25	M204	Plomberie - Eau Domestique - Vues Agrandies Plumbing - Domestic Water - Enlarged Views	1	
26	M211	Plomberie - Drainage - Sous-Dalle - Zone 1 Plumbing - Drainage - Underground - Zone 1	1	
27	M212	Plomberie - Drainage - Sous-Dalle - Zone 2 Plumbing - Drainage - Underground - Zone 2	1	
28	M213	Plomberie - Drainage - Niveau 1 - Zone 1 Plumbing - Drainage - Level 1 - Zone 1	1	
29	M214	Plomberie - Drainage - Niveau 1 - Zone 2 Plumbing - Drainage - Level 1 - Zone 2	1	
30	M215	Plomberie - Drainage - Salle Mécanique Plumbing - Drainage - Mechanical Room	1	
31	M216	Plomberie - Drainage - Vues Agrandies Plumbing - Drainage - Enlarged Views	1	
32	M251	Plomberie - Eau Domestique - Diagramme Plumbing - Domestic Water - Diagram	2	
33	M252	Plomberie - Drainage - Diagramme Plumbing - Drainage - Diagram	1	
34	M261	Plomberie - Détails Plumbing - Details	0	
35	M262	Plomberie - Détails Plumbing - Details	1	
36	M301	Tuyauterie - Niveau 1 - Zone 1 Piping - Level 1 - Zone 1	1	
37	M302	Tuyauterie - Niveau 1 - Zone 2 Piping - Level 1 - Zone 2	1	
38	M303	Tuyauterie - Salle Mécanique Piping - Mechanical Room	1	
39	M304	Tuyauterie - Tours d'Eau Piping - Cooling Towers	1	
40	M305	Tuyauterie - Tours d'Eau Vues 3D Piping - Cooling Towers 3D Views	0	
41	M351	Tuyauterie - Diagramme Piping - Diagram	1	
42	M352	Tuyauterie - Diagramme Piping - Diagram	1	
43	M361	Tuyauterie - Détails Piping - Details	1	
44	M401	Ventilation - Niveau 1 - Zone 1 Ventilation - Level 1 - Zone 1	2	
45	M402	Ventilation - Niveau 1 - Zone 2 Ventilation - Level 1 - Zone 2	3	Issued / Émis
46	M403	Ventilation - Salle Mécanique - Partie Basse Ventilation - Mechanical Room - Low Level	1	
47	M404	Ventilation - Salle Mécanique - Partie Haute Ventilation - Mechanical Room - High Level	1	

48	M451	Ventilation - Diagramme - Salle Mécanique Ventilation - Diagram - Mechanical Room	1	
49	M452	Ventilation - Diagramme de Ventilation des Pièces Ventilation - Room Ventilation Diagram	1	
50	M461	Ventilation - Détails Ventilation - Details	1	
51	M471	Ventilation - Coupes Ventilation - Sections	0	
52	M472	Ventilation - Coupes Ventilation - Sections	0	
53	M473	Ventilation - Coupes - Salle Mécanique Ventilation - Sections - Mechanical Room	0	
54	M474	Ventilation - Coupes - Salle Mécanique Ventilation - Sections - Mechanical Room	0	
55	M475	Ventilation - Coupes - Salle Mécanique Ventilation - Sections - Mechanical Room	0	
56	M501	Régulation - Niveau 1 Controls - Level 1	1	
57	M502	Régulation - Salle Mécanique Controls - Mechanical Room	0	
58	M551	Régulation Automatique - Diagrammes Building Controls - Diagrams	0	
59	M552	Régulation Automatique - Diagrammes Building Controls - Diagrams	1	
60	M553	Régulation Automatique - Diagrammes Building Controls - Diagrams	1	
61	M554	Régulation Automatique - Diagrammes Building Controls - Diagrams	1	

1.0 GENERAL

1.1 Related Sections

- .1 Section 09 91 00 – Painting.
- .2 Section 21 05 00 – Common Work Results for Mechanical.
- .3 Section 23 05 19.13 - Thermometers and Pressure Gauges - Piping Systems.
- .4 Section 26 05 00 - Common Work Results for Electrical.
- .5 Section 28 31 00.01 – Multiplex Fire Alarm System.

1.2 Reference Standards

- .1 National Fire Protection Association (NFPA)
 - .1 NFPA 13-2016, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 20-2016, Standard for the Installation of Stationary Pumps for Fire Protection.
 - .3 NFPA 22-2016, Standard for Water Tanks for Private Fire Protection.
 - .4 NFPA 24-2016, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
 - .5 NFPA 25-2016, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
 - .6 NFPA 291-2016, Recommended Practice for Fire Flow Testing Marking of Hydrants.
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN4 S543-M984, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

1.3 Action and Informational Submittals

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data :
 - .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Quebec, Canada.
 - .2 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.
 - .6 Reinforcement.
 - .7 Assembly details.
 - .8 Accessories.

- .4 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.
- .5 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .6 Manufacturers' Instructions :
 - .1 Provide manufacturer's installation instructions.
- .7 Field Quality Control Submittals:
 - .1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.4 Closeout Submittals

- .1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Manufacturer's catalogue 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 Fire department connections.
 - .7 Excess pressure pump.
 - .8 Mechanical couplings.
- .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760 mm by 1050 mm detail 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.
 - .2 Electrical wiring diagrams.
- .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.
- .5 Field Test Reports :
 - .1 Preliminary tests on piping system.

- .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 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.
- .7 Operation and Maintenance Manuals :
 - .1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for underground and aboveground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.5 Quality Assurance

- .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.

1.6 Maintenance Material Submittals

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
 - .2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.7 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 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.
- .4 Packaging Waste Management: remove for reuse of padding, pallets, crates, packaging materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 Performance Specifications

- .1 This document is a performance specification.
- .2 All hydraulic design calculations shall be authenticated, including signature, and all plans and specifications to be used for construction and installation of automatic sprinkler system shall be authenticated, including seal and signature, in all these cases by an engineer member of the “Ordre des Ingénieurs du Québec”.
- .3 The engineer identified in the preceding article who will have authenticated the hydraulic design calculations will also be responsible for providing an authenticated certificate of conformity of the work at the end of the work. It will therefore include one or more site visits (depending on the size of the work) to supervise the installation of the work in fire protection.
- .4 The Contractor is responsible for carrying out the tests required by NFPA 291 to determine the characteristics of the water source.
- .5 This performance specification and drawings include corresponding information and specifications other than the minimum set out in guidelines published by the “Ordre des Ingénieurs du Québec”.

2.2 Design Requirements

- .1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, NFPA 20, and NFPA 22, by hydraulic calculations for uniform distribution of water over design area.
- .2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .3 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.
- .4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.
- .5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.
- .6 Design systems for earthquake protection for buildings in seismic zones 3 and 4, and only essential and high risk buildings in seismic zone 2.
- .7 For storage area, design for the following commodity: Class I to IV. Refer to drawings for storage information such maximum storage height and maximum ceiling/roof height.
- .8 Location of Sprinkler Heads:
 - .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed:
 - .1 9.3m² for Early Suppression Fast-Response (ESFR) upright ceiling sprinklers with K-factor of 16.8, maximum spacing between sprinklers of 3.7m.
 - .2 9.3m² for Early Suppression Fast-Response (ESFR) pendent ceiling sprinklers with K-factor of 22.4, maximum spacing between sprinklers of 3.7m.

- .3 20.9m² for light hazard, maximum spacing between sprinklers of 4.57m.
 - .4 12m² for ordinary hazard, maximum spacing between sprinklers of 4.57m.
 - .5 In-rack sprinklers: refer to drawings for solid shelving areas and in-rack sprinklers locations. Sprinklers to be installed at every level below the highest solid shelf. Maximum spacing between in-rack sprinklers shall be 3.0m. Sprinkler shall have a minimum K-factor of 8.0, quick response, and be located as close to the underside of the solid shelf as possible. Install with guard to protect sprinkler from damage.
- .2 Coordinate ESFR sprinkler positioning/spacing with structural shop drawings to eliminate obstructions created by structural elements (such as trusses, bar joists, etc.). Refer to NFPA-13 (chapter 8) for deviations from the permitted maximum sprinkler spacing. ESFR sprinklers shall be positioned a minimum of 300mm horizontally from the nearest edge to any bottom chord of a bar joist or open truss.
 - .3 Coordinate ESFR sprinkler positioning/spacing with continuous obstructions such as ductwork and lighting as per NFPA-13, article 8.12.5.3.1:
 - .1 Additional row of ceiling sprinklers shall be required where the obstruction is 300mm or less in width and located a minimum of 300mm horizontally from the sprinkler.
 - .2 Additional row of ceiling sprinklers shall be required where the obstruction is 600mm or less in width and located a minimum of 600mm horizontally from the sprinkler.
 - .4 Uniformly space sprinklers on branch.
- .9 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.
- .10 Density of Application of Water:
 - .1 Size pipe to provide specified density when system is discharging specified total maximum required flow.
 - .2 Application to horizontal surfaces below sprinklers shall be as per NFPA 13.
- .11 Pressure Requirements :
 - .1 Collections Storage Historical & Archaeological: Size pipe to provide a minimum operating pressure of 241kPa at the ESFR sprinkler head, and as per NFPA 13 for a commodity of Class I to IV, maximum storage height of 7.6m, maximum ceiling/roof height of 9.1m, Nominal K-factor of 16.8.
 - .2 Flexible Staging Area: Size pipe to provide a minimum operating pressure of 172kPa at the ESFR sprinkler head, and as per NFPA 13 for a commodity of Class I to IV, maximum storage height of 6.0m, maximum ceiling/roof height of 7.0m, Nominal K-factor of 22.4.
- .12 Sprinkler Discharge Area:
 - .1 Area: hydraulically most remote area as defined in NFPA 13. For ESFR sprinklers, and as per NFPA 13, the design area shall consist of the most hydraulically demanding area of 12 ESFR sprinklers, consisting of four sprinklers on each of the three branch lines.
- .13 Outside Hose Allowances:
 - .1 Include allowance in hydraulic calculations of 3.78l/min for outside hose streams.

- .14 Friction Losses:
 - .1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping and 140 for cement-lined ductile-iron piping.
- .15 Water Supply:
 - .1 Base hydraulic calculations on static pressure of 400 kPa with 4944 lpm available at residual pressure of 289 kPa. Refer to attached appendix for test results and location.
- .16 Fire Protection Break Tanks :
 - .1 Three (3) fire protection break tanks will be provided by the Civil Division on this project. Coordinate with tanks manufacturer and installer for piping and accessories installation/penetrations. The following piping and accessories are to be provided and installed by Division 21:
 - .1 Water supply piping (fill).
 - .2 Water discharge piping.
 - .3 Overflow piping.
 - .4 Vent piping.
 - .5 Flexible tank heaters (quantity 3), and associated remote control panel, and control wiring/conduit (process temperature and over-temperature sensors). Ensure sufficient length of controls wiring/conduit between remote control panel and flexible tank heaters termination box.
 - .6 Break-tank fill station, including piping, valves, supports, control panel, water level floats and wiring between fill station and break tanks. Ensure sufficient length of wiring/conduit between remote control panel and water-level floats termination box.
 - .2 Submit complete layout including piping connection on the break tank side and on the sprinkler system side for review. The information shall include the following:
 - .1 Size and arrangement of all pipes.
 - .2 Size, location, and type of all valves, and other accessories.
 - .3 Seismic bracing details and calculations. Utilize bearing and/or gravity thrust blocks for underground piping. Provide signed and sealed thrust blocks calculations as per NFPA-13 – Chapter 10.
 - .4 Operational settings and sequence of operation.
 - .5 Monitoring equipment and connections.
 - .3 Provide signed and sealed letter demonstrating compliance with NFPA-22 requirements.

2.3 Above Ground Piping Systems

- .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 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

2.4 Pipe, Fittings and Valves

- .1 Pipe :
 - .1 Ferrous: to NFPA 13.

- .2 Shall be cUL/ULC listed for fire protection. Alternatives to listed pipes will not be accepted onsite.
- .2 Fittings and joints to NFPA 13:
 - .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
 - .2 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .3 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .4 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .5 Fittings: ULC approved for use in wet and dry pipe sprinkler systems.
 - .6 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .7 Side outlet tees using rubber gasketed fittings are not permitted.
 - .8 Sprinkler pipe and fittings: metal.
- .3 Valves :
 - .1 ULC listed for fire protection service.
 - .2 Gate valves:
 - .1 Valves 50mm and under: bronze to ASTM B61 double disc screwed ends, exterior stem and York, or standard.
 - .2 Valves 65mm and over: Underwriters' Laboratories pattern, iron body, bronze mounted, with OS&Y, double disc or wedge, flanged ends.
 - .3 Butterfly valves: UL approved, iron body, bronze disc, replaceable soft gasket and seat, union grooved or flanged ends.
 - .4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.
 - .5 Provide gate or butterfly valve in piping protecting machinery spaces, machine rooms, and in-rack sprinklers.
 - .6 For each riser, provide a zone control riser module:
 - .1 Cast body with shutoff valve, test and drain valve combination, flow switch and pressure gauge.
 - .2 Pipe material: carbon steel, schedule 10, schedule 40
 - .3 Maximum working pressure: up to 2517 kPa.
 - .4 Housing: Cast ductile iron conforming to ASTM A536, Grade 65-45-12.
 - .5 Finish: Orange enamel.
 - .6 Shut-off and test/drain valve: chrome plated brass ball, S 37700 brass clapper, 416SS or 410SS shafts, enhanced Teflon and EPDM rubber seals.
 - .7 Waterflow switch: vane type waterflow detector with sealed retard, visual switch activation, and mechanical delay adjustment. Cover includes tamper resistant security screws and tool.
 - .8 Provide with pressure relief kit – ULC listed and FM approved for working pressures up to 1200kPa.
- .4 Pipe hangers:
 - .1 ULC listed for fire protection services in accordance with NFPA.

2.5 Sprinkler Heads

- .1 General: to NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type :
 - .1 Type A: upright bronze.
 - .2 Type B: pendent chrome glass bulb type.
 - .3 Type C: concealed sprinkler, pendent, glass bulb, brass cover plate.
 - .4 Type D: upright ESFR, K-Factor 16.8, natural brass finish, copper deflector, fusible link assembly.
 - .5 Type E: In-rack sprinklers, quick response of factor K-8.0, with guard for damage protection. Glass bulb type, brass finish.
 - .6 Type F: specific application window sprinklers, sidewall, 5.6 K-Factor. Glass bulb type, bronze deflector.
 - .7 Type G: dry pendent sprinklers, barrel type, quick response, K-Factor 5.6, brass deflector, glass bulb, tube in ERW steel.
 - .8 Type H: pendent ESFR, K-Factor 22.4, natural brass finish, bronze deflector, fusible link assembly.
 - .9 Type I: Flex dry sprinkler, concealed pendent, K-Factor 5.6, brass deflector, glass bulb with glycerin solution, stainless steel flexible hose, length up to 1475mm, carbon steel brackets.
- .3 Provide nominal 1.2 cm orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide polished chromium-plated finish on copper alloy ceiling plates sprinklers below suspended ceilings.
 - .3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .4 Provide sprinkler heads, as indicated.
 - .5 Deflector: not more than 75 mm below suspended ceilings.
 - .6 Ceiling plates: not more than 25 mm deep.
 - .7 Ceiling cups: not permitted.
 - .8 For light and ordinary hazard occupancy, sprinklers shall be of the quick response type.

2.6 Supervisory Switches

- .1 General: to NFPA 13 and ULC listed for fire service.
- .2 Valves :
 - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
- .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 00.01 – Multiplex Fire Alarm System.
 - .5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.

- .4 Pressure alarm switch :
 - .1 With normally open and normally closed contacts and supervisory capability.

2.7 Fire Department Connection

- .1 Provide connections approximately 1.5 m above finish grade, location as indicated.
- .2 To NFPA 13 and ULC S543 listed, Siamese type.
- .3 Polished recessed of approved two-way type with 65mm National Standard female hose threads with plug, chain, and identifying fire department connection escutcheon plate.
- .4 Thread specifications: compatible with local fire department.
- .5 Install a 90-degree elbow with drain connection at the low-point near each fire department connection to allow for system drainage to prevent freezing.
- .6 Display requirements:
 - .1 Location signs:
 - .1 Must comply with the requirements of location signs established by La Ville de Gatineau, "Info-citoyen, raccord-pompier", except for the dimensions;
 - .2 When multiple location signs are paired in order to guide first responders towards the fire department connection, the maximum dimension for each sign is 30 x 30 cm.
 - .2 Directional signs:
 - .1 Must be of metallic type;
 - .2 Must be on a red background with a 12mm white border;
 - .3 Must be installed at a height of 1.8 to 2.4m above the fire department connection or any other location previously authorized by the local fire department.
 - .4 Must respect the above dimensions, depending on the distance between its locations and the public road:
 - .1 14 x 30 cm within 6m.
 - .2 22.5 x 45 cm from 7 to 15m
 - .3 30 x 50 cm over 15m
 - .5 Must be proportional to all of the combined location signs.
 - .6 Must be a maximum dimensions of 60 x 90 cm when all the signs (location and directional) are combined.
 - .3 Combined signs (location and directional)
 - .1 Must be positioned flat when facing a building;
 - .2 When a second direction on the side of the building is to be followed, they must be positioned at an angle of 45° or 90° on the wall.
 - .3 Must be positioned at an angle of 45° or 90° on the wall when located above the fire department connection.

2.8 Excess Pressure Pump

- .1 Construction
 - .1 Provide excess pressure pump as indicated on the plans. The pump shall have a continuously rising curve from the minimum head to the shut off condition and shall have a motor installed that is suitable for the full range of the published performance curve.
 - .2 All hydraulic components shall be manufactured from Type 304 stainless steel.

- .3 The 316L stainless steel shaft shall be fitted from Tungsten Carbide intermediary bearings.
- .2 Mechanical Seal
 - .1 The mechanical seal shall be suitable for the full pressure and temperature range of the pump and shall be fitted with Carbon rotating face and Silicon Carbide stationary face.
- .3 Pedestal Bearing
 - .1 The motor pedestal shall be fitted with an integral thrust bearing on pumps where the motor is greater than 5HP.
 - .2 The thrust bearing must be connected to the adapter and shaft in such a manner as to eliminate any transfer of pump axial loads to the motor, allowing standard NEMA design motors to be used.
- .4 Connections
 - .1 The base mounted pump shall be assembled in a vertical shaft configuration with the suction and discharge connection being 180° in-line at the bottom.
 - .2 Suction and discharge connections shall have same size flanges with an ANSI 150 rating.
- .5 Motor
 - .1 Supply a standard NEMA design 2-pole motor with the electrical characteristics, efficiency level and enclosure as indicated on the drawings.
- .6 Capacity : refer to drawings.

2.9 Tank Flexible Heaters

- .1 Flexible tank heater designed for heating water in fiberglass tanks with normal manhole entry. Standard equipment with every heater includes flexible pipe and riser, two (2) lifting cables, 100mm high sludge legs and 50-250° non-indicating thermostat with well, weatherproof terminal housing, process and over temperature sensors. Riser's length to be coordinate with tank manufacturer.
- .2 A control center (NEMA IV, weather-resistant construction) is designed for controlling the water temperature by regulating the heater's on-off cycle. It is to be mounted remotely with standard components consisting of a NEMA IV enclosure with a vertical wall mounted brackets and hasp and staple for padlocking. Electrical components include: failsafe overheat device, master circuit-breaker, contactor(s), relay(s), selector switch pilot lights, fuses and a 120-volt control circuit transformer.
- .3 Heater consists of a thermowell, heater terminal housing, riser, single tube heater assembly, vent tube, gasket, manhole adapter, lifting cables, process and overtemperature sensor. Coordinate manhole adaptor and heater terminal housing with tank manufacturer.
- .4 The heater assembly shall undergo a factory leak test prior to shipment from factory.
- .5 Heater Specifications:
 - .1 Quantity: 3 (one per tank)
 - .2 Capacity per heater: 6kW
 - .3 Heater length: 3753mm
 - .4 Heater width: 133mm
 - .5 No. Tubes & circuits: 1
 - .6 Approximate net weight: 36kg.

- .7 Minimum fluid depth for safe heater operation: 300mm.
- .8 Overtemperature thermocouple
- .9 Process thermocouple
- .10 304SST terminal housing
- .11 Anti-condensation heater included.
- .12 Voltage: 208V/3ph/60Hz.
- .6 Remote control panel specifications :
 - .1 Quantity: 1 (one for 3 heaters)
 - .2 Dimensions (Height x Width x Depth): 763 x 610 x 305mm
 - .3 Enclosure Type: Standard
 - .4 100A Main Non-Auto Magnetic Circuit Breaker
 - .5 Fused power Control Transformer
 - .6 Power: 18kW, 208V/3Ph/60Hz.
 - .7 Short Circuit Current Rating (SCCR): 5kA
 - .8 Design type: Zone
 - .9 Number of zones: 3
 - .10 -40°C min. to 40°C max. ambient temperature
 - .11 Top In / Bottom Out Power
 - .12 cUL/ULC
 - .13 Zone 1:
 - .1 6.0kW, 17A, 1ckt
 - .2 Branch Circuit Protection : Fuse
 - .3 Power Control Contactor per Circuit
 - .4 Load Management : None
 - .5 Shutdown method : Contactor
 - .6 Tag Material: Black Phenolic Engraved
 - .7 Tag Mounting : Adhesive
 - .8 Heater Enable/Disable : Local/Remote
 - .9 Overtemperature Alarm: Local Indication w/shutdown & dry contact
 - .10 Process controller: communication 4-20mA input, Bacnet output, on/off process control method.
 - .11 Overtemperature controller: communication 4-20mA input, Bacnet output.

2.10 Break Tank Fill Station Level Alarm Control Panel

- .1 General
 - .1 Incoming power shall be single phase, 60 Hz, 115/120 VAC.
 - .2 The panel shall be built by a UL 508A approved control systems manufacturer and 100% tested at the factory prior to shipping.
 - .3 The panel containing intrinsically safe circuits shall be built by a UL 698A approved control systems manufacturer and 100% tested at the factory prior to shipping.
 - .4 The control panel shall be warranted in writing against defects in materials and workmanship under normal use and service for a period of three (3) years from the date of shipment when installed and used in accordance with the manufacturer recommendations.
- .2 Construction
 - .1 The enclosure shall be at a minimum type 4X rated with lockable latches approved for indoor and outdoor environments.

- .2 LED red day light visible, flashing alarm beacon, mounted on the top of the enclosure.
- .3 Alarm buzzer
- .4 UL489 single pole main disconnect, 7amp.
- .5 Conductivity critical high level relay
 - .1 Redundant relay operation protects against PCL or sensor failure system upset.
- .6 The front panel indicators shall include:
 - .1 Fill Valve 3-position selector switch, open-close-auto, green illuminated LED
 - .1 120VAC power to open.
 - .2 Solenoid operation
 - .2 Block Valve 3-position selector switch, close-open-auto, red illuminated LED
 - .1 120VAC power to close
 - .2 120VAC power to open
 - .3 L1 and neutral for enclosure heater
 - .4 Motor operated valve
 - .3 One (1) critical high level alarm red LED indicator.
 - .4 LED backlit digital touchscreen
- .7 Touchscreen HMI functions as follows:
 - .1 Lead Fill Valve Selection
 - .2 Alarm Silence Button
 - .3 « High Level Alarm » Indication
 - .4 « Low Level Alarm » Indication
 - .5 Continuous Level Readout, in millimeters (other scales available upon request).
 - .6 Level Settings, including:
 - .1 Level sensor span
 - .2 Level read-out offset
 - .3 Level display refresh rate
 - .4 Alarm reset differential
 - .5 Alarm on-delay timer, seconds (Range 0-9999)
 - .6 High Level Alarm setpoint
 - .7 Low Level Alarm setpoint
 - .8 Fill Valve close
 - .9 Fill Valve open
- .8 The panel shall be equipped with a remote monitory dry contact for general alarm. The general alarm contact shall be normally closed to indicate a power failure or loss of system control.
- .9 Two (2) BAS dry contact for High Level Alarm.
- .10 Two (2) BAS dry contact for Low Level Alarm.
 - .1 All field terminations located in one location, segregated by voltage.
 - .2 Adjacent labeling, sensors, BAS interface, incoming power, valve wiring.
- .11 Heat shrink wire markers with circuit voltage indication.
- .12 Supply one set of spare fuses.
- .13 Panel nameplate shall be permanently affixed inside the enclosure displaying panel mode number, serial number, voltage, phase, and SCCR ratings. There shall be a schematic drawing located on the inside the enclosure for field personnel.

- .3 Sequence of Operation
 - .1 High Level Alarm
 - .1 Should the level in the tank rise to the high level setpoint, the following panel functions shall occur:
 - .1 Alarm buzzer to sound
 - .2 Red LED general alarm beacon to illuminate
 - .3 Display to flash RED and display “HIGH LEVEL” alarm condition.
 - .4 Block Valve to close.
 - .5 Remote high level alarm contact to close.
 - .2 The alarm buzzer can be silenced by using the touch screen «Alarm Silence », however, the general alarm beacon is to remain illuminated, the Block Valve to remain closed, and the remote alarm contact to remain closed until the level in the tank has recessed below the high level setpoint.
 - .2 Back-Up High Level Alarm
 - .1 Should the level in the tank rise to the Back-Up High Level Float, the following panel functions shall occur:
 - .1 Alarm buzzer to sound
 - .2 Red LED general alarm beacon to be illuminated
 - .3 Display to flash red and display “BACK-UP HIGH LEVEL” Alarm Condition.
 - .4 Block valve will close
 - .5 Relay to open dropping out all automatic fill valve operation.
 - .6 Remote back-up high level alarm contact will close.
 - .2 The alarm buzzer can be silenced by using the touch screen «Alarm Silence », however, the general alarm beacon shall remain illuminated, the Block Valve will remain closed, the Fill Valve interrupt relay will remain open and the remote alarm contact will remain closed until the level in the tank has receded below the Back-Up Float.
 - .3 Fill Valve Operation
 - .1 Should the level in the tank recede below the Fill Valve set point, the following panel function shall occur:
 - .1 The Fill Valve Pilot Solenoid circuit to energize.
 - .2 The Fill Valve green ON light to be illuminated. The Fill Valve shall remain open until the level in the tank rises to the Fill Valve off set point.
 - .4 Low Level Alarm
 - .1 Should the level in the tank recede below the Low Level set point, the panel functions shall occur:
 - .1 Alarm buzzer to sound.
 - .2 Red LED general alarm beacon to be illuminated.
 - .3 Display with flash red and display “LOW LEVEL” alarm condition.
 - .4 Remote low level alarm contact to close.
 - .2 The alarm buzzer can be silenced by using the touch screen « Alarm Silence », however, the general alarm beacon will remain illuminated and the low level remote alarm contact will remain closed until the level in the tank has risen to the Fill Valve set point.

2.11 Break Tank Fill Station Automatic Valve

- .1 On-off control valve that either opens or closes upon receiving an electrical signal to the solenoid pilot control. Valve consists of a main valve and a three-way solenoid valve that alternately applies pressure to or relieves pressure from the diaphragm chamber of the main valve.

- .2 Valve body & cover: ASTM A216-WCB, cast steel.
- .3 Flanged: B16.5 ANSI Standard, Class 150 pressure class.
- .4 Disc retainer & diaphragm washer: cast steel.
- .5 Trim disc guide, seat & cover bearing: bronze.
- .6 For voltage/current, coordinate with break tank fill station manufacturer.

2.12 Break Tank Level Control Sensor Assembly

- .1 Sensor assembly consists of a Type 4X Polycarbonate Junction Box and 3" schedule 80 150# PVC flange.
- .2 The level control devices consist of:
 - .1 Submersible Pressure Transmitter: continuous pressure sensor, stainless steel material. Provides continuous liquid level measurement by sensing the hydrostatic pressure produce by the height of the liquid above the sensor and providing a 4-20mA output signal compatible with control panel. A shielded cable with atmospheric vent tube and a tough polyurethane jacket incorporating an exclusive "water block" liner beneath the jacket is attached to the sensor using an over-molding process that prevents moisture intrusion. Slim 25mm diameter housing and a ported bullet nose cap for protection of the sensor diaphragm. Sensor pressure range to match tank's dimensions and buried depth. Refer to drawings.
 - .2 High level backup probes – steel wire suspended electrodes, polyethylene body material and 316 stainless steel probe material. Provide three (3) electrodes; one (1) for high level indication, one (1) for high level reset, and one (1) for reference.

2.13 Pressure Gauges

- .1 ULC listed and to Section 23 05 19.13 - Thermometers and Pressure Gauges - Piping Systems.
- .2 Maximum limit of not less than twice normal working pressure at point where installed.

2.14 Buried Water Piping System

- .1 Pipe and Fittings:
 - .1 Provide outside-coated, cement-mortar lined, ductile-iron pipe, and fittings, in accordance with NFPA 24, for piping under building and outside of building walls.
 - .2 Anchor joints in accordance with NFPA 24.
 - .3 ***Provide concrete thrust block at each change of direction as per NFPA 13 requirements and details on the drawings.***
 - .4 Refer to drawings for pipe size and depth of cover.
- .2 Piping: Ductile Iron, cement-mortar lined, class and type as per NFPA 24. Piping must be listed cUL/ULC.
- .3 Fittings for Ductile Cast Iron Pipes:
 - .1 Type as per NFPA 24, mechanical joint, and flange.
 - .2 Fittings: painted with tar epoxy resin paint.



- .4 **Flexible connections**
 - .1 *Supplied with flexible radius grooves in accordance with ANSI/AWWA C-606.*
 - .2 *Meets the design requirements of AWWA M11 for the accommodation of differential movement*
 - .3 *Supports the accommodation of seismic movement, thermal movement and differential settlement.*
 - .4 *Housing: Ductile iron conforming to ASTM A536, Grade 65-45-12.*
 - .5 *Pipe/Housing coating: in accordance with the requirements of AWWA C210.*
 - .6 *Pipe lining: Cement/Mortar Type 2 Lining conforming to AWWA C104.*
 - .7 *Gaskets: compatible with operation parameters.*
- .5 Exterior Coating for Ductile Iron Pipes and Fittings:
 - .1 Exposed and submerged pipe type as per NFPA 24.
- .6 Rubber Gasket for Pipe Connection:
 - .1 As per NFPA 24.
- .7 Bolt and Nut for Flange:
 - .1 Galvanized Hexagon Head bolts and Hexagon nuts.
- .8 Valves :
 - .1 In accordance with NFPA 24.
 - .2 Gate valves: ULC listed and opened by counterclockwise rotation.
- .9 Valve Boxes :
 - .1 For each buried valve, provide plastic, cast-iron, ductile-iron, valve box of suitable size.
 - .2 Plastic boxes: constructed of acrylonitrile butadiene styrene (ABS), inorganic fiber-reinforced black polyolefin.
 - .3 Provide ductile-iron, cast-iron, plastic cover for valve box with Bilingual wording for "WATER" cast on cover.
 - .4 Minimum box shaft diameter: 13.3 cm.
 - .5 Coat ductile-iron, cast-iron boxes with bituminous paint applied to minimum dry-film thickness of 10 ml.
- .10 Buried Utility Warning and Identification Tape:
 - .1 Provide detectable aluminum foil plastic backed tape, detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping detectable by electronic detection instrument.
 - .2 Provide tape in rolls, 7.6 cm minimum width, colour coded in accordance with local utility, with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length.
 - .3 Warning and identification: to read "CAUTION BURIED WATER PIPING BELOW".
 - .4 Use permanent code and letter colouring unaffected by moisture and other substances contained in trench backfill material.

2.15 Double Check Detector Backflow Prevention Assembly

- .1 The Double Check Detector Backflow Prevention Assembly shall be ASSE Listed 1048, and supplied with full port OS & Y gate valves.

- .2 The main body and access cover shall be epoxy coated ductile iron to ASTM A536 Grade 4, the seat ring and check valve shall be NSF Listed, the stem shall be stainless steel to ASTM A276 and the seat disc elastomers shall be EPDM.
- .3 The first and second check valves shall be accessible for maintenance without removing the device from the line.

2.16 Pipe Sleeves

- .1 Provide pipe sleeves where piping passes through floors and walls.
- .2 Secure sleeves in position and location during construction.
- .3 Provide sleeves of sufficient length to pass through entire thickness of floors and walls.
- .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 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.
- .5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide cast-iron, hot-dip galvanized steel, or ductile-iron sleeves.
- .6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
 - .1 Provide 0.61 mm thick galvanized steel sheet.

2.17 Escutcheon Plates

- .1 Provide split hinge, one piece type metal plates for piping passing through floors, walls, and ceilings in exposed spaces.
- .2 Provide polished stainless steel plates in finished spaces.
- .3 Provide paint finish on metal plates in unfinished spaces.

2.18 Signs

- .1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

2.19 Spare Parts Cabinet

- .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.

3.0 EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Installation

- .1 Install, inspect and test to acceptance in accordance with NFPA 13, NFPA 22, NFPA 24, and NFPA 25.
- .2 Testing to be witnessed by authority having jurisdiction and Departmental Representative.
- .3 Install a sign, as required by NFPA 13, to indicate the characteristics of the hydraulically calculated network.

3.3 Pipe Installation

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .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.
- .4 Inspect piping before placing into position.

3.4 Electrical Connections

- .1 Provide electrical work associated with this section under Section 26 05 00 - Common Work Results for Electrical.
- .2 Provide fire alarm system under Section 28 31 00.01 – Multiplex Fire Alarm System.
- .3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with Canadian Electrical Code.
- .4 Provide wiring in rigid metal conduit or intermediate metal conduit.



3.5 Deleted

3.6 Buried Piping System

- .1 Bury tape with printed side up at depth of 30 cm below the top surface of earth or top surface of subgrade under pavements.

3.7 Field Painting

- .1 Painting: to Section 09 91 00 – Painting.
- .2 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .3 Apply coatings to clean, dry surfaces, using clean brushes.
- .4 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .5 Immediately after cleaning, provide metal surfaces with one (1) coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.
- .6 Shield sprinkler heads with protective covering while painting is in progress.
- .7 Upon completion of painting, remove protective covering from sprinkler heads.
- .8 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .9 Provide primed surfaces with following:
 - .1 Provide primed surfaces with two (2) coats of paint to match adjacent surfaces.
 - .2 Provide valves and operating accessories with one (1) coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
 - .3 Provide piping with self-adhering red plastic bands 50 mm wide red enamel bands spaced at maximum of 6 m intervals throughout piping systems.

3.8 Field Quality Control

- .1 Site Test, Inspection :
 - .1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Preliminary Tests:
 - .1 Hydrostatically test each system at 1379 kPa for a 2-hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.
 - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .4 Test alarms and other devices.
 - .5 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.
 - .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, connecting devices, equipment, instruments, personnel for tests.
 - .6 Authority of Jurisdiction will witness formal tests and approve systems before they are accepted.
- .2 Manufacturer's Field Services :
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.
- .3 Site Tests :
- .1 Field test each fire pump, driver and controllers in accordance with NFPA 20. Testing shall include:
 - .1 Verification of proper fine tuning, adjustment, system initiation installation.
 - .2 Verification of the sequence of operations, alarm systems.
 - .2 Testing to be witnessed by Departmental Representative and authority having jurisdiction.
 - .3 Develop, with Departmental Representative assistance, detailed instructions for O&M of this installation.

3.9 Cleaning

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

4.0 APPENDIX

4.1 Flow Test Results

END OF SECTION

1.0 GENERAL

1.1 Related Sections

- .1 Section 07 84 00 – Fire and Smoke Protection
- .2 Section 21 05 00 – Mécanique - Exigences générales concernant les résultats des travaux.
- .3 Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

1.2 Reference Standards

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- .2 ASTM International (ASTM)
 - .1 ASTM A653/A653M-19a, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2018, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2018, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.
 - .2 SMACNA HVAC Air Duct Leakage Test Manual, 2012.
 - .3 IAQ Guideline for Occupied Buildings Under Construction 2007.

1.3 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for metal ducts and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit coordination drawings signed by each subcontractor.

1.4 Delivery, Storage And Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Store and protect from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 Seal Classification

- .1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
0 to 500	A

- .2 Seal classification :
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof

2.2 Sealant

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

2.3 Tape

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 Duct Leakage

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 Fittings

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows:
 - .1 Rectangular: centreline radius: 1.5 times width of duct.
 - .2 **Rectangular, over 600 mm: 1.5 times width of duct, with one splitter vane.**
 - .3 Round: five piece, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with 45 degrees entry on branch.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.

- .3 Provide volume control damper in branch duct near connection to main duct.
- .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 30 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 As indicated or full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.6 Galvanized Steel

- .1 Lock forming quality: to ASTM A653/A653M, G90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

2.7 Stainless steel

- .1 To ASTM A480/A480M, Type 316.
- .2 Finish: number 2B.
- .3 Thickness, fabrication and reinforcement: to SMACNA, except for the minimum thickness which shall not be smaller than 22 ga.
- .4 Joints: to be continuous inert gas welded.

2.8 Hangers and Supports

- .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: 500.
 - .2 Hanger configuration: to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA and the following table :

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
 - .1 For concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

3.0 EXECUTION

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for metal duct installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 General

- .1 Do work in accordance with SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.3 Hangers

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with SMACNA and as follows:

Duct Size	Spacing
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 Watertight Duct

- .1 Provide watertight duct for:
 - .1 Fresh air intake plenum.

- .2 Exhaust plenums.
- .3 As indicated.
- .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Weld joints of bottom and side sheets.
 - .2 Seal other joints with duct sealer.
- .3 Apply sealant in accordance with SMACNA.
- .4 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 Seismic control measures

- .1 Install seismic control measures as required by Section 23 05 48 – Vibration and Seismic Controls for HVAC.

3.6 Protection

- .1 Protect ventilation systems as required by Section 01 81 19 – Indoor Air Quality (IAQ) requirements.

3.7 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

1.0 GENERAL

1.1 Related Sections

- .1 Section 21 05 00 – Common Work Results for Mechanical
- .2 Section 23 05 48 – Vibration and Seismic Controls for HVAC
- .3 Section 23 07 16 – HVAC Equipment Insulation

1.2 Reference Standards

- .1 American Conference of Governmental Industrial Hygienists (ACGIH)
 - .1 ACGIH 2099, Industrial Ventilation: A Manual of Recommended Practice for Design.
- .2 ASTM International
 - .1 ASTM C700-13, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 91-2010, Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Non combustible Particulate Solids.
- .4 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .5 Underwriters' Laboratories of Canada (ULC)

1.3 Action and Informational Submittals

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data :
 - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Québec, Canada. Drawings to include the design of the following:
 - .1 Methods of sealing sections.
 - .2 Methods of expansion.
 - .3 Details of thimbles.
 - .4 Bases/Foundations.
 - .5 Supports.
 - .6 Guy wire details.
 - .2 Submit chimney sizing calculation, stamped and signed by a professional engineer registered or licensed in Québec, Canada

1.4 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS**2.1 Positive Pressure Emergency Generator Chimney**

- .1 General requirements
 - .1 The factory built modular exhaust system shall be tested and listed by Underwriters Laboratories according to ULC standard for use with medium heat equipment burning gas, liquid or solid fuels as described in NFPA-37 and NFPA-211, which produce exhaust flue gases at a maximum temperature of 740°C under continuous firing.
 - .2 The chimney shall be listed for temperatures not exceeding 760°C under continuous firing and 980°C in brief forced firing according to UL-2561.
 - .3 The exhaust system shall be listed by Underwriters Laboratories in accordance with UL103 to withstand up to 1525 mm internal water column pressure at 538°C.
 - .4 The UL listed fiber insulated flue and air insulated flue system shall have surface temperatures published as per the UL-103 538°C chimney test.
- .2 Construction
 - .1 Each section shall be made of two steel cylinders separated by 50 mm of high temperature insulation.
 - .1 316 stainless steel inner wall, 0.917 mm thick.
 - .2 50 mm ceramic insulation.
 - .3 **304 stainless steel outer wall, 0.917 mm thick.**
 - .2 The published clearance to combustible shall be the result of UL/ULC listing of the standard.
 - .3 The inner wall (flue) shall be laser or plasma welded.
 - .4 All section joints shall have a self-centering sleeve to ensure proper alignment at the inner wall (flue).
 - .5 All section joints are connected and sealed with a factory supplied locking band at the inner wall (flue) only. Use appropriate sealant as specified in the manufacturer's installation manual. Each section joint outer wall (casing) shall have a closure band.
 - .6 The exhaust system shall be designed to compensate for thermal expansion.
 - .7 Connections to mufflers/silencers shall be made with matching ANSI flanges.

2.2 Accessories

- .1 Cleanouts: bolted, gasketed type, full size of chimney, as indicated.
- .2 Acceleration cone.
- .3 Explosion relief valve.
- .4 Hangers and supports.
- .5 Draining section.
- .6 Expansion sleeves with heat resistant caulking, held in place as required.
- .7 Roof collars.

3.0 EXECUTION

3.1 Examination

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 Installation - General

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels.
- .4 Install thimbles where penetrating roof, floor and ceiling.
- .5 Install flashings on chimneys penetrating roofs, as indicated.
- .6 Install cleanouts, as indicated.
- .7 Install silencer provided by division 26.
- .8 Install seismic control measures as required by Section 23 05 48 – Vibration and Seismic Controls for HVAC.

3.3 Thermal Insulation

- .1 To Section 23 07 16 – HVAC Equipment Insulation.

3.4 Cleaning

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION